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Infrastructure Investment and the Composition of Economic Activity in Portugal (*)

Alfredo Marvão Pereira and Rui Manuel Pereira
Department of Economics
The College of William and Mary
Williamsburg VA 23187

Abstract

This study analyzes the effects of infrastructure investment at the industry level using a newly developed data set for Portugal. We employ a vector autoregressive approach for twenty two sectors covering the whole spectrum of economic activity in the country and consider five main types of infrastructure assets to estimate industry-infrastructure specific effects. We first establish that the most important effects come from infrastructure investments in other transportation (railroads, ports, and airports), social infrastructures (education and health) and telecommunications with some less important effects from road infrastructures (roads and highways) and insignificant effects from public utilities (electricity, water, and refineries). In relative terms, with a focus on the industry divide between sectors producing traded and non-traded goods, we find that the infrastructure investments tend to shift the industry mix towards private and public services and therefore mostly towards non-traded good sectors. We find that the sectors that benefit the most in relative terms are construction, trade, and real estate among the private services and public administration, education and health among the public services, all of these non-traded goods sectors. There also some important effects in some traded goods sectors such as chemical and pharmaceutical, machinery and equipment and in particular transportation and storage, as well among emerging trading sectors, such as hospitality and professional services. In general, these results highlight the fact that infrastructure development strategies may be far from neutral for the perspective of the industry mix. Moreover, the fact that the benefits accrue mostly to sectors producing non-traded goods represents a move in the direction of a development model based on domestic demand, a model that may not be sustainable given its implications for the foreign account position of the country.

Keywords: Infrastructure Investment, Economic Performance, Industry Mix, Traded and non-traded sectors, VAR, Portugal.
JEL Classification: C32, E22, H54, O52, L90, L98

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1. Introduction

The analysis of the economic effects of infrastructure investments was brought to the limelight by the seminal work of Aschauer (1989a, 1989b). The body of empirical literature that developed in its aftermath is extensive and focuses on a large variety of issues, both at the aggregate and at the regional levels, both for the US and for other countries [see, for example, Munnell (1992), Gramlich (1994), Kamps (2005), Romp and de Haan (2007) and Pereira and Andraz (2013), for literature surveys]. Studies of these effects at the industry level are less common.

Although several studies for the US make reference to specific industries, they have essentially a regional focus [see, for example, Evans and Karras (1994), and Moomaw and Williams (1991)]. The sector-specific dimension is more directly relevant in the studies of Fernald (1993), Gokirmak (1995), Nadiri and Mamuneas (1994, 1996), Greenstein and Spillar (1995), Holleyman (1996), Pinnoi (1992) and Pereira and Andraz (2003). The international evidence at the industry level is even less abundant. It includes contributions such as Berndt and Hansson (1991) for Sweden, Seitz (1994), Seitz and Licht (1995) for Germany, Lynde and Richmond (1993) for the U.K., Shah (1992) for Mexico, and Pereira and Roca-Sagales (2001) for Spain and Pereira and Andraz (2007) for Portugal and multi-country studies, such as Evans and Karras (1993).

One issue that is virtually absent in this literature on the impact of infrastructure investments at the industry level is the relationship between aggregate and industry-specific effects, specifically how the aggregate effects can be decomposed at the industry level. This is a critical issue since the

relevance of the aggregate of the effects of infrastructure investments does not provide any useful information as to the industry incidence of such effects. Significant positive aggregate effects can be associated with balanced positive industry-level effects or they can mask uneven gains across industries. Also, it is conceivable that small effects at the aggregate level could hide significant effects for specific industries. Ultimately, there is the question of how the development of an infrastructure network has affected the industry mix in the country.

The question of how infrastructure investments affect the industry mix is a critical one when we consider small open economies depending on their ability to export to sustain improvements in their standards of living. Here, the effects of infrastructure investments as they affect the industry mix along the divide between sectors that produce traded and non-traded goods is of the utmost importance. Infrastructure investments that affect mostly sectors producing traded goods will help with this export-oriented development strategy, while those affecting mostly sectors producing non-traded goods will create added pressure on the external accounts and thereby erode the long term sustainability of the development model. The aggregate effects of infrastructure investments may, therefore, hide very different industry-specific patterns and thereby lead the economy into markedly different directions.

In this paper, we address the issue of the industry-specific effects of infrastructure investments using a newly developed data set for Portugal [see Pereira and Pereira (2015)]. From a methodological perspective, we use a multivariate dynamic time series approach, based on the use of industry specific vector autoregressive (VAR) models including industry output, employment, and private investment, in addition to different types of infrastructure investments. This approach was developed in Pereira and Flores (1999) and Pereira (2000, 2001), and was subsequently applied to the U.S. in Pereira and Andraz (2003, 2004), to Portugal in Pereira and Andraz (2005, 2007, 2011), and

to Spain in Pereira and Roca-Sagales (2001, 2003, 2007). This econometric approach highlights the dynamic nature of the relationship between infrastructure investments and the economy.

In addition, it should be pointed out that although our approach is eminently empirical, it is not a-theoretical. Indeed, our analysis is grounded in a dynamic model of the economy. In this model, the economy uses a production technology based on the use of capital and labor, as well as public infrastructure, to generate output. Given market conditions and the availability of public infrastructure, private economic agents decide on the level of input demand and the supply of output. In turn, the public sector engages in infrastructure investment based on a policy rule that relates public infrastructure to the evolution of the remaining economic variables. The estimated VAR system can be seen as a dynamic reduced form system for a production function and three input demand functions – for employment and private investment as well as infrastructure investment [a policy function]. This framework captures the role of public infrastructure investment as a direct input to production and as an externality in production. Infrastructures further affect output indirectly through their effect on the demand for labor and private capital.

In this context, our work is also related to the literature on fiscal multipliers, i.e., on the macroeconomic effects of taxes and government purchases [see, for example, Baunsgaard et al. (2014) and Ramey (2011), for recent surveys of this literature, and Leduc and Wilson (2012) for a related application]. It is in fact very much in the spirit of the approach pioneered by Blanchard and Perotti (2002), which is based on a VAR approach and uses the Choleski decomposition to identify government spending shocks. We focus, however, on a specific type of public spending – infrastructure investment and its effects on the economy, as opposed to aggregate spending or military spending as it is traditional in this literature. In this sense, this paper is closer in focus to Leduc and Wilson (2012), but has much more disaggregated nature both in terms of infrastructure assets and in its industry dimension.

In terms of the scope of the analysis, we estimate industry-specific models for twenty two industries spanning the whole spectrum of economic activity. The different sectors are grouped into two primary sectors (agriculture and mining) and seven manufacturing (food, textiles, paper, chemical, metals, machinery, etc.) which are traded good sectors as well as ten private services sectors (electricity, water, construction, trade, transportation, hospitality, finance, real estate, etc.) and three public services sectors (administration, health and education) which are mostly non-traded goods sectors.

As to the infrastructure investments, we consider five main groups of assets: road transportation infrastructures (including national roads, municipal roads, and highways), other transportation infrastructures (including railroads, ports, and airports), social infrastructures (including education and health infrastructures), public utilities (including water and wastewater, electricity and gas, and petroleum refineries), and telecommunications. For each sector of economic activity, we estimate five different industry-specific models, one for each infrastructure type. Accordingly, this approach allows us to identify the long-term aggregate multipliers for each type of infrastructure investment as well as the industry decomposition of these aggregate multipliers, thereby allowing us to identify the effects of different types of infrastructure investments on the industry mix.

This paper is organized as follows. Section 2 presents the economic and the infrastructure investment data sets. Section 3 presents the preliminary econometric results, including the VAR model specification and discusses the identification of exogenous shocks to infrastructure investment as well as the measurement of their effects. Section 4 presents the main evidence as to the economic impact of infrastructure investment on employment, private investment and output at

the industry level as well as their impact on the industry mix. Section 5 presents a summary, policy implications, and concluding remarks.

2. Data Sources and Description

2.1 The Infrastructure Investment Data Set

The data for infrastructure investment are from a new data set developed by Pereira and Pereira (2015) and covers the period between 1978 and 2011. Infrastructure investment is measure in constant 2005 euros. It considers twelve individual types of infrastructure investments grouped in five main groups: road transportation infrastructure, other transportation infrastructure, social infrastructures, public utilities, and telecommunication infrastructures. Table 1 presents summary information for the infrastructure investment efforts, investments as a percent of GDP, as well as a percent of total infrastructure investment.

Road transportation infrastructures include national roads, municipal roads and highways and account for 28.2 percent of total infrastructure for the sample period. Investment efforts and the extension of motorways in Portugal grew tremendously during the 1990s with the last ten years marked by a substantial increase in highway investment made possible due to public private partnerships. This corresponds in absolute terms to an increase from 0.75% of the GDP in the 1980s to 1.56% in the last decade.

Other transportation infrastructures include railroads, airports and ports, and account for 9.0 percent of total infrastructure investment between 1978 and 2011. These investment reached their greatest levels, as a percent of total infrastructure investment, with the modernization of the railroad network and port expansion projects while the last ten years has also brought with it substantial growth in investment in airports. In absolute terms, this reflects an increase from 0.22% of the GDP in the 1980s to 0.48% in the last decade.

Social infrastructures include health facilities and educational buildings. Social infrastructures account for 23.8 percent of infrastructure investment and show a slowly declining pattern over time in terms of their relative importance in total infrastructure investment. In absolute terms, however, these investments remained stable over the last two decades representing just over 1.0% of the GDP in average.

