Reply to referee 1

We wish to thank the referee for his/her insightful comments, all of which we have taken on board. We are confident that our paper has substantially improved thanks to your observations and suggestions; the econometric analysis has been entirely re-worked and greatly improved. Below, we list each comment, explain our response, and describe how these were incorporated into the new version of the paper. We hope these changes satisfy the referee.

Major Comments

Literature Review

Comment 1

it may contain also contain the more recent and relevant findings concerning the role of expansionary fiscal policy, of course with a greater focus on why public investments-type of intervention may have larger effects (Demetriades and Mamuneas (2000) just as an example);

Response to comment 1

The literature review now includes more studies (including the one suggested above), most of which look at developed countries in search of evidence of a positive effect of public investment on economic growth.

Comment 2

It may contain some references to developing countries (Ramirez and Nazmi (2003) as an example)

Response to comment 2 This reference is now included.

Comment 3

It may describe the main findings of those reference papers that had focused on the Mexican experience. What are their main findings? Are authors' findings compatible with existing literature? In Section III there is only mention to the results obtained in Lachler and Aschauer (1998) and Nazmi and Ramirez (1997).

Response to comment 3

First, we compute the elasticity of GDP with respect to public investment. Only one previous study has done this, Nazmi and Ramirez (1997), who use a different sample period. We comment on this in the paper and mention that our elasticity estimate is higher than theirs. This is in line with the research of Ilzetzki, Mendoza, and Végh (2013), who document that the macroeconomic effect of fiscal stimuli depends on key country-specific characteristics, such as openness to trade and exchange rate regimes, two characteristics that differ greatly between our sample period and that of Nazmi and Ramirez. In addition, we mention other papers that document the positive impact of public investment on economic activity, although their results are not comparable to ours because they do not estimate any elasticity.

Second, we investigate the relationship between public and private investment. We find that public investment (both total and each of its components) has a crowding-in effect on private investment. This finding contrasts with that of Lachler and Aschauer (1998) and of Nazmi

and Ramirez (1997), who estimate a crowding-out effect. However, it is similar to that of Ramirez (1994), who finds that public investment had a positive and significant effect overall on gross private investment expenditures during the period 1950–1988. We justify our finding for the period analyzed using the results of Ilzetzki, Mendoza, and Végh (2013).

Econometric Analysis

The econometric analysis is clear, but not exhaustive. Preliminary batteries tests for unit root, structural break and cointegration are convincing and strongly suggest the presence of more than one cointegrating relationships between the variables of interest.

Comment 4

However, authors do not include any structural analysis (impulse response and variance decomposition analysis): an easy-to-implement Choleski factorization of the covariance matrix of the reduced-form residuals, with a suggested recursive causal order (G_t , I_t , GDP_t), may deliver interesting hints. An interpretation of the long-run equilibrium conditions that authors find lacks: for example, which shocks may have permanent effects? Authors should motive the reason why they do not explore further the implications of their econometric model.

Response to comment 4

The referee's comment about the relative lack of structural analysis is indeed relevant. Such an analysis would actually extend the reach of our paper and make it more interesting, which is why we decided to do precisely that, i.e., to replace the previous econometric analysis with a new considerably more robust one. We begin with a more formal recursive causal order, which is not exactly that suggested in the referee's comment, but rather (GDP_t , I_t , G_t), i.e., GDP is affected by all contemporaneous shocks, while private investment is affected by contemporaneous shocks in public investment. The reasoning behind this ordering of the variables is simply that investment, whether private or public, reacts with some delay to shocks in GDP. The order between public and private investment is less obvious. We tried both possibilities, I_t , G_t and G_t , I_t ; the results were the same (parameter estimates, IRF, FEVD), so we opted for the first. As requested by the referee, we now include Impulse-Response Functions (IRF) and Forecast Error Variance decompositions (FEVD), together with an interpretation of the more salient features.

