World Development 109 (2018) 323–333

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Crowding-out or crowding-in? Public and private investment in India ☆

Girish Bahal [a], Mehdi Raissi [b,*], Volodymyr Tulin [b]

[a] National Council of Applied Economic Research, India
[b] International Monetary Fund, Washington DC, USA

ARTICLE INFO

Article history:
Accepted 3 May 2018

JEL classification:
C32
E22
H54

Keywords:
India
Public and private investment
Crowding in (out)

ABSTRACT

This paper contributes to the debate on the relationship between public and private investment in India along the following dimensions. First, acknowledging major structural changes that the Indian economy has undergone in the past three decades, we study whether public investment in recent years has become more or less complementary to private investment in comparison to the period before 1980. Second, we construct a novel data-set of quarterly aggregate public and private investment in India over the period 1996–2015 using investment-project data from the CapEx-CMIE database. Third, embedding a theory-driven long-run relationship on the model, we estimate a range of Structural Vector Error Correction Models (SVECMs) to re-examine the public and private investment relationship in India. Identification is achieved by decomposing shocks into those with transitory and permanent effects. Our results suggest that while public investment crowds out private investment in India over the period 1950–2012, the opposite is true when we restrict the sample to post 1980 or conduct a quarterly analysis since 1996. This change can likely be attributed to the policy reforms which started during the early 1980s and gained momentum after the 1991 crisis.

1. Introduction

The relationship between public and private investment has received renewed interest among academics and policy makers alike in the aftermath of the global financial crisis. On the one hand, higher public investment may "crowd out" private spending on capital goods, irrespective of the financing mechanism (including through levying taxes or issuing debt). On the other hand, higher government spending on infrastructure facilities (like roads, highways, and power) as well as health and education may have a complementary impact on private investment by raising its marginal productivity. The literature, which mostly relies on time-series and cross-country regression analyses, finds mixed predictions on the relationship between public and private investment. We re-examine this relationship in India by estimating Structural Vector Error Correction Models (SVECM) in three variables (public investment, private investment, and output) over different time periods.

Importantly, we investigate whether this relationship has changed over time after the policy reforms that started during 1980s (using annual observations) as well as post liberalization in early 1990s (using quarterly data over 1996–2015 from the CapEx-CMIE database), and compute the corresponding rupee response of private investment to an equivalent increase in public investment. Our main contribution to the literature is the adoption of a novel identification strategy and the use of a theory-driven long-run relationship, namely, the "great ratio" of aggregate investment and output. We estimate a SVECM and decompose the structural shocks into those with permanent and transitory effects on the level of the variables for identification. We find that while public investment crowds out private investment in India over the full sample (1950–2012), the opposite is true when we restrict the sample to post 1980 or focus on private corporate and household investment separately. The crowding in result continues to hold when we construct and use quarterly data over 1996–2015. These findings underscore how pro-business reforms of the early 1980s and the structural reforms of 1990s induced a complementary relationship between public and private investment in India.

We use long-run restrictions for identification as they are typically free of particular model assumptions and are motivated from what is generally agreed-upon in the empirical macroeconomic

☆ We are grateful to Paul Cashin, Giancarlo Corsetti, Kalpana Kochhar, Siddharth Kothari, Aart Kraay, Pritha Mitra, Rakesh Mohan, Sam Ouliaris, Markus Rodlauer, and Luis Serven for their comments and suggestions. We also thank the editor in charge of our paper, Arun Agrawal, and two anonymous referees for helpful suggestions. The views expressed in this paper are those of the authors and do not necessarily represent those of the International Monetary Fund or IMF policy.

* Corresponding author.
E-mail addresses: girish.bahal@gmail.com (G. Bahal), mraissi@imf.org (M. Raissi), vtulin@imf.org (V. Tulin).

https://doi.org/10.1016/j.worlddev.2018.05.004
0305-750X/

literature, see Chudik, Mohaddes, Pesaran, and Raissi (2016, 2017) for details. This is in contrast to solving the identification problem in VAR models by imposing short-term restrictions which require assumptions on the short-run dynamics of the variables that may be too restrictive (especially with annual data).[1] Specifically, we impose a long-run relationship between the three variables considered based on the "great ratio" of aggregate investment to output. Regarding identification, we assume that private-sector demand disturbances have transitory effects (given evidence for the presence of one cointegrating, or long run, relationship among the three variables considered), while the two structural innovations that have permanent effects are productivity shocks and (possibly) public investment innovations. As evidence, Binder and Pesaran (1999) argue that in the long run, the evolution of per-capita output is largely determined by technological process. Furthermore, endogenous growth models predict that per-capita output follows a stochastic trend where certain policy changes (i.e. productive public-investment decisions) may have long-run consequences for the level of output, see Jones (1995) and Kocherlakota and Yi (1996).[2]

Although there is a large body of literature analyzing the relationship between public and private investment, the empirical findings are mixed and research on developing and emerging market economies is rather limited. What is even more scarce is an attempt to identify whether the interaction between public and private investment has changed over time in those developing and emerging market economies which have witnessed significant structural reforms like deregulation of domestic/foreign goods markets (liberalization). Aschauer 1989a, 1989b argues that public investment in the United States, especially on infrastructure facilities, has a significant positive impact on private investment by increasing its productivity. While this conclusion of complementarity between public and private investment was further supported by Greene and Villanueva (1991) and Blejer and Khan (1984), there were also some strong criticism of Aschauer's results by Evans and Karras (1994) among others.

