

ANNEX 2

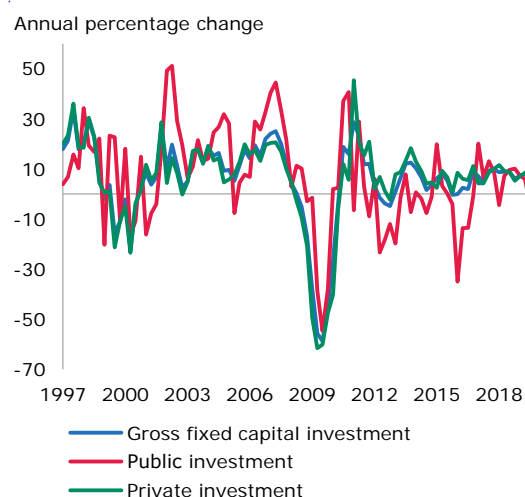
AN ANALYSIS OF INVESTMENTS AND THEIR DRIVERS IN LITHUANIA

This Annex analyses Lithuania's investment performance, trying to disentangle its potential drivers and shock effects.³⁹ The aim here is to shed light on these points, possibly helping policy makers in keeping the momentum going and improving high innovation (and growth) oriented investment.

After the global financial crisis, and until the COVID-19 outbreak, investments in Lithuania recovered and were expected to be buoyant owing to the need for modernisation and automation as well as improvement in the use of EU funds (EC Country Report 2019). Last year, more innovation-oriented investment types, particularly investment in ICT equipment and IPP, gained momentum. On average, the former grew by 24%, while the latter – by 6.6% on a year-on-year basis. Overall, each of these investment types account for 10% of the total, while investment in construction still takes the lion's share, yet its percentage over the total investment has declined from 70% to 50%. Its annual growth rate is also relatively stable, standing at around 8% since 2017.

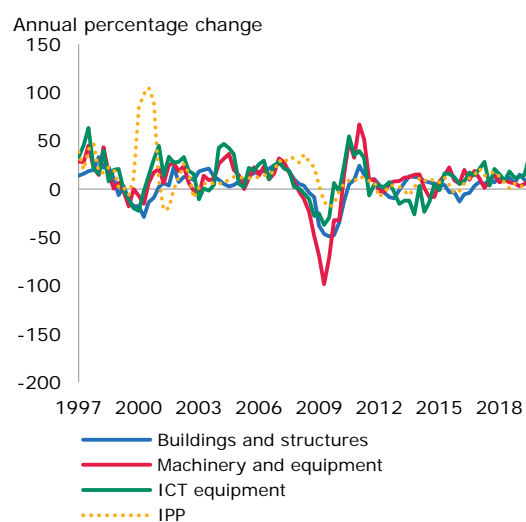
Investment development in Lithuania.⁴⁰

Chart A. Private and public investment



Sources: Author's calculations based on Eurostat and Bank of Lithuania data.

Chart B. Investment development by type of assets



Source: Author's calculations based on Eurostat data.

In order to look at the drivers behind these investments, a Bayesian VAR model was applied, using the quarterly data of 1997–2019. The VAR setup allows us to fully take into account the endogenous links among the variables and compute a historical decomposition to analyse the development of drivers over time as well as investment responses to different shocks.⁴¹ As possible drivers, the analysis included foreign demand, EU funds, the REER with regard to price competitiveness, the uncertainty index⁴², private consumption, gross operating surplus (as a proxy for profits), credit impulse (based on loans to NFCs) and

³⁹ The annex is based on Comunale (2020), An Analysis of Investments and their Drivers in Lithuania, Bank of Lithuania, Discussion Paper Series, *forthcoming*.

⁴⁰ Provided in year-on-year log differences.

⁴¹ Four lags and priors were used: the independent Normal-Wishart (S0 as univariate AR). Block exogeneity for foreign demand was also applied. Several robustness checks based on BVAR and variable choices are available in Comunale (2020).

⁴² The average uncertainty index for Lithuania is from Gieseck and Largent (2016) and includes uncertainty in macroeconomic and financial variables.

real interest rates to NFCs.⁴³ It also included two dummies: the first one for 2009, as there was a shift due to the global financial crisis and co-financing of EU-funded projects (9 cents for every €1 compared to 42 cents for every €1 before) and the second one for 2016 due to the new EU funds programme. The data was taken in year-on-year log differences with the exception of the uncertainty index and real interest rates.

The main outcomes are mostly in line with the literature (e.g. IMF, 2015). They point to the crucial role of the demand-side factors and uncertainty. However, some crucial differences between private and public investments as well as across their types have also been found, because they are quite heterogeneous in terms of incentives, decision making and financing sources.

Private investment is mainly driven by foreign demand, while response to its shocks tends to be of a larger magnitude compared to those of private domestic consumption, and this difference is more prominent than in case of public investment. The more business-related sectors are more exposed to foreign markets, given their propensity to export. For the same reason, the REER also plays an important role.