Public utilities include electric power generation, transmission and distributions, water supply and treatment, petroleum refining and **telecommunications infrastructures**. Together these account for 39.1 percent of total infrastructure investment in the sample period. In terms of their relative importance, investment in utilities reached a relatively high relevance in terms of total infrastructure investment in the 1980s, driven by the expansion of the telephone network, substantial investment in the major coal powered electricity production units and in two refineries. More recently, the expansion of mobile communications networks as well as investments in renewable energies have contributed to sustained growth in investment in utilities since 2000. In absolute terms, we witnessed a constant increase in importance from 1.13% of the GDP in the 1980s to 2.09% in the last decade.

Overall, investment levels have grown substantially over the past thirty years, averaging 2.92% of the GDP in the 1980s, 4.45% in the 1990s and 5.17% over the last decade. The increase is particularly pronounced after 1986, the year in which Portugal joined the EU, and in the 1990s when EU transfers within the context of the Structural and Cohesion Funds - Community Support Framework I (1989-1993) and Community Support Framework II (1994-1999) - stimulated a substantial increase in investment levels. The investment effort decelerated substantially during the last decade during the Community Support Framework III (2000-2006) and the QREN (2007-2013). These landmark dates for joining the European Union as well as the start of the different

community support frameworks are all considered as potential candidates for structural breaks in every single step of the empirical analysis that follows.

2.2 The Industry Data Set

The economic data – output, employment, and private investment, are obtained from different annual issues of the National Accounts published by National Institute of Statistics and available on-line at http://www.ine.pt. Output and private investment are measured in millions of constant 2005 Euros while employment is measured in thousands of employees.

We consider twenty two industries divided in four main groups. The different sectors are grouped into two primary sectors (agriculture and mining), seven manufacturing (food, textiles, paper, chemical and pharmaceutical, non-metallic minerals, metallic, and machinery), ten private services sectors (electricity, water, construction, trade, transportation, hospitality, telecommunications, finance, real estate, and professional services) and three public services sectors (administration, health and education). In Table 2 we include details on the definition of the different sectors.

We use the share of exports in the sector output over the last decade to identify the sectors producing internationally traded good and those which do not. We define the two primary sectors, the seven manufacturing sectors, and the sector of transportation as being traded goods sectors. The remaining nine private service sectors as well as the three public service sectors are defined as non-traded. Here, however, we will find useful to identify some private service sectors such as water, hospitality, telecommunications, finance and professional services as emerging traded goods sectors. In these sectors international trade plays a small but possibly increasing role.

Summary statistics on the industry mix during the sample period are provided in Table 3. The output share of the primary and the manufacturing sectors declined sharply over the sample period. The primary sector was 7.1% of output in the 1980s and declined to 3% in the last decade. The manufacturing sector, declined from 15.7% to 10.7%. Transportation declined in the 1990s but has somewhat rebound in the last decade. The sectors producing traded goods overall declined from 27.9% of output in the 1980s to 21.6% in the last decade, a decline that would be more pronounced if it weren't for the increase in the relative role of transportation and storage services. Private services, net of transportation, increased slightly from 61.1% of output in the 1980s to 62.3% in the last decade, led by a large increase in the role of professional services. The large increase over the sample period was in public services, which rose from 11% in the 1980s to 16.1% in the last decade, a change led directly by public administration services.

3. Preliminary Data Analysis

3.1. Unit Roots, Cointegration, and VAR specification

We start by using the Augmented Dickey-Fuller t-tests to test the null hypothesis of a unit root in the different variables. We use the Bayesian Information Criterion (BIC) to determine the number of lagged differences, the deterministic components, as well as the dummies for the potential structural breaks to be included. We find that stationarity in first differences is a good approximation for all series under consideration. This evidence is consistent with the conventional wisdom in the macro literature that aggregate output, employment, and private investment are I(1). Although our series are more disaggregated, the same pattern of stationarity is not surprising.

We test for co-integration for each region among output, employment, private investment, and infrastructure investment for each of the different infrastructure types. We use the standard Engle-Granger approach. We have chosen these procedures over the often used Johansen approach

for two reasons. First, since we do not have any priors that suggest the possible existence of more than one co-integration relationship, the Johansen approach is not strictly necessary. More importantly, however, for smaller samples based on annual data, Johansen's tests are known to induce strong bias in favor of finding co-integration when it does not exist (although, arguably, the Engle Granger approach suffers from the opposite problem). Again, we use the BIC to determine the number of lagged differences, the deterministic components as well as dummies for the potential structural breaks to be included. As a general rule our tests cannot reject the null hypothesis of no co-integration. This is consistent with the view that it is unlikely to find co-integration at a more disaggregated level when we fail to find co-integration at the aggregate level.

The absence of cointegration is neither surprising nor problematic and is, in fact, consistent with results in the relevant literature [see, for example, Pereira (2000) and Pereira and Andraz (2003) for the US case, Pereira and Roca (1999, 2001) for the Spanish case, and Pereira and Andraz (2005) and Pereira and Andraz (2007) for the Portuguese case]. On one hand, it is not surprising to find lack of evidence for long-term equilibrium relationships for an economy that has a long way to go in its process of converging to the level of its peers in the European Union. This is so at a more aggregated level and even more so when we consider the data at the regional level and its interaction with aggregate infrastructure investment variables. On the other hand, the absence of cointegration is not problematic as it only implies that a less simultaneous and dynamic approach based exclusively on OLS univariate estimates using these variables' would lead to spurious results. Specifically, the existence of cointegration means that two variables tend to a fixed ratio that is that in the long-term they grow at the same rate. Absence of cointegration suggests that they do not grow at the same rate, that is, there are differentiated effects of infrastructure investments on the levels of the each of the other variables.

Having determined that all of the variables are stationary in first differences and that they do not seem to be cointegrated, we follow the standard procedure in the literature and determine the specifications of the VAR models using growth rates of the original variables. We estimate five VAR models for each of the twenty two industries, one for each of the different infrastructure types. Each VAR model includes output, employment, and private investment in the sector as well as the relevant infrastructure investment variable. This means that, consistent with our conceptual arguments, the infrastructure investment variables are endogenous variables throughout the estimation procedure. We use the BIC to determine structural breaks and deterministic components, to be included. Our test results suggest that a VAR specification of first order with a constant and a trend as well as structural breaks in 1989, 1994, and 2000, the years of the inception of the first three community support frameworks, is the preferred choice in the overwhelming majority of the cases.

One important point to mention in terms of the VAR estimates is that the matrices of contemporaneous correlations between the estimated residuals display typically a block diagonal pattern. Specifically, the contemporaneous correlations between innovations in infrastructure investment and the other variables tend to be substantially smaller, if significantly different from zero, than the correlations between the different pairs of innovations among the other variables. As a corollary, the effects of the innovations in infrastructure investment are very robust to the orthogonalization mechanisms, a matter that we further discuss below.

3.2. Identifying Exogenous Innovations in Infrastructure Investment

While the infrastructure investment variables are endogenous in the context of the VAR models, the central issue in determining the economic impact of infrastructure investment is the identification of exogenous shocks to these variables. These exogenous shocks represent innovations in infrastructure investments that are not contaminated by other contemporaneous innovations and avoid contemporaneous reverse causation issues.

In dealing with this issue we draw from the approach typically followed in the literature on the effects of monetary policy [see, for example, Christiano, Eichenbaum and Evans (1996, 1999), and Rudebusch (1998)] and adopted by Pereira (2000) in the context of the analysis of the effects of infrastructure investment.

Ideally, the identification of shocks to infrastructure investment which are uncorrelated with shocks in other variables would result from knowing what fraction of the government appropriations in each period is due to purely non-economic reasons. The econometric counterpart to this idea is to consider a policy function which relates the rate of growth of infrastructure investment to the information in the relevant information set; in our case, the past and current observations of the growth rates of the economic variables. The residuals from this policy functions reflect the unexpected component of the evolution of infrastructure investment and are, by definition, uncorrelated with innovations in other variables.

In the central case, we assume that the relevant information set for the policy function includes past but not current values of the economic variables. This is equivalent in the context of the standard Choleski decomposition to assuming that innovations in investment lead innovations in economic variables. This means that while innovations in infrastructure investment affect the economic variables contemporaneously, the reverse is not true.

We have two reasons for making this our central case. First, it seems reasonable to assume that the economy reacts within a year to innovations in infrastructure investments. Second, it also seems reasonable to assume that the public sector is unable to adjust infrastructure investment decisions to innovations in the economic variables within a year. This is due to the time lags involved in information gathering and public decision making.

Furthermore, this assumption is reasonable also from a statistical perspective. This is so for two main reasons. First, invariably, the policy functions point to the exogeneity of the innovations in

infrastructure investment, i.e., the evolution of the different infrastructure investments does not seem to be affected by the lagged evolution of the remaining variables. This is to be expected because infrastructure investments were very much linked to EU support programs and therefore not responsive to the ongoing economic conditions and regardless we would not expect any single economic sector to have an impact on decision making for infrastructure investments at the national level. Second, and in a more technical vein, when we added to the policy functions contemporaneous values for the economic variables in addition to the lagged values, again, invariably, the estimated coefficients' were not significant. This is consistent with the block diagonal patterns we found for the matrices of contemporaneous correlations among the estimated residuals.

3.3. Measuring the Effects of Innovations in Infrastructure Investment

We consider the effects of one-percentage point, one-time shock in the rates of growth of the different types of infrastructure investment on output, employment, and private investment. We expect these temporary shocks in the growth rates of infrastructure investment to have temporary effects on the growth rates of the other variables. They will, however, have permanent effects on the levels of these variables. All of these effects are captured through the impulse response functions and accumulated impulse response functions associated with the estimated VAR models.

