Investment

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## Introduction

The objective of this analysis was to see whether there has been any effect of PLI on physical investment undertaken by beneficiary firms. To understand the same a regression analysis was performed.

The data consists of consolidated annual financial statements of firms wherever available. If firms do not prepare a consolidated statement, the standalone statement was considered.

Only beneficiaries of Category 1 are considered. This is because they were incentivised by the scheme to undertake greater investment. The selection criteria was based on investment plans, with those pledging greater investment being ranked higher.

The time period considered is FY15-FY23. Of these FY 22 and FY 23 are the years when the PLISFPI was implemented.

## Regression

In order to correct for endogeneity, GMM method is used in the literature[[1]](#footnote-21).

Therefore, GMM method was used for estimation.

### Problem of multicolinearity

For a panel data model it is not possible to calculate a normal correlation matrix between the dependent variables. For the purposes of this analysis some indication of the correlation can be obtained by looking at a cross section. This is dome below by drawing the correlation matrix for the FY 2019.

## i.by.k cf\_1.by.k\_1 s\_1.by.k\_1 d\_1.by.k\_1 i\_1.by.k\_1  
## i.by.k 1.0000000 0.2794588 0.3952933 0.11769238 0.26778388  
## cf\_1.by.k\_1 0.2794588 1.0000000 0.4807706 -0.19728445 -0.16659567  
## s\_1.by.k\_1 0.3952933 0.4807706 1.0000000 -0.19280853 0.12557521  
## d\_1.by.k\_1 0.1176924 -0.1972845 -0.1928085 1.00000000 -0.07111992  
## i\_1.by.k\_1 0.2677839 -0.1665957 0.1255752 -0.07111992 1.00000000  
## ds.by.k 0.1779361 -0.1201284 0.4760660 -0.13630165 0.07433533  
## ds.by.k  
## i.by.k 0.17793610  
## cf\_1.by.k\_1 -0.12012837  
## s\_1.by.k\_1 0.47606600  
## d\_1.by.k\_1 -0.13630165  
## i\_1.by.k\_1 0.07433533  
## ds.by.k 1.00000000

The results show that there is a high correlation between cashflows and sales. One way to look at the correlation matrix for the entire panel is to take the average of the correlation for all the cross sections. The direction of correlation varies from year to year, so that it is better to take an average of the absolute values.This is what is done next.

## i.by.k cf\_1.by.k\_1 s\_1.by.k\_1 d\_1.by.k\_1 i\_1.by.k\_1 ds.by.k  
## i.by.k 1.0000000 0.2386143 0.3484504 0.1794819 0.2390381 0.1794642  
## cf\_1.by.k\_1 0.2386143 1.0000000 0.4474223 0.1737618 0.1850261 0.2651702  
## s\_1.by.k\_1 0.3484504 0.4474223 1.0000000 0.1857770 0.1732519 0.3142167  
## d\_1.by.k\_1 0.1794819 0.1737618 0.1857770 1.0000000 0.1169841 0.1191739  
## i\_1.by.k\_1 0.2390381 0.1850261 0.1732519 0.1169841 1.0000000 0.1418173  
## ds.by.k 0.1794642 0.2651702 0.3142167 0.1191739 0.1418173 1.0000000

The results again show that there is a high correlation between cashflows and sales. In the presence of imperfect multicollinaearity the t-ratios of the coefficients are not reliable for the correlated variables. However, as the variable of interest is not correlated with the other variables, there is no need to worry about the problem of collinearity.

### Models

Following models were estimated:

Model 1

Model 2

Model 3

Model 4

Model 5

The annual measure of uncertainty was taken by taken the average of the monthly Economic Policy Uncertainty Index by Scott Baker, Nicholos Bloom and Steven J. Davis. The annual repo rate series was generated by averaging for quarterly figures available at the Database on Indian Economy maintained by the RBI. Here, represents investment, represents capital stock, represents cash flows, represents sales, represents debt and represents change in a variable. Year fixed effects other than PLI were sought to be captured through repo rate and uncertainty.