The other key drivers of private investment are EU funds and uncertainty. Although EU funds certainly feed investment, in the short run business and business-related investments are crowded out. However, EU funds have some positive contributions to public investment, as they are mainly directed thereto. Such crowding-out effect is not observed between private and public investments *per se* but only in terms of money from EU funds. Due to the latter, the injection of funds may have some distortionary impact on the public investment market, with EU funds being directed to public investment, by providing a service or good that would otherwise be a business opportunity for the private industry, or by allocating EU funds and favouring specific investment categories. Looking at type-specific investments, there are some differences in the impact of EU funds across sectors. As for uncertainty, this means that businesses are more likely to make investment decisions when the prevailing uncertainty at both global and local levels is lower. The uncertainty index is measured as the average of several macroeconomic and financial measures, reflecting both international and domestic uncertainty. Uncertainty is also a key factor for the construction sector, especially in case of business-related construction, e.g. of offices or shops, as its increase may redirect investment towards more profitable projects.

Interest rates play a very minor role as an investment driver, thus no significant reactions to their shocks have been observed. This means that changes in credit conditions have almost no impact on investment. The largest negative contribution, although much smaller than in case of other drivers, could be spotted during the global financial crisis. In addition, the contribution of credit impulse, as a relative growth rate of loans to NFCs over GDP, generally seems to be only of minor importance for private investment growth. This could be explained by the relatively low level of investment financing through credit institutions. In the last decade, the share of investment financed by bank lending in Lithuania reached roughly 20%, which only started increasing in the more recent periods. However, own funds remain the main financing method (accounting for more than 50%), while the share of the state/municipal budget together with EU sources stands at roughly 25%.

As regards public investment, a clear pro-cyclicity can be observed, with an increase in response to shocks in both the REER and demand (in the past, these two factors were among the most important drivers as well). This can probably be simply explained by higher budget income when a country is in the positive phase of the business cycle, which entails higher investment possibilities and expected gains. Public and private investments are also positively correlated and contribute to each other's variations.

⁴³ The analysis started with the same drivers as in ESCB (2018). The variables come from a selection by Granger causal priority applied by Jarociński and Maćkowiak (2017) and from the analysis of impulse response functions (in terms of signs and significance). Then the analysis included EU funds and some Lithuania-specific dummies. The identification is a Cholesky type with the ordering as in the text. Investments were placed before interest rates. More details on the BVAR setup are available in Comunale (2020).

EU funds are mainly directed to public investment: there is a positive, albeit limited, reaction to positive short-term shocks of EU funds and some positive contribution of this particular driver in the longer term. This outcome can also be the result of certain accounting issues: EU funds are accounted in a cash flow way, while investments are more continuous and smoothed in the long term, hence they are accounted in different periods, which in turn can be important at a quarterly frequency. Moreover, co-financing has varied over time since 2004 and this can affect the outcomes. In addition to this direct effect of EU funds, there is also an indirect impact through the REER, as its increase (i.e. a decline in competitiveness) gives a positive reaction in public investment. The growth in EU funds makes a country richer through a boost in demand, thus increasing inflation (in good times and in transition periods, the Balassa-Samuelson effect can kick in causing a rise in prices) and ultimately pushing the REER up, i.e. leading to a lower competitiveness level. Therefore, both public investment and competitiveness seem to have in common synchronisation with business cycles.

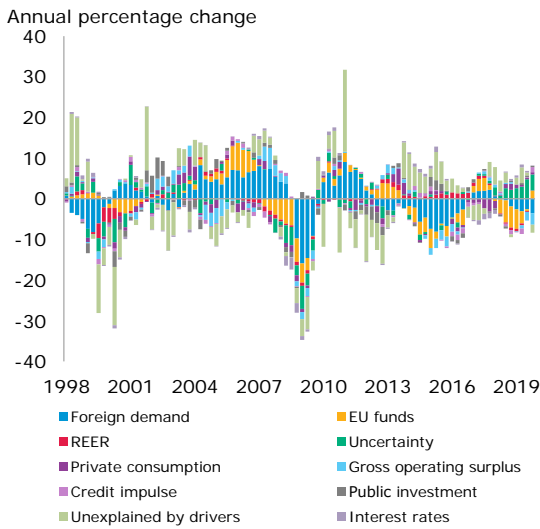
Having looked specifically at more innovative categories – investments in ICT and IPP – some major differences have been found. These types are mostly, but not exclusively, linked to private investment. Looking at their simple correlations, ICT equipment is more linked to traditional types of investment, such as machineries, as compared to IPP. This is mainly due to the fact that the latter includes rather intangible assets (computer software, databases, entertainment, literary and artistic originals) together with a general category of investment in R&D.⁴⁴ Uncertainty shocks seem to matter only for IPP, which reacts positively to increased uncertainty, suggesting riskier types of investment. When uncertainty is higher, investors are either prone to safer assets or more cutting-edge investment. In Lithuania, the latter way seems to be more popular, with IPP investments benefitting from heightened macro-financial uncertainty. Historical data shows that credit impulse is important for the both innovation types, yet there is a significant positive reaction to a shock in loans to investment in ICT equipment. EU funds contribute mostly positively to the both types. However, in case of ICT, the effect is very marginal and is seen only in the medium term, while for IPP the positive response in the short-to-medium run is more significant. IPP may benefit more from a positive shock in EU funds, as there are several programmes for direct and indirect allocation of EU funds designed for cutting-edge innovation ideas, researchers and institutions, start-ups, renewables and green economy, to name only a few.