The accumulated impulse-response functions as well as the corresponding 90% bands that characterize the likelihood shape are presented in the Appendix in APPENDIX

Figure A1 to **Error! Reference source not found.**, for each of the five main industry assets and for all twenty two sectors of economic activity. These figures show the cumulative effects of shocks on infrastructure investments based on the historical record of thirty five years of data as filtered through the VAR and the reaction function estimates described above**.** We observe that without exception the accumulated impulse response functions converge within a relatively short time period suggesting that most of the growth rate effects occur within the first ten years after the

shocks occur. Accordingly, we present the accumulated impulse response results for only a twenty-year horizon.

The error bands surrounding the point estimates for the accumulated impulse responses convey uncertainty around estimation and are computed via bootstrapping methods. We consider 90% intervals although bands that correspond to a 68% posterior probability are the standard in the literature (Sims and Zha, 1999). Employing one standard deviation bands narrows the range of values that characterize the likelihood shape and only serves to reinforce and strengthen our results. Further evidence exists that nominal coverage distances may under represent the true coverage in a variety of situations (Kilian, 1998). Similarly, placing too great a weight on the intervals presented in evaluating significance in unwarranted in all but the most extreme cases. Thus, the bands presented are wider than the true coverage would suggest. From a practical perspective, when the 90% error bands for the accumulated impulse response functions include zero in a way that is not marginal (to allow for the difference between the 90% and 68% posterior probability) we consider that the effects are not significantly different from zero.

To measure the effects of shocks in infrastructure investment on the economic variables, we calculate the long-term elasticities and the long-term marginal products of the different economic variables with respect to each type of infrastructure investment, which we will also refer to as long-term multipliers. These concepts depart from the conventional understandings because they are not based on *ceteris paribus* assumptions, but rather include all the dynamic feedback effects among the different variables. Naturally, these are the relevant concepts from the standpoint of policy making.

We present estimates of the long-term accumulated elasticities of private investment, employment and output with respect to infrastructure investment. These elasticities are to be interpreted as the total accumulated percentage point long-term change in the other variables per one-percentage point accumulated long-term change in infrastructure investment.

We also present the long-term accumulated marginal products for private investment, employment and output with respect to infrastructure investment. These marginal products measure the dollar change in private investment and output, and the number of permanent jobs created, for each additional dollar of investment in infrastructures. The marginal product figures are obtained by multiplying the average ratio of each variable to infrastructure investment by the corresponding elasticity. Accordingly, the marginal product figures are the most interesting from a policy perspective as they capture both the effects of scarcity and to the effects of the coupling of infrastructure investment and the economy as reflected in the elasticities figures.

In computing the marginal products or multipliers, we use the average ratio of the economic variable to the level of infrastructure investment over the last ten years of the sample. Using a recent time period allows the marginal products to reflect the relative scarcity of the different types of infrastructures at the margin of the sample period, thereby accommodating for patterns of diminishing marginal returns to these investment. At the same time the choice of ten years prevents these ratios from being overly affected by business cycle factors.

4. On the Effects of Infrastructure Investment

4.1. Preliminary Conceptual Remarks

To help frame the effects of infrastructure investments on the industry mix it is useful to understand the different mechanisms through which these investments and the related assets affect economic performance. In general terms, infrastructures fall in the category public goods or of externalities - they provide services that although being necessary for private sector activity, would not be available or would be in short supply if totally left to private sector mechanisms. As such their provision is either public or done through close public tutelage. For some assets such as public

utilities and telecommunications technological advances and the evolution of the domestic and international markets has led to full private provision.

In this context, we can see infrastructure investments and the assets they generate affecting economic activity through different channels each with rather different impact on what one would expect in terms of the industry-specific incidence of the effects. First, there is what we could call a functional channel. Infrastructures fulfill a role as production inputs directly relevant for the activity in question. Transportation services for example, need a good road and other transportation network, while sectors that are either more labor intensive or rely more on skilled labor, such as finance or telecommunications, professional services, will have their productivity affected directly by the network of social infrastructures. This is, therefore, essentially a supply side channel. The ultimate effects the industry mix are going to depend on the direct relevance of the infrastructure as an additional input to production as well as on the nature of the relationship between infrastructure and private inputs – labor and private capital.

While the functional channel is the most recognized and often the only recognized channel it is neither the only channel nor necessarily the most important. A second channel is what we could call the construction channel. These investment projects inevitably use vast pools of resources, engage the rest of the economy in the process itself of constructing these assets. Making available a road, or a port, a hospital or a waste management facility, directly engages the construction industry and through it the rest of the economy - construction materials, etc. These are demand side effects on output and employment that although reverberating throughout the economy are expected to be short-lived.

A third channel through which infrastructures affect economic performance is the operation and maintenance channel. Operating and maintaining existing infrastructures creates needs for use of resources - goods and services and labor. While the effects of the economic effort involved in

operation and maintenance of a road infrastructures, for example, could easily be neglected, the same cannot be said about operating and maintaining a port, an airport, a hospital or a school. This is also a demand side effect but unlike the previous one it is more long lasting.

Finally, there is what we could call a site location channel. The existence of certain infrastructures such as certain transportation infrastructures, schools, and hospitals serve as an attractor for population and business. There should follow important effects, for example, for trade and real estate. Naturally, the opposite is true for airports, waste and wastewater facilities or power plants and refineries which have a negative effect on the desirability of where they are located.

Considering these different channels is important to understand industry incidence of the effects of infrastructure investments on the industry mix. The reverse is also true. The type of sector specific effects we estimate offer a glimpse into what channels seem to be the most important for each infrastructure asset.

4.2 The Effects at the Industry Level: A First Look

The most aggregate results are reported in last rows of Table 4 to Table 8. When we consider the five main infrastructure assets a clear pattern emerges. Investments in other transportation has the largest effects closely followed by investments in social infrastructures and in telecommunications. Investments in road transportation infrastructure have positive but much smaller effects while the effects of investments in public utilities are negligible. For example, in terms of the long-term output multipliers, the effects of other transportation, social infrastructures, and telecommunications are €19.84, €18.50, and €13.98, respectively, while the multipliers for road transportation is €5.69.

When we consider the effects of the five main types of infrastructures at the more disaggregated level on four different economic activities: primary sector, manufacturing, private

services and public services, again a clear pattern emerges. The empirical results are reported in Table 4 to Table 8 in the rows with the partial totals.

There are stark differences in terms of the sector-specific effects. The effect of the different types of infrastructure investments on the primary sector are either negative or very small while the effects on manufacturing are generally positive but small. The effects on private services are the largest followed at a distance by the effects on public services. For example, the effects of other transportation infrastructure investments on the output of the private services and public services are €17.16 and €3.68, respectively, the effects of social infrastructures, €13.58 and €4.58, and of telecommunications €10.88 and €1.82. For a sense of perspective the largest effect on primary sector output comes from other transportation infrastructures with -€0.08 and the largest effect on manufacturing comes from social infrastructure with €1.46.

4.3 The Effects at the Industry Level: A Closer look

We consider now the effects of the five main types of infrastructure assets across the twenty two sectors covering the whole spectrum of the domestic economic activity.

The effects of investments in **road infrastructure** are reported in Table 4 and Figure 1. When we consider the four main sectors of economic activity, we observe that the relatively small effects of road infrastructure investments are concentrated mostly on private services and to a lesser extent on public services, the effect on manufacturing being much smaller and in the case of the primary sector negative. Looking at the more detailed results, we see that for the primary sectors and for manufacturing sectors, the effects are all very small – 15 of the twenty seven elasticities estimated are not statistically different from zero. In terms of the private and public services, the picture is richer. For private investment, the largest benefits accrue to S18 (real estate), S19 (professional services) and S20 (public administration), but are all very small compared to the effects observed from other types of infrastructures. For employment, the benefits accrue mostly to S13 (trade) and

S19 (professional services). In turn, the main benefits in terms of output accrue to S18 (real estate) with €2.47. The much smaller effects on S12 (construction), S13 (trade), S20 (public administration) and S21 (education) are also very small comparatively to the effects of other infrastructures.

In terms of **other transportation** infrastructure investments, the results are reported in Table 5 and Figure 2. The effects are substantial and overwhelmingly concentrated on private services, and to a lesser extent on public services, while the only effects worth mentioning for the primary sector are for employment and for the manufacturing sector for investment. For private investment the largest benefits accrue to S12 (construction), S13 (trade), S14 (transportation), and S19 (public administration). For employment, the largest effects are in S12 (construction), S13 (trade), and S19 (professional services) and to a lesser extent S15 (hospitality) and S20 (public administration). In terms of the effects on output, the sectors that benefit the most are S18 (real estate) with €10.45 followed by S12 (construction), S13 (trade), S19 (public administration), and S20 (education) with still rather sizable effects of €2.44, €2.54, €1.70 and €1.79, respectively.

The effects of **social infrastructure** investments are reported in Table 6 and Figure 3. Across the four main sectors of economic activity the benefits are again overwhelmingly concentrated on private services and to a lesser extent on public services, being mostly negative for the primary sectors and small but most often than not positive for manufacturing. At a more disaggregated level, the positive effects on private investment are particularly significant for S18 (real estate) and S19 (professional services) and very important for S13 (trade), S17 (finance), and S20 (public administration). In terms of employment, we start by noticing sizable negative effects on employment in S1 (agriculture), S4 (textiles), and S15 (hospitality). On the flip side, we see very large effects on employment in S12 (construction), S13 (trade) and S19 (professional services). As output is concerned, there are sizable positive effects on output of S9 (machinery and equipment) and sizable negative effects for output of S10 (electricity and gas) and S11 (water). The largest output

effects are on S12 (construction) with €3.41 and S18 (real estate) with €5.31, with very sizable effects for S13 (trade), S14 (transportation), S17 (finance), and S19 (professional services) and the three public services sectors, S20 (administration), S21 (education) and S22 (health).