Erden and Holcombe (2005) compare the interaction of public and private investment in developing and developed economies, and conclude that while public investment is complementary to private investment in developing countries, the effect is opposite in developed countries. The difference in these results is attributed to structural differences between the two types of economies: while public investment may provide the necessary infrastructure facilities in developing countries and hence boost private investment, in developed economies the public sector is already large and may compete with the private sector. For the case of India, Mitra (2006) estimates a structural VAR model (using data over 1969–2005) in three variables (public investment, private investment, and output), and argues that public investment "crowds out" private investment. Serven (1996) analyzes how public and private investment interact with each other in India, and finds evidence of crowding-out in the short run but crowding-in over the long term due to investment in infrastructure sector.

Our main departure from these studies is the use of theory-driven long-run restrictions in our structural vector error correction models.[3] Garratt, Lee, Pesaran, and Shin (2012) argue that there are inherent difficulties with the interpretation that are given to the impulse responses that are obtained under the Structural VAR approach, and stress the importance of embedding structural long-run relationships in unrestricted VAR models as their steady-state solutions.[4] To the best of our knowledge, no previous study has employed this method to study the relationship between private and public investment in India.

The findings of our paper are in line with Mitra (2006) and Serven (1996) when, like these earlier studies, our data encompasses annual observations before 1980. However, we find that unlike in the period 1950–2012, public investment is complementary to private-sector investment after 1980. Our "crowding in" finding is corroborated by similar results obtained from SVECMs on quarterly data over the period 1996–2015, using public and private investment data constructed from the Indian CapEx-CMIE database (see Section 4).

The rest of the paper is organized as follows. Section 2 discusses the econometric methodology and outlines our identification approach. Section 3 describes the data while Section 4 presents the empirical findings. Section 5 concludes with some policy recommendations.

2. Structural VECM

We estimate a range of SVECMs with the baseline specifications including log per capita output, y_t, public investment, gi_t, and private investment, pi_t. As Appendix B discusses, all the variables are integrated of order one with evidence of one cointegrating relation among the three variables. The long run relationship between y_t, gi_t and pi_t can be motivated from the stationarity of the "great ratio" of aggregate investment and output. Appendix A expresses this relationship as $\beta_1 gi_t + \beta_2 pi_t - y_t$ where both β_1 and β_2 are less than 1. We embed this relationship in the following reduced form vector error correction model:

$$\Delta \mathbf{z}_t = \boldsymbol{\alpha}\boldsymbol{\beta}'\mathbf{z}_{t-1} + \sum_{i=1}^{m}\Gamma_i \Delta \mathbf{z}_{t-i} + \mathbf{u}_t \tag{1}$$

where $\mathbf{z}_t = (y_t, gi_t, pi_t)'$ is a (3×1) vector of endogenous variables, $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are (3×1) vectors of loading coefficients and cointegrating vectors respectively, Γ_i is a (3×3) parameter matrix.[5] Finally, $\mathbf{u}_t$ represent the reduced form residuals $(u_t^y, u_t^{gi}, u_t^{pi})$.

To express the reduced form residuals in terms of structural shocks, $\mathbf{u}_t$ can be represented as $\mathbf{B}\boldsymbol{\varepsilon}_t$, where $\mathbf{B}$ is a (3×3) matrix, while $\boldsymbol{\varepsilon}_t$ represent the structural innovations $(\varepsilon_t^y, \varepsilon_t^{gi}, \varepsilon_t^{pi})$ of the system. Specifically, ε_y denotes a productivity shock, ε_t^{gi} a structural disturbance to public investment, and ε_t^{pi} can be motivated as a demand shock. Identification is usually achieved by imposing short run restrictions on the matrix $\mathbf{B}$—See for e.g., Blanchard and Perotti (2002) for details.[6] This requires a well-defined economic theory of the short-run dynamics and can be rather restrictive in data with annual frequency. Our identification strategy, instead, relies on long-run restrictions as they are typically free of particular model assumptions and are motivated from what is generally agreed-upon in empirical macroeconomic modelling.[7] We take the structural innovations in productivity and public investment to have long term effects on the variables and assume a demand disturbance, ε_{pi}, to have transitory effects. Our choice of public investment having a

[1] For example, most economists agree that monetary policy shocks are neutral in the long run, whereas productivity shocks can have permanent effects. This idea was first introduced in the context of a bivariate model in Blanchard and Quah (1989).

[2] Rodrik and Subramanian (2005) identify a productivity-boosting role for public infrastructure investment in India. Serven (1996) finds that government investment in infrastructure projects in India "crowds in" private investment over the long run.

[3] Serven (1996) does find cointegration, but estimates a single equation conditional model.

[4] Mitchell (2000) shows that ignoring cointegration when it indeed exists (by estimating a VAR in first differences) can result in misspecification error and bias at both long and short run horizons in the impulse responses.

[5] Given the ordering of the variables, $\boldsymbol{\beta}$ can be equivalently written as $(1, -\beta_1, -\beta_2)$.

[6] See Kilian (2013) for relevant literature on identification using short and long run restrictions.

[7] The idea of imposing restrictions on the long-run response of variables to shocks was first motivated by Blanchard and Quah (1989) in a bivariate model of output and rate of unemployment. They argue that unlike demand disturbances, supply shocks have a long run impact on output; see also King, Plosser, Stock, and Watson (1991) and Gali (1999).