= Addition to Gross fixed Assets - Total addition to gross intangible assets

= Long term borrowings + Current portoin of long term borrowings

= Sale of goods

= Net fixed Assets

= Net Cash flows from operating activities

##   
## GMM Panel Regression Models of effect of PLI scheme on Category 1 beneficiary investment  
## =========================================================  
## Dependent variable:   
## -------------------------------------------  
## i.by.k   
## (1) (2) (3) (4) (5)   
## ---------------------------------------------------------  
## i\_1.by.k\_1 0.218 0.258 0.506 0.280 0.759\*\*\*  
## (0.172) (0.187) (0.365) (0.348) (0.268)   
##   
## cf\_1.by.k\_1 -0.009 -0.005 0.053\*\*\* 0.021 0.059\*\*\*  
## (0.032) (0.036) (0.019) (0.049) (0.012)   
##   
## s\_1.by.k\_1 0.014\*\*\* 0.014\*\*\* 0.014\*   
## (0.005) (0.005) (0.008)   
##   
## ds.by.k 0.009\*\*\* 0.008\*\*\*  
## (0.003) (0.002)   
##   
## d\_1.by.k\_1 0.096\*\* 0.093\*\* 0.073\*\* 0.089\*\* 0.073\*\*   
## (0.048) (0.046) (0.032) (0.043) (0.031)   
##   
## uncertainty\_1 -0.0002 -0.0003 -0.0004 0.0003 -0.0001   
## (0.0005) (0.0004) (0.001) (0.001) (0.001)   
##   
## repo\_rate 0.015\* 0.013 0.016\*\*   
## (0.008) (0.008) (0.008)   
##   
## d.repo\_rate -0.021 -0.015   
## (0.016) (0.019)   
##   
## pli 0.008 0.008 0.059\*\* 0.050   
## (0.019) (0.026) (0.027) (0.035)   
##   
## ---------------------------------------------------------  
## Observations 46 46 46 46 46   
## =========================================================  
## Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

The results indicate that PLI has had no significant effect on the investment levels of the beneficiaries for all the specifications except one, where there is a significant positive effect at the 5% level.

In model 3 and 4, the AR(1) statistic turns out to be insignificant at the 5% level, that is we fail to reject the null hypothesis that there is no autocorrelation of order 1. This means that in these models, the application of OLS should give reasonable estimates. This is what is done next.

##   
## OLS Panel Regression Models of effect of PLI scheme on Category 1 beneficiary investment  
## ======================================================  
## Dependent variable:   
## ----------------------------  
## i.by.k   
## (3) (4)   
## ------------------------------------------------------  
## i\_1.by.k\_1 -0.045 -0.054   
## (0.053) (0.036)   
##   
## cf\_1.by.k\_1 0.004 -0.011   
## (0.050) (0.032)   
##   
## ds.by.k 0.005   
## (0.004)   
##   
## s\_1.by.k\_1 0.017\*\*\*   
## (0.006)   
##   
## d\_1.by.k\_1 0.124\* 0.090   
## (0.066) (0.092)   
##   
## uncertainty\_1 -0.001\* -0.001   
## (0.001) (0.001)   
##   
## repo\_rate 0.008   
## (0.010)   
##   
## d.repo\_rate -0.004   
## (0.018)   
##   
## pli -0.043\*\* -0.016   
## (0.017) (0.034)   
##   
## ------------------------------------------------------  
## Observations 340 340   
## R2 0.060 0.171   
## Adjusted R2 -0.110 0.021   
## F Statistic (df = 7; 287) 2.627\*\* 8.448\*\*\*   
## ======================================================  
## Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### Measuring goodness of fit

In GMM estimation, we are not minimising the sum of error terms, so it is not a good idea to claculate the R square value. However, as a rule of thumb, some people calculate the correlation between actual and predicted values and square it to use as a pseudo R squared.

## References

Gezici, Armağan, Özgür Orhangazi, and Cihan Yalçın. 2019. “Determinants of Investment in Turkey: A Firm-Level Investigation.” *Emerging Markets Finance and Trade* 55 (6): 1405–16. <https://doi.org/10.1080/1540496X.2018.1473247>.

Panagiotidis, Theodore, and Panagiotis Printzis. 2021. “Investment and Uncertainty: Are Large Firms Different from Small Ones?” *Journal of Economic Behavior & Organization* 184 (April): 302–17. <https://doi.org/10.1016/j.jebo.2021.01.011>.

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1. See for example Panagiotidis and Printzis (2021), Rashid and Saeed (2017), Poncet, Steingress, and Vandenbussche (2010), Gezici, Orhangazi, and Yalçın (2019), Saeed and Vincent (2012) [↑](#footnote-ref-21)