As to investments in **public utilities**, results are reported in Table 7 and Figure 4. The results are, with very few exceptions, very small. Indeed, forty of the sixty six elasticities estimated are not statistically different from zero.

Finally, the effects of investments in **telecommunications** are reported in Table 8 and Figure 5. These investments have the greatest impact on private services with moderate positive effects on the output in public services, employment in all the other sectors and private investment in manufacturing. The largest effects on private investment are in S14 (transportation), S18 (real estate) and S19 (professional services) and to a lesser extent in S13 (trade) while the largest effects on employment occur in sectors S12 (construction), S13 (trade) and S19 (professional services), and to a lesser extent on S15 (hospitality). In terms of output, the largest effects occur in S18 (real estate) with €4.47 followed by S12 (construction), S13 (trade), S17 (finance), S19 (professional services), and S21 (public administration) with effects of €1.79, €1.16, €1.59, €1.19, and €1.04, respectively.

A clear picture emerges from these more disaggregated results. The fact that the benefits of the different types of infrastructure investments accrue mostly to private services and to a lesser extent to public services is now sharpened as even within these sectors there are sector that seem to benefit the most while others seem to be mainly unaffected. Let's consider some informative details.

We have identified one hundred and ten infrastructure-industry specific effects on each of private investment, employment, and output. For private investment, we observe fourteen effects that are significantly positive and above €1, of which twelve are in private services – three in S13 (trade), S19 (professional services), two in S18 (real estate) and S14 (transportation) and one for S12 (construction) and S17 (finance). For employment there are sixteen effects that are significantly

positive and larger than 15 full time jobs per one million euros of investment. Of these, thirteen accrue to private services – four to S12 (construction) and S19 (professional services) three to S13 (retail) and two to S15 (hospitality). The remaining three go to S20 (public administration), S21 (education) and S1 (agriculture). Finally, for output there are seventeen effects that are significantly positive and greater that €1, fourteen for private services – five for S18 (real estate) three for S12 (construction) and two for S13 (trade) and S19 (professional services), with the remaining for S15 (hospitality) and S17 (finance) - and three for public services – two for S20 (public administration) and one for S21 (education).

A casual observation, therefore, suggests that within private services S12 (construction), S13 (trade), S18 (real estate) and S19 (professional services) and to a lesser extent S15 (hospitality) and S17 (finance) were in absolute terms the great beneficiaries from infrastructure investments. In turn, S20 (public administration) was the greatest beneficiary for public services.

4.4 On the Effects on the Composition of Economic Activity

In this section, we probe in a more formally into the issue of which sectors benefit the most from infrastructure investments. We want to identify the effects of infrastructure investment on the industry mix in the country, in particular as it affects the traded – non-traded divide.

To analyze the effects of infrastructure investments on the industry mix, we need to move beyond the magnitude of the effects of infrastructure investments in absolute terms and turn to the effects in relative terms. This means, first, for each sector the size of its effects relative to the total effects for all sectors and, second, these shares relative to the size of the industry. The point is that the small effects for certain sectors, maybe just a reflection of the fact that these sectors are small. Furthermore, even small effects are significant if the share of the total effects they represent exceeds the share of the sector in the total economy. In this case, the marginal effects induced by the

infrastructure investments exceed the average size of the sector and as such infrastructure investments tend to make such sector relatively more important in the industry mix.

We can conceptualize the results in four categories – for sectors with negative effects or effects that are not statistically different from zero, infrastructure investments have decisively changed the industry mix away from them, while for sectors with positive effects in particularly when the share of the total effects they represent exceeds the share of the sector in the total economy, infrastructure investments have biased the industry mix in their favor. The results of infrastructure investments in the industry mix are reported in Tables 9 to 13.

Road infrastructure investments at the more aggregated level leads to a shift of private investment to private and public services, employment to private services, and output to also to both private and public services. At a more disaggregated level, in terms of private investment the largest gains go to S19 (professional services) followed by S15 (hospitality) and S21 (education) while for employment, the largest relative gains go also to S19 (professional services), followed by S13 (trade), S15 (hospitality), and S20 (public administration). Finally, in terms of the output mix, the largest gains in relative terms come to S18 (real estate), and to a lesser extent, to S12 (construction), S15 (hospitality), S21 (education), and S22 (health).

Other transportation infrastructure investments, at a more aggregated level induce a shift in the industry mix towards greater employment and private investment shares in private services and a clear shift in output towards private and public services. In terms of private investment the largest relative gains go to S3 (food), S5 (paper) S14 (transportation), S15 (hospitality), S19 (professional services) while for employment the largest relative gains go to S2 (mining), as well as S12 (construction), S15 (hospitality) and S19 (professional services). For output, S18 (real estate) is the largest beneficiary in relative terms, followed by S10 (electricity and gas), S11 (water), S12 (construction), S15 (hospitality), and S21 (education).

In terms of **social infrastructure** investments, the industry mix is shifted toward manufacturing and public services for private investment, private services for employment and private and public services for output. At a more detailed level, for private investment, the large relative gains accrue to S5 (paper) and S8 (basic metals) as well as S13 (trade), S17 (finance), S19 (professional services), S21 (education) and S22 (health). For employment, we see high relative gains for S12 (construction), S18 (real estate), and S19 (professional services) and to a lesser extent S7 (non-metallic) and S8 (basic metal). For output the largest relative gains accrue to S12 (construction), S18 (real estate) followed by S9 (machinery and equipment) S14 (transportation and storage), S17 (finance), S19 (professional services), S21 (education), and S22 (health).

The case of investments in **public utilities** is not particularly interesting or informative as its effects tend to be rather small and make very little difference in terms of the industry mix. Finally, for investments in **telecommunication infrastructures**, the effects suggest an industry shift towards manufacturing for private investment and towards private services for private investment, employment, and output. For private investment the largest relative gains accrue to S3 (food) S5 (paper) S7 (non-metallic) as well as S14 (transportation), S15 (hospitality), S16 (telecommunications), S21 (education) and S22 (health). The largest relative employment effects go for S7 (non-metallic) and S9 (machinery and equipment) as well as S15 (hospitality), S18 (real estate), S19 (professional services), and S21 (education). Finally, the largest relative output effects go to S7 (non-metallic), S12 (construction), S18 (real estate), and S19 (professional services).

In final analysis, overall the ten sectors producing traded goods lost ground in their relative importance due to the impact of infrastructure investments. This is despite some relative gains across the board for S7 (non-metallic minerals), S8 (basic metals), S9 (machinery and equipment) and S14 (transportation and storage), some employment gains for S2 (mining) and S8 (basic metals), and some private investment gains for S3 (food) and S5 (paper). Among the five emerging traded

sectors only S15 (hospitality) and S19 (professional services), seemed to have benefitted in a very clear, consistent and significate manner. Finally, the largest gains in relative terms across the board go unquestionably to S12 (construction), S18 (real estate), S21 (education) and S22 (health), with important gains for S13 (trade) in terms of employment and private investment and for S20 (public administration) in terms of employment.

4.5 On the Relationship between the Aggregate and Sectorial Effects

The relationship between the aggregate effects and the sum of the industry-specific results deserves some considerations. This is because we want to make sure that the results discussed here which were obtained from the twenty two individual industries for each one of the five main infrastructure assets, are consistent with the results obtained at a more aggregate level, say when we consider the aggregate economy as a whole.

Given their public good nature, when infrastructure investments occurs, the new assets become available, simultaneously, to all industries. From this standpoint, one could think that the sum of the marginal products of infrastructure investments across industries should be equal to the marginal products estimated with more aggregate models.

It is more likely, however, for the sum of the industry-specific effects to somewhat differ from the aggregate effects. This is due to the likely existence of general equilibrium effects that are not captured at the individual industry level. Consider, for example, the effects of infrastructure investments on private input decisions. When an infrastructure is made available, more inputs are desired, simultaneously, by all industries. This simultaneous increase in demand, however, is limited by resource constraints in the economy. Therefore, part of the increased demand induces higher input prices and a downward adjustment of the industry-specific input demands. Thus, it is likely that the sum of the sectorial marginal products will somewhat exceed the aggregate effects.

In the same vein, the increase in output observed for each industry individually would not

affect substantially the output prices at the aggregate level. This is to say that it is as if each sector has a horizontal output supply schedule. At the aggregate level, however, we would expect the simultaneous increase in output in most industries to lead to a reduction in the equilibrium output price and to smaller aggregate output effects.

To check on this issue, we first obtain the sum (weighted by the share of each infrastructure asset in total infrastructure investment) across the different industries of all of the statistically significant marginal products of infrastructure investment (among the one hundred and ten estimates). We then obtain the sum (again weighted by the share of each infrastructure asset) of the marginal products obtained with the five aggregate models for the whole economy, one for each of the infrastructure assets. The weights allow us to interpret both sums as the total marginal product for the economy of a one euro invested in infrastructures in the country. We find that the sum of the marginal products from the one hundred and ten industry-infrastructure specific models represent for private investment, employment, and output, 134.7%, 125.5% and 167.4%, respectively, of the sum of the marginal products for the five aggregate models. In light of the previous discussion, these figures have several corollaries. First, the results from the industry-infrastructure specific models are very much in line with the results from the more aggregate models. Second, the general equilibrium effects seem to be relevant in all cases, in particular output. Finally, the magnitude of these general equilibrium effects are in line with our estimates for Portugal, Spain and the United States [see, Pereira and Andraz (2001), Pereira and Roca (2001), Pereira and Andraz (2007)], although they tend to be slightly larger general equilibrium effects in our case.