Summing up the key results: (1) the role of interest rates is very minor; (2) demand-side variables (foreign demand or private consumption) play a crucial role; (3) there is pro-cyclicality of public investment and a positive correlation with private investment; (4) uncertainty is a key factor for some sectors and it positively drives more innovative/intangible investment; and (5) although EU funds certainly feed investment flows, a crowding-out effect can be observed in the short run (especially for business and business-related investment), while there are some positive contributions to public investment. Lastly, part of the dynamics seems to be not explained by common drivers. Therefore, further analysis on specific potential drivers for each sector is needed.

⁴⁴ The categories and structures of asset types are described in European system of accounts (ESA) 2010 Manual (Chapter 23) ([online source](#)).

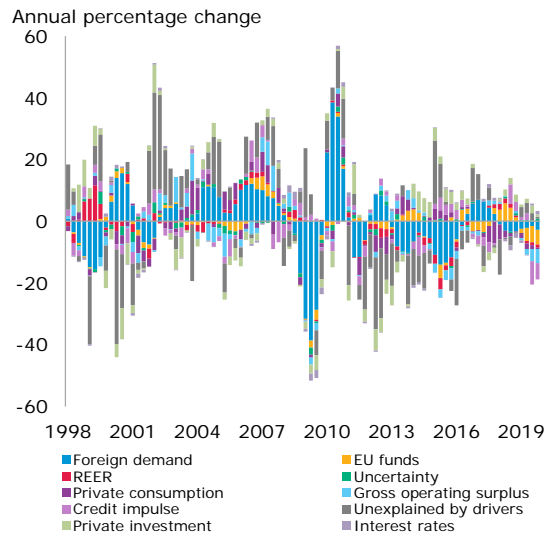
Historical decomposition: private vs. public investment.

Chart C. Private investment



Source: Author's calculations.

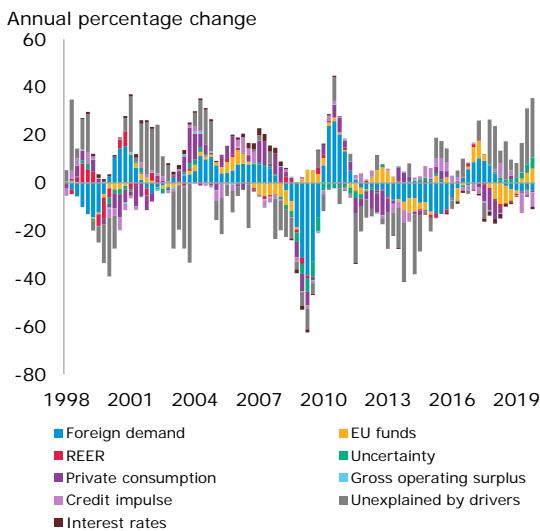
Chart D. Public investment



Source: Author's calculations.

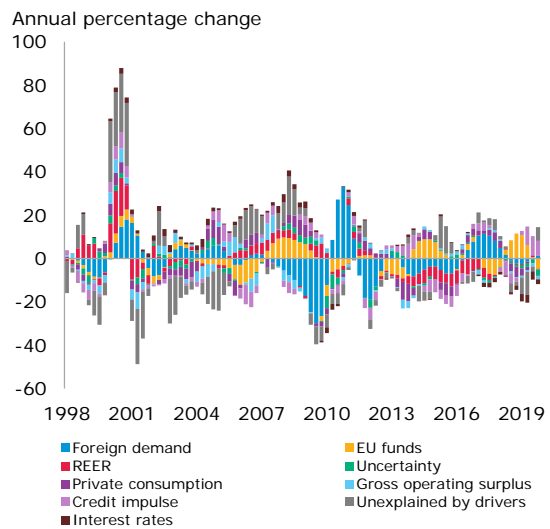
Historical decomposition: investment in innovation.

Chart E. Investment in ICT equipment



Source: Author's calculations.

Chart F. Investment in IPP



Source: Author's calculations.

Notes: Historical decomposition provides an interpretation of historical fluctuations in the modelled time series (in this case – investment) through the lens of the identified shocks.⁴⁵ The columns indicate percentage point contributions to the growth of each type of investment.⁴⁶

⁴⁵ The idea is that all variables in a VAR can be fully decomposed into the contribution of different shocks and an exogenous component which is the baseline projection. Therefore, if we take the sum of the contribution of all shocks at any time t , together with the baseline projection, we recover the original time series at time t (Wong, 2017).

⁴⁶ The “unexplained by drivers” shocks refer to the exogenous own shocks, given the current set of investment drivers. Having a different set of drivers and identification, for instance *ad hoc* for each type of investment, can reduce the importance of this component.

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