Comment 5

In Section III.2 (Empirical analysis and results - Cointegration Analysis), cointegration results are analyzed. In particular, column 6 of Table 2 shows the estimated parameters of the cointegration relationship. It is not clear, however, how the long-run equilibrium equations listed in column 6 may refer to the cointegrating vector estimated in the VEC model. Given the VEC representation of the form:

$$\Delta y_t = \Pi y_{t-1} + \sum_{k=1}^{n-1} \Gamma_k \Delta y_{t-k} + u_t$$

 y_t represents the *n*-dimensional vector of endogenous variables, $\Pi = \alpha \beta'$ is the cointegrating matrix, Γ_k are *n* x *n* matrices of estimated coefficients for the lagged first differences. The

Johansen procedure exploits the fact that the rank *r* of the matrix Π is informative about the number of cointegrating relationships. Both α and β are *n* x *r* full column rank matrices: the former is the matrix of loadings that ensure convergence to the long-run equilibrium; the latter contains *r* linearly independent cointegrating vectors for which $\beta' y_{t-1}$ is stationary.

In a system of three equations with two cointegrating relationships (n = 3, r = 2), the reader would expect that the long-run equilibrium conditions are of the form:

$$GDP_t = \widehat{\beta_{12}}G_t + \widehat{\beta_{13}}I_t$$
$$GDP_t = \widehat{\beta_{23}}G_t + \widehat{\beta_{23}}I_t$$

under a unit normalization of the cointegrating vector. A more precise and explicit specification of the cointegrating vectors / relationship is suggested.

Response to comment 5

The referee's suggestion is once again relevant. The previous version of the paper did not include a "more precise and explicit specification of the cointegrating vectors / relationship" but the new one does. As the referee can see in equations 1-5, we first present the raw model, then collect evidence of cointegration, and, importantly, propose a set of restrictions to ensure that the model is identified; to be precise, we propose a number of restrictions that over-identify the models in such a way that we can test the validity of the restrictions; moreover, our restrictions also allow us to obtain a rather intuitive set of cointegrating vectors to facilitate their interpretation (see equations 6 and 7). It should be noted that we followed Johansen (2005) to ensure that the parameters can be understood as partial derivatives and therefore, given that the variables are in logs, as long-run elasticities. We would like to express our genuine thanks to the referee, as his/her request compelled us to substantially improve the validity and reach of our models.

Throughout the paper, the authors stress the positive "impact" of public investment to GDP. This is not what estimates can tell precisely, though. For two particular reasons:

1. Having not identified the VEC model, it is imprecise to look at the estimates as being impact coefficients. Structural impulses response functions would be more informative;

Response: The referee is right; that said, as we explained in the previous reply, the model has now been identified, so he/she no longer has any cause for concern. Nonetheless, we also include the IRFs, because they are quite informative of the short-run dynamics.

2. Table 2 contains long-run elasticities that are proportional to the long-run change of one variable, let's say GDPt, when Gt increases. This is different to say that public investment has a direct impact on GDP, at least in the short-run. For a proper interpretation of cointegrating coefficients we refer to Lutkepohl (1994).

Response: As the referee correctly comments, we avoided any reference in the paper to any "direct impact." For the short-run dynamics, IRFs are, once again, more informative.

Minor Comments

Minor comment 1

In commenting Graph (3), it's private investment, not public, that never exceeded 5 percent of GDP before 1955 and reached 10 percent (and more) afterwards. On the contrary, public investment stayed lower than 5 percent for almost all the period under analysis.

Response to minor comment 1

The referee is right. The paragraph has been rewritten; please see the new version.

Minor Comment 2

Still while commenting Graph (3), "at the end of the sample [...], total public investment represented 20 percent of GDP" is probably referring again to private investment instead.

Response to minor comment 2 The referee is right. The paragraph has been rewritten; please see the new version.

Minor Comment 3

At page 9 there is a typo in repeating twice "impact of each of each investment component..."

Response to minor comment 3

The paragraph has been rewritten; please see the new version.

Minor Comment 4

At page 9 "The second column of Table 2 shows the order of the VEC". The VEC model is just a representation of the estimated VAR. The VEC model has a (p-1)-lag specification with respect to its VAR representation. To which value the order in Table 2 refers?

Response to minor comment 4

The previous version of the paper was somewhat imprecise, for which we apologize. In the final column of the new Table 2, we refer to the number of lags in the VEC as k (as stated in equations 3-5), which is equal to p-1, where p is the AIC lag selection criterion.

Comment 5 Table A2's title is partially written in Spanish

Response to minor comment 5 Our apologies. Table 2 has been corrected and everything is now in English.