From a practical perspective what this means is that the estimates presented here at the individual industry-infrastructure specific level are likely to over-estimate the actual effects of the infrastructure investments. There is no reason, however, to think that this would in any way affect

the disaggregated patterns we have identified in terms of the effects both in absolute terms and in relative terms.

5. Summary and Concluding Remarks

This study analyzes the effects of infrastructure investment at the industry level in Portugal. We employ a vector autoregressive approach for twenty two sectors covering the whole spectrum of economic activity and considering five different infrastructure assets to estimate industry-infrastructure specific effects and ultimately identify the effects of infrastructure investments on the industry mix.

At a more aggregate level, we first establish that the most important effects from infrastructure investments come from other transportation, social infrastructures and telecommunications with some less important effects from road infrastructures and insignificant effects from public utilities. We also find that the benefits from infrastructure investment tend to accrue mostly to private services and to a lesser extent to public services with typically detrimental effects on the primary sector and more mixed effects on the manufacturing sector.

With this background information, we analyze the industry effects in detail. In absolute terms, we find that within the private service sectors, construction, trade, real estate, and professional services, and to a lesser extent hospitality and finance, were the greatest beneficiaries from infrastructure investments while public administration was the greatest beneficiary among the public service sectors.

In relative terms, with a focus on the industry divide between traded and non-traded goods, we find that the infrastructure investments tended to shift the industry mix towards private and public services and therefore mostly towards sectors producing non-traded goods. We find that the sectors that tended to benefit the most in relative terms are construction, trade, and real estate

among the private services and public administration, education and health among the public services. All of these are sectors producing non-traded goods. There also some important effects in some sectors producing traded sectors such as chemical and pharmaceutical, machinery and equipment and, in particular, transportation and storage, as well as among emerging trading sectors such as hospitality and professional services.

There are several important policy implications from these results. They stem from the key finding that the positive aggregate effects of the different types of infrastructure investments mask rather diverse effects at the industry level. Accordingly, a first policy implication is the recognition that infrastructure development strategies are far from neutral in that they effectively represent picking winners and losers as different industries are concerned. Moreover, the fact that the lopsided benefits accrue mostly to non-traded sectors represents a push in the direction of a development model based on domestic demand that may not be sustainable given its implications for the foreign account position of the country.

Second, and from a prospective standpoint, there is the issue of what can be expected from the infrastructure investments that are currently being considered in the country. It would seem that the great focus for the next few decades will be on non-road transportation and social infrastructure. Indeed, the time has passed for any focus on road infrastructure, which is perceived as having already achieved a high level of maturity if not outright overinvestment. In addition, investments in public utilities and telecommunications are now mostly in the hands of the private sector and therefore less directly affected by public policy.

As per our results, infrastructure investments in the areas of other transportation and social infrastructures will have very important aggregate effects but may also deepen the bias in the industry mix towards non-traded goods. Investments in other transportation in relative terms mostly favors employment in professional services and to a lesser extent construction, hospitality, and real

estate, and mostly favors output in real estate and to a lesser extent in utilities, construction, and education. In turn, investments in social infrastructures tend to increase the share of employment in real estate, professional services, and construction as well as the traded sectors of non-metallic minerals and basic metals, and the share of output in real estate, construction, finance, education, and health as well as the traded sector of machinery and equipment.

The results in this paper open the door to several important research avenues, technical and yet directly relevant for policy making. An important next step would be going more in the direction of the fiscal multiplier literature and to explore how non-linearities may affect the effects of infrastructure investments. In particular, it would interesting to consider the issue of regime switching, i.e., if it makes a different if the investments occur in a boom or a bust, as well as the issue of the potential differential effects between investment increases and decreases. In addition, a closer look at the timing of the effects, that is, the issue of whether most of the effects occur in the short-term or over a longer time frame would help in understanding the nature of the mechanisms behind these effects. Finally, exploring the panel dimension of the data could bring new insights into the results and obviate any concerns about relative small sample sizes so common in this literature.

At more of a policy level, the first avenue, would be probing at a more detailed level into the effects of different individual infrastructure assets. For example, does it make a difference for the industry mix if road infrastructure investments are in the form of municipal roads or highways? If other transportation investments are in railroads or port? If social infrastructure investments are in education or health facilities? The second, would be a more detailed look at these issues from the perspective of the different industries to shed light on how each industry fits into the development model of the country and how infrastructure and industrial policies interact. For example, from the perspective of traditional traded sectors such as the textile sector, or some of the emerging traded sectors such as finance or hospitality, how have infrastructure policies affected their performance?

The third, would be investigating the meaning of the patterns of results we identified at the industry level as they relate to the nature of the effects of infrastructure investments and the channels through which they affect economic performance. For example, how does it mean that the benefits to construction and real estate are pervasive? Finally, it would be informative to analyze the interaction between infrastructure investments and, for example, foreign direct investment as clearly not all infrastructure assets affect these investments equally and such investments are regarded as key to the economic performance in the country.

To conclude, it should be mentioned that although this paper is an application to the Portuguese case and is intended to be directly relevant from the perspective of policy making in Portugal, its interest is far from parochial. The quest for policies that promote long-term growth in a framework of fragile public budgets is widespread. In the EU context, Greece, Ireland, Portugal and to a lesser extent Italy and Spain benefited after the early 1990s from important community structural transfers in no small part targeting infrastructure developments. The same is true in more recent years for the more recent EU entrants from Eastern Europe. At the same time, all of these countries, as small open economies, depend critically on improved international competitiveness to maintain improvements in standards of living. Whether infrastructure investments lead to favorable aggregate outcomes that hide a bias towards traded or towards non-traded goods is, therefore, a critical piece of information when designing development strategies that rely to a meaningful extent on infrastructure development.

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Table 1 Infrastructure Investment by Type of Asset

% of GDP	1978-2009	1980-89	1990-99	2000-09
Road Transportation	**1.42**	**0.89**	**1.59**	**1.88**
National Roads	0.61	0.39	0.73	0.71
Municipal Roads	0.44	0.40	0.50	0.45
Highways	0.37	0.09	0.36	0.73
Other Transportation	**0.46**	**0.26**	**0.56**	**0.57**
Railroads	0.34	0.18	0.45	0.43
Airports	0.05	0.04	0.04	0.08
Ports	0.06	0.04	0,07	0.07
Social Infrastructures	**1.15**	**0.97**	**1.30**	**1.26**
Health	0.55	0.34	0.57	0.75
Education	0.60	0.63	0.73	0.51
Public Utilities	**1.99**	**1.33**	**1.85**	**2.53**
Water and Wastewater	0.37	0.17	0.32	0.52
Electricity and Gas	0.73	0.55	0.46	1.09
Petroleum Refining	0.22	0.11	0.22	0.18
Telecommunications	0.67	0.49	0.85	0.75
% of Infrastructure Investment	**1978-2009**	**1980-89**	**1990-99**	**2000-09**
Road Transportation	**28.20**	**25.95**	**30.35**	**30.23**
National Roads	12.21	11.52	14.09	11.43
Municipal Roads	9.33	11.90	9.47	7.10
Highways	6.67	2,56	6.29	11.76
Other Transportation	**8.98**	**7.57**	**10.52**	**9.21**
Railroads	6.72	5.17	8.31	6.92
Airports	1.03	1.17	0.81	1.21
Ports	1.23	1.23	1.40	1,08
Social Infrastructures	**23.76**	**28.41**	**24.52**	**20.13**
Health	10.74	9.89	10.73	11.79
Education	13.02	18.52	13.79	8.16
Public Utilities	**39.06**	**38.04**	**34.61**	**40.43**
Water and Wastewater	6.80	4.90	5.98	8.17
Electricity and Gas	14.34	15.97	8.48	17.53
Petroleum Refining	4.58	3.22	4.06	2.83
Telecommunications	13.34	13.94	16.12	11.89

Table 2 Industry Classification

Industry Sector	
Primary Sector – Agriculture	
Agriculture (S1)	Agriculture, forestry and fishing
Mining (S2)	Mining and quarrying
Secondary Sector - Manufacturing	
Food (S3)	Manufacture of food products, beverages and tobacco products
Textiles (S4)	Manufacture of textiles, wearing apparel and leather products
Paper (S5)	Manufacture of wood and paper products, and printing
Chemical and Pharmaceutical (S6)	Manufacture of chemicals and chemical products. Manufacturing of basic pharmaceutical products and pharmaceutical preparations.
Non-metallic minerals (S7)	Manufacture of rubber and plastics products, and other non-metallic mineral products
Basic metals (S8)	Manufacture of basic metals and fabricated metal products, except machinery and equipment
Machinery and equipment (S9)	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment; Manufacture of transport equipment; Manufacture of furniture; other manufacturing; repair and installation of machinery and equipment
Tertiary Sector - Private Services	
Electricity and gas (S10)	Electricity, gas, steam and air-conditioning supply
Water (S11)	Water, sewerage, waste management and remediation activities
Construction (S12)	Construction
Wholesale and retail trade (S13)	Wholesale and retail trade, repair of motor vehicles and motorcycles
Transportation and storage (S14)	Transportation and storage
Hospitality (S15)	Accommodation and food service activities
Telecommunications (S17)	Telecommunications
Finance (S17)	Financial and insurance activities
Real estate (S18)	Real estate activities
Professional services (S19)	Publishing, audiovisual and broadcasting activities; Computer programming, consultancy and related activities; information service activities; Legal and accounting activities; activities of head offices; management consultancy activities; architecture and engineering activities; technical testing and analysis; Scientific research and development; Advertising and market research; other professional, scientific and technical activities; veterinary activities; Administrative and support service activities; Arts, entertainment and recreation; Other services activities
Tertiary Sector - Public Services	
Public administration (S20)	Public administration and defense; compulsory social security
Education (S21)	Education
Health (S22)	Human health services; Social work activities

Table 3 Industry Composition

	Private Investment				Employment				Output			
	1978-2009	1980-89	1990-99	2000-09	1978-2009	1980-89	1990-99	2000-09	1978-2009	1980-89	1990-99	2000-09
Agriculture	**4.7**	**7.1**	**3.9**	**3.0**	**15.5**	**20.8**	**13.7**	**10.1**	**8.6**	**14.1**	**6.6**	**3.4**
Agriculture (S1)	3.8	5.1	3.5	2.6	14.5	19.1	13.0	9.7	6.7	10.2	5.6	2.9
Mining (S2)	1.0	2.0	0.4	0.4	1.0	1.7	0.7	0.3	1.9	3.9	1.0	0.5
Manufacturing	**13.1**	**15.7**	**12.3**	**10.7**	**21.8**	**25.0**	**21.7**	**18.0**	**18.1**	**20.5**	**18.5**	**15.1**
Food (S3)	1.4	1.3	1.3	1.6	2.7	3.1	2.6	2.4	2.1	2.0	2.2	2.1
Textiles (S4)	1.3	1.9	1.3	0.7	7.4	8.9	7.6	5.5	3.7	4.2	4.2	2.7
Paper (S5)	1.4	1.6	1.2	1.5	2.3	2.5	2.3	1.8	2.2	2.4	2.2	1.8
Chemical and pharmaceutical (S6)	2.0	2.2	1.5	1.3	0.8	1.1	0.7	0.5	1.7	2.3	1.5	1.2
Non-metallic minerals (S7)	2.0	2.6	1.7	1.6	2.0	2.2	2.0	1.8	2.7	3.4	2.6	2.0
Basic metals (S8)	1.1	1.2	1.0	1.0	2.3	2.6	2.2	2.1	2.5	3.5	2.1	1.8
Machinery and equipment (S9)	4.0	4.9	4.2	2.9	4.0	4.9	4.2	2.9	3.3	2.7	3.7	3.7
Private Services	**67.8**	**66.2**	**66.8**	**70.2**	**45.2**	**39.2**	**46.3**	**51.7**	**56.3**	**52.7**	**56.7**	**60.3**
Electricity and gas (S10)	4.9	8.0	1.7	3.9	4.3	4.6	4.2	3.9	2.1	1.8	2.4	2.2
Water (S11)	3.4	5.6	1.5	2.3	0.4	0.5	0.4	0.2	0.6	0.5	0.6	0.9
Construction (S12)	5.3	5.5	6.4	4.1	0.9	1.1	0.8	0.7	7.1	6.8	7.0	7.7
Wholesale and retail trade (S13)	5.6	4.7	6.2	6.3	10.7	10.5	10.1	11.4	15.4	16.8	15.1	14.1
Transportation and storage (S14)	5.8	5.1	4.4	7.9	13.9	12.0	14.5	15.8	4.6	5.2	4.3	4.6
Hospitality (S15)	1.9	1.6	2.1	2.2	3.5	3.8	3.3	3.4	3.7	2.7	3.9	4.7
Telecommunications (S16)	2.7	2.0	3.0	3.1	4.4	3.6	4.5	5.4	1.9	1.4	2.0	2.3
Finance (S17)	4.8	5.1	6.0	3.7	0.4	0.5	0.4	0.3	6.3	6.3	6.1	6.6
Real estate (S18)	26.6	24.8	28.2	27.0	2.3	2.5	2.5	2.1	7.5	6.0	7.4	8.0
Professional services (S19)	6.7	3.9	7.3	9.7	0.5	0.2	0.6	0.7	7.2	5.2	7.8	9.1
Public Services	**14.4**	**11.0**	**17.0**	**16.1**	**17.5**	**15.0**	**18.4**	**20.2**	**17.0**	**12.8**	**18.2**	**21.2**
Public administration (S20)	10.8	8.4	13.1	11.8	8.0	7.1	8.2	9.1	8.5	7.2	8.9	9.9
Education (S21)	1.7	1.5	2.0	1.8	5.7	4.7	6.2	6.6	5.3	3.6	6.0	6.8
Health (S22)	1.9	1.1	2.0	2.6	3.8	3.2	4.0	4.6	3.2	2.0	3.3	4.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 4 Effects of Road Transportation Investment by Sector of Economic Activity

	Elasticity			Marginal Product		
	Private Investment	**Employment**	**Output**	**Private Investment**	**Employment**	**Output**
Agriculture and Mining				**-0.03**	**0.9**	**-0.19**
Agriculture (S1)	0.1641*	0.0024*	**-0.1180**	0.06*	0.5*	-0.18
Mining (S2)	**-1.4527**	0.0545*	-0.0566*	-0.09	0.4*	-0.01*
Manufacturing				**0.60**	**2.0**	**0.41**
Food (S3)	0.0882*	**-0.0359**	**0.1138**	0.02*	-1.7	0.13
Textiles (S4)	0.3323*	-0.0031*	0.0629*	0.03*	-0.3*	0.09*
Paper (S5)	0.1283*	**0.0396**	-0.0505*	0.03*	1.4	-0.05*
Chemical and Pharmaceutical (S6)	**1.1317**	0.0092*	**-0.1251**	0.11	0.1*	-0.06
Non-metallic minerals (S7)	**0.4417**	**0.0435**	**0.1530**	0.10	1.6	0.16
Basic metals (S8)	**0.3712**	0.0162*	-0.0557*	0.05	0.7*	-0.05*
Machinery and equipment (S9)	**0.6143**	0.0031*	0.0965*	0.26	0.2*	0.19*
Private Services				**3.62**	**55.1**	**4.16**
Electricity and gas (S10)	0.2866*	**-0.1848**	-0.0824*	0.16*	-0.9	-0.10*
Water (S11)	0.8385*	**-0.1461**	-0.0949*	0.28*	-2.2	-0.04*
Construction (S12)	0.2550*	0.0125*	**0.1429**	0.15*	2.8*	0.58
Wholesale and retail trade (S13)	**0.4155**	**0.0628**	**0.0965**	0.37	19.7	0.72
Transportation and storage (S14)	0.4518*	0.0031*	0.0017*	0.51*	0.2*	0.00*
Hospitality (S15)	**0.5122**	**0.0796**	**0.1558**	0.16	8.5	0.39
Telecommunications (S16)	**0.3827**	0.0007*	-0.0027*	0.17	0.0*	0.00*
Finance (S17)	**0.5326**	-0.0328*	0.0613*	0.28	-1.4*	0.22*
Real estate (S18)	**0.2431**	0.0055*	**0.5827**	0.94	0.1*	2.47
Professional services (S19	**0.4446**	**0.1233**	-0.0163*	0.61	28.3	-0.08*
Public Services				**0.93**	**10.9**	**1.31**
Public administration (S20)	**0.4184**	**0.0611**	**0.1094**	0.62	8.1	0.51
Education (S21)	**0.4842**	0.0128*	**0.1407**	0.12	1.7*	0.51
Health (S22)	0.3256*	0.0082*	**0.0936**	0.19*	1.1*	0.29
TOTAL				**5.13**	**68.9**	**5.69**

(*) The estimates marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Figure 1 Effects of Road Transportation Investment by Sector of Economic Activity

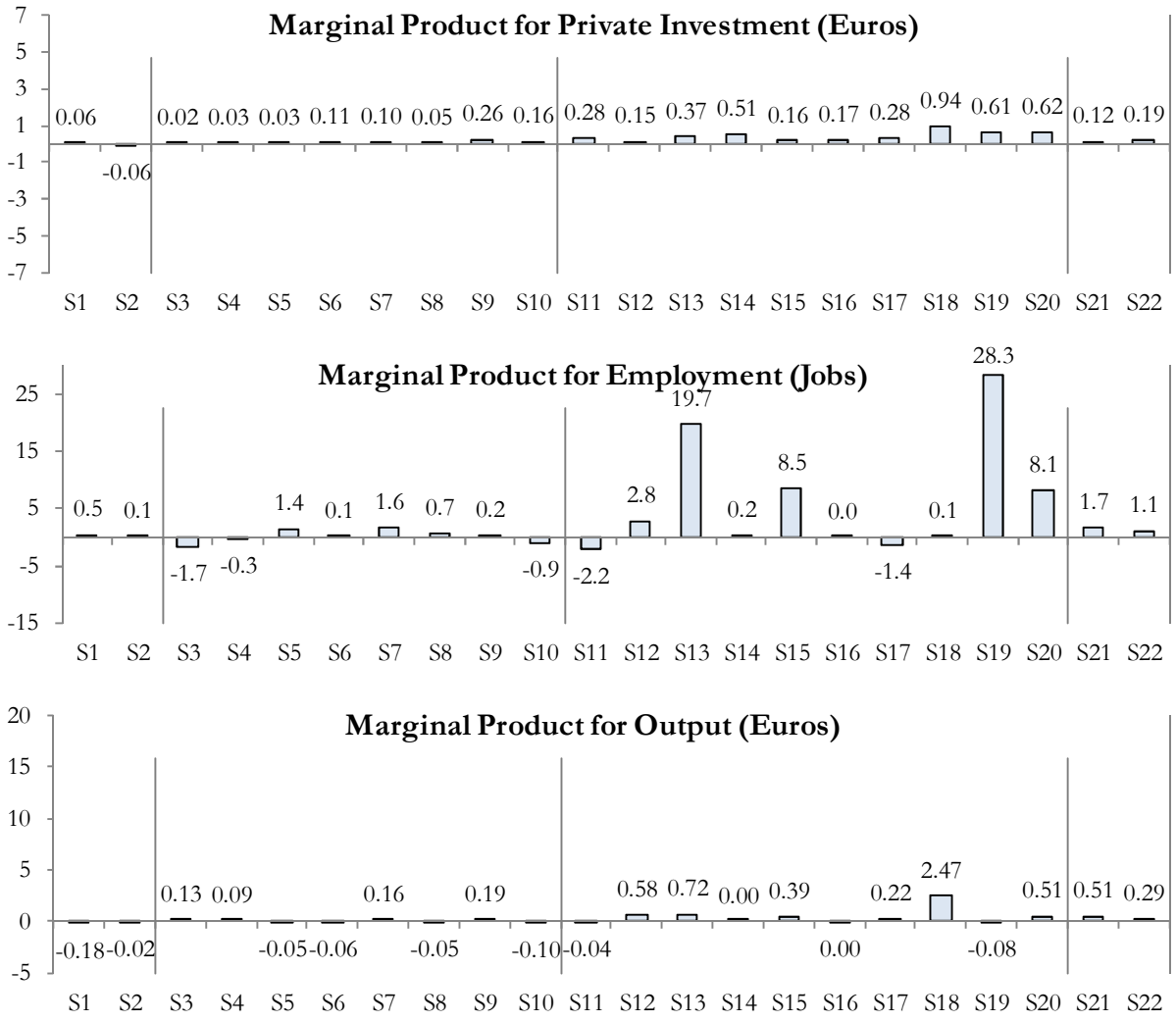


Table 5 Effects of Other Transportation Investment by Sector of Economic Activity

	Elasticity			Marginal Product		
	Private Investment	**Employment**	**Output**	**Private Investment**	**Employment**	**Output**
Agriculture and Mining				**0.21**	**38.9**	**-0.08**
Agriculture (S1)	**0.4602**	**0.0507**	-0.0159*	0.56	32.3	-0.08*
Mining (S2)	**-1.7191**	**0.2900**	0.0008*	-0.35	6.6	0.00*
Manufacturing				**1.93**	**-18.9**	**-0.92**
Food (S3)	**0.5144**	**-0.0291**	**0.0718**	0.38	-4.5	0.27
Textiles (S4)	**0.4315**	0.0143*	0.0315*	0.15	5.1*	0.15*
Paper (S5)	**0.6064**	0.0173*	-0.0536*	0.42	2.1*	-0.17*
Chemical and Pharmaceutical (S6)	**0.8075**	0.0009*	**-0.0690**	0.27	0.0*	-0.10
Non-metallic minerals (S7)	0.0981*	-0.0101*	0.0151*	0.07*	-1.2*	0.05*
Basic metals (S8)	0.1424*	-0.0210*	-0.0136*	0.07*	-2.9*	-0.04*
Machinery and equipment (S9)	**0.6038**	**-0.0679**	**-0.1832**	0.84	-17.5	-1.17
Private Services				**13.68**	**245.6**	**17.16**
Electricity and gas (S10)	0.6703*	**-0.0950**	**0.1714**	1.21*	-1.5	0.67
Water (S11)	-0.3523*	-0.0378*	**0.1440**	-0.38*	-1.8*	0.22
Construction (S12)	**0.6136**	**0.0975**	**0.1814**	1.19	72.8	2.44
Wholesale and retail trade (S13)	**0.4940**	**0.0507**	**0.1026**	1.46	52.3	2.54
Transportation and storage (S14)	**1.1246**	0.0175*	-0.0560*	4.15	4.0*	-0.45*
Hospitality (S15)	**0.9224**	**0.0834**	**0.1330**	0.96	29.3	1.10
Telecommunications (S16)	**0.3642**	-0.0215*	**-0.0376**	0.54	-0.5*	-0.15
Finance (S17)	**-0.4479**	**-0.1193**	-0.0009*	-0.77	-16.4	-0.01*
Real estate (S18)	0.1878*	0.1007*	**0.7476**	2.40*	4.7*	10.45
Professional services (S19	**0.6419**	**0.1358**	0.0229*	2.92	102.7	0.37*
Public Services				**1.33**	**8.3**	**3.68**
Public administration (S20)	0.1967*	**0.0352**	**0.1116**	0.96*	15.4	1.70
Education (S21)	0.2413*	0.0150*	**0.1492**	0.20*	6.4*	1.79
Health (S22)	0.0878*	-0.0295*	**0.0192**	0.17*	-13.5*	0.19
TOTAL				**17.15**	**273.9**	**19.84**

(*) The estimates marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Figure 2 Effects of Other Transportation Investment by Sector of Economic Activity

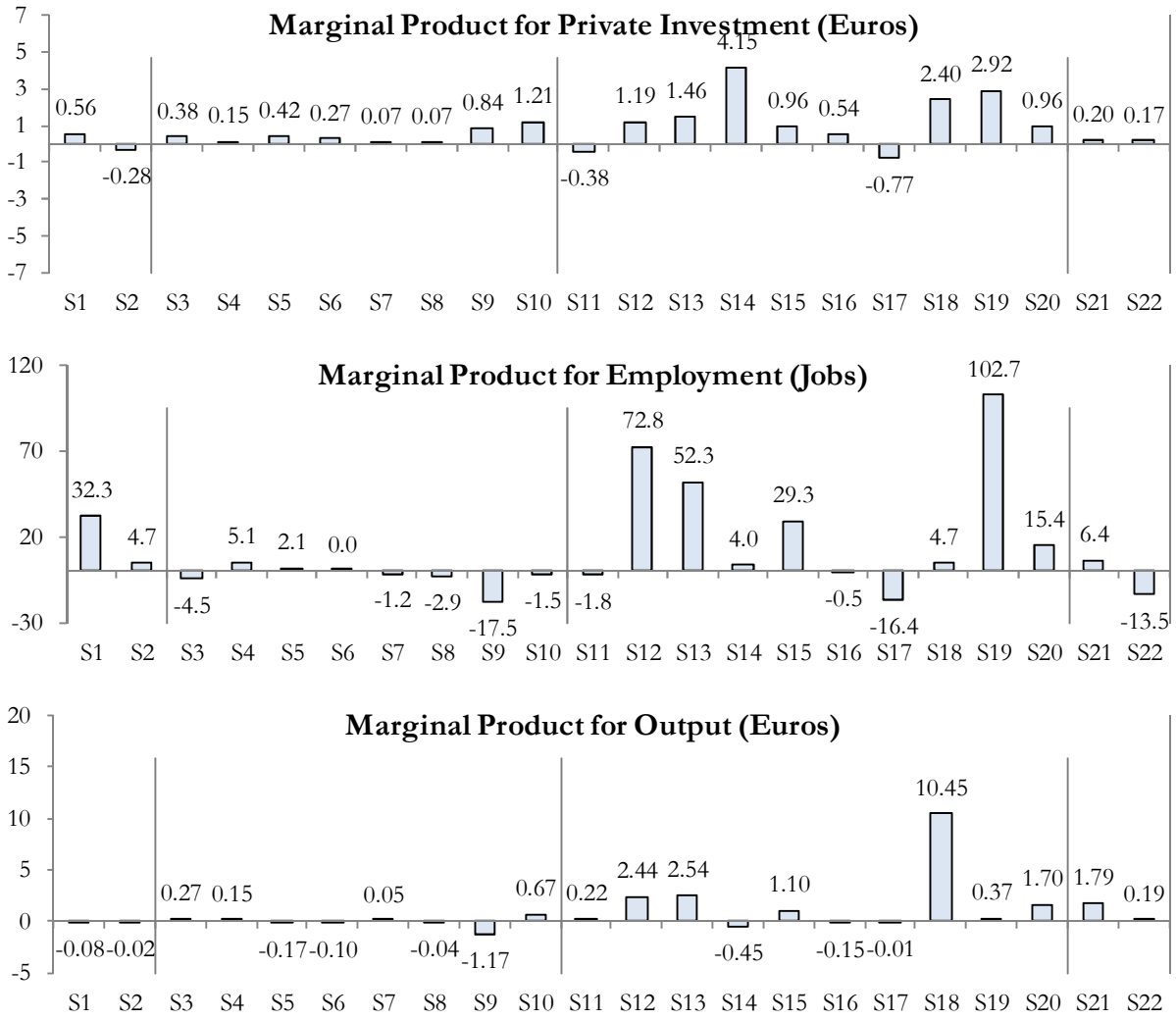


Table 6 Effects of Social Infrastructure Investment by Sector of Economic Activity

	Elasticity			Marginal Product		
	Private Investment	**Employment**	**Output**	**Private Investment**	**Employment**	**Output**
Agriculture and Mining				**-0.12**	**-59.1**	**-1.12**
Agriculture (S1)	0.1627*	**-0.1364**	**-0.2930**	0.14*	-60.1	-1.03
Mining (S2)	-1.8931*	0.0602*	**-0.1525**	-0.26*	1.0*	-0.09
Manufacturing				**2.91**	**16.2**	**1.46**
Food (S3)	0.1629*	0.0143*	0.0562*	0.08*	1.5*	0.14*
Textiles (S4)	0.1150*	**-0.0545**	**-0.1206**	0.03*	-13.5	-0.39
Paper (S5)	**0.7114**	0.0001*	**0.1377**	0.34	0.0*	0.29
Chemical and Pharmaceutical (S6)	**1.2704**	**0.0432**	**-0.2060**	0.29	0.9	-0.21
Non-metallic minerals (S7)	**0.8187**	**0.0913**	**0.2366**	0.43	7.6	0.56
Basic metals (S8)	**1.2334**	**0.1049**	0.0347*	0.41	10.0	0.07*
Machinery and equipment (S9)	**0.7296**	0.0543*	**0.2804**	0.70	9.7*	1.24
Private Services				**12.40**	**191.2**	**13.58**
Electricity and gas (S10)	1.1682*	**-0.0738**	**-0.4602**	1.46*	-0.8	-1.24
Water (S11)	0.6854*	**-0.1370**	**-0.4291**	0.51*	-4.6	-0.45
Construction (S12)	**0.7300**	**0.1629**	**0.3659**	0.98	84.2	3.41
Wholesale and retail trade (S13)	**0.8651**	**0.0611**	**0.0707**	1.77	43.7	1.21
Transportation and storage (S14)	0.1068*	**0.0742**	**0.2468**	0.27*	11.6	1.37
Hospitality (S15)	-0.0124*	**-0.0727**	-0.0362*	-0.01*	-17.7	-0.21*
Telecommunications (S16)	0.0164*	-0.0287*	-0.0297*	0.02*	-0.4*	-0.08*
Finance (S17)	**1.0855**	0.0204*	**0.2547**	1.30	1.9*	2.06
Real estate (S18)	**0.3488**	**0.1755**	**0.5494**	3.08	5.7	5.31
Professional services (S19	**0.9586**	**0.1482**	**0.1985**	3.02	77.6	2.20
Public Services				**3.21**	**31.1**	**4.58**
Public administration (S20)	**0.4642**	0.0086*	**0.1505**	1.57	2.6*	1.59
Education (S21)	**1.1187**	**0.0575**	**0.2369**	0.65	17.1	1.96
Health (S22)	**0.7540**	**0.0359**	**0.1481**	0.99	11.4	1.03
TOTAL				**18.40**	**179.4**	**18.50**

(*) The estimates marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Figure 3 Effects of Social Infrastructure Investment by Sector of Economic Activity

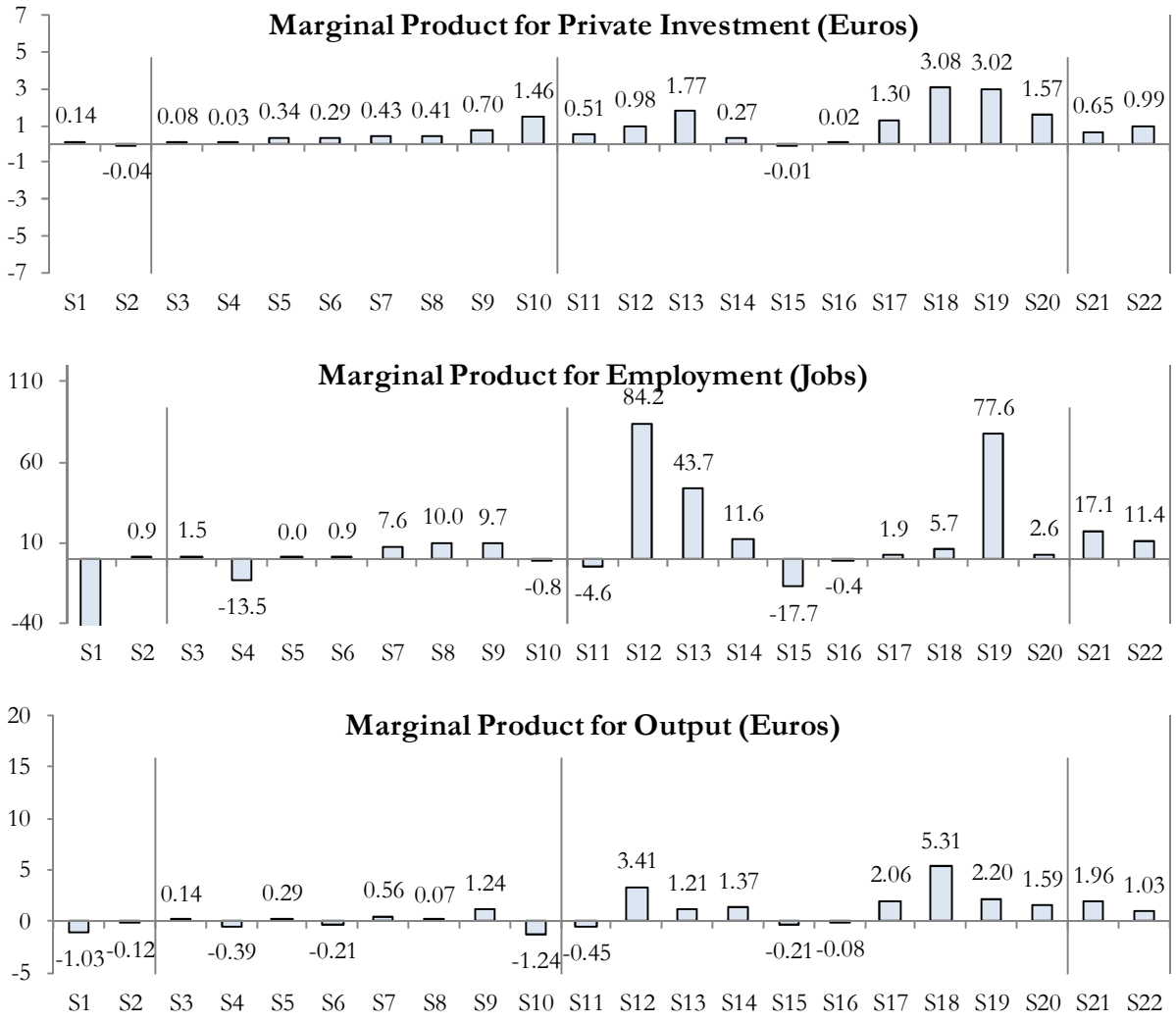


Table 7 Effects of Public Utility Investment by Sector of Economic Activity

	Elasticity			Marginal Product		
	Private Investment	**Employment**	**Output**	**Private Investment**	**Employment**	**Output**
Agriculture and Mining				**-0.06**	**-3.5**	**-0.12**
Agriculture (S1)	**-0.1680**	**-0.0205**	**-0.0891**	-0.07	-4.2	-0.15
Mining (S2)	0.0955*	**0.0953**	**0.1095**	0.01*	0.7	0.03
Manufacturing				**-0.04**	**2.3**	**-0.02**
Food (S3)	**-0.1905**	0.0107*	-0.0053*	-0.05	0.5*	-0.01*
Textiles (S4)	-0.0166*	**0.0122**	0.0002*	0.00*	1.4	0.00*
Paper (S5)	**-0.2232**	-0.0051*	-0.0028*	-0.05	-0.2*	0.00*
Chemical and Pharmaceutical (S6)	-0.0319*	**0.0177**	**-0.0579**	0.00*	0.2	-0.03
Non-metallic minerals (S7)	**-0.1272**	-0.0066*	-0.0113*	-0.03	-0.3*	-0.01*
Basic metals (S8)	0.2288*	**0.0413**	**0.1307**	0.04*	1.8	0.13
Machinery and equipment (S9)	-0.0607*	-0.0108*	**-0.0663**	-0.03*	-0.9*	-0.14
Private Services				**0.21**	**-17.7**	**-1.29**
Electricity and gas (S10)	**1.3999**	0.0156*	**-0.0695**	0.82	0.1*	-0.09
Water (S11)	**1.0323**	0.0108*	-0.0381*	0.36	0.2*	-0.02*
Construction (S12)	-0.0887*	0.0424	0.0227*	-0.06*	10.3*	0.10*
Wholesale and retail trade (S13)	-0.0715*	0.0046*	**0.0156**	-0.07*	1.5*	0.13
Transportation and storage (S14)	-0.2044*	0.0040*	-0.0202*	-0.25*	0.3*	-0.05*
Hospitality (S15)	**-0.2324**	-0.0056*	-0.0023*	-0.08	-0.6*	-0.01*
Telecommunications (S16)	**-0.2096**	0.0080*	-0.0027*	-0.10	0.1*	0.00*
Finance (S17)	-0.2227*	**-0.0250**	-0.0420*	-0.13*	-1.1	-0.16*
Real estate (S18)	-0.0539*	**-0.0829**	**-0.2726**	-0.22*	-1.3	-1.24
Professional services (S19	-0.0433*	**-0.1063**	0.0103*	-0.06*	-26.2	0.05*
Public Services				**-0.06**	**2.6**	**0.07**
Public administration (S20)	-0.0308*	**0.0198**	**0.0312**	-0.05*	2.8	0.16
Education (S21)	-0.0285*	0.0036*	-0.0298*	-0.01*	0.5*	-0.12*
Health (S22)	-0.0011*	-0.0046*	0.0088*	0.00*	-0.7*	0.03*
TOTAL				**0.05**	**-16.3**	**-2.36**

(*) The estimates marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Figure 4 Effects of Public Utility Investment by Sector of Economic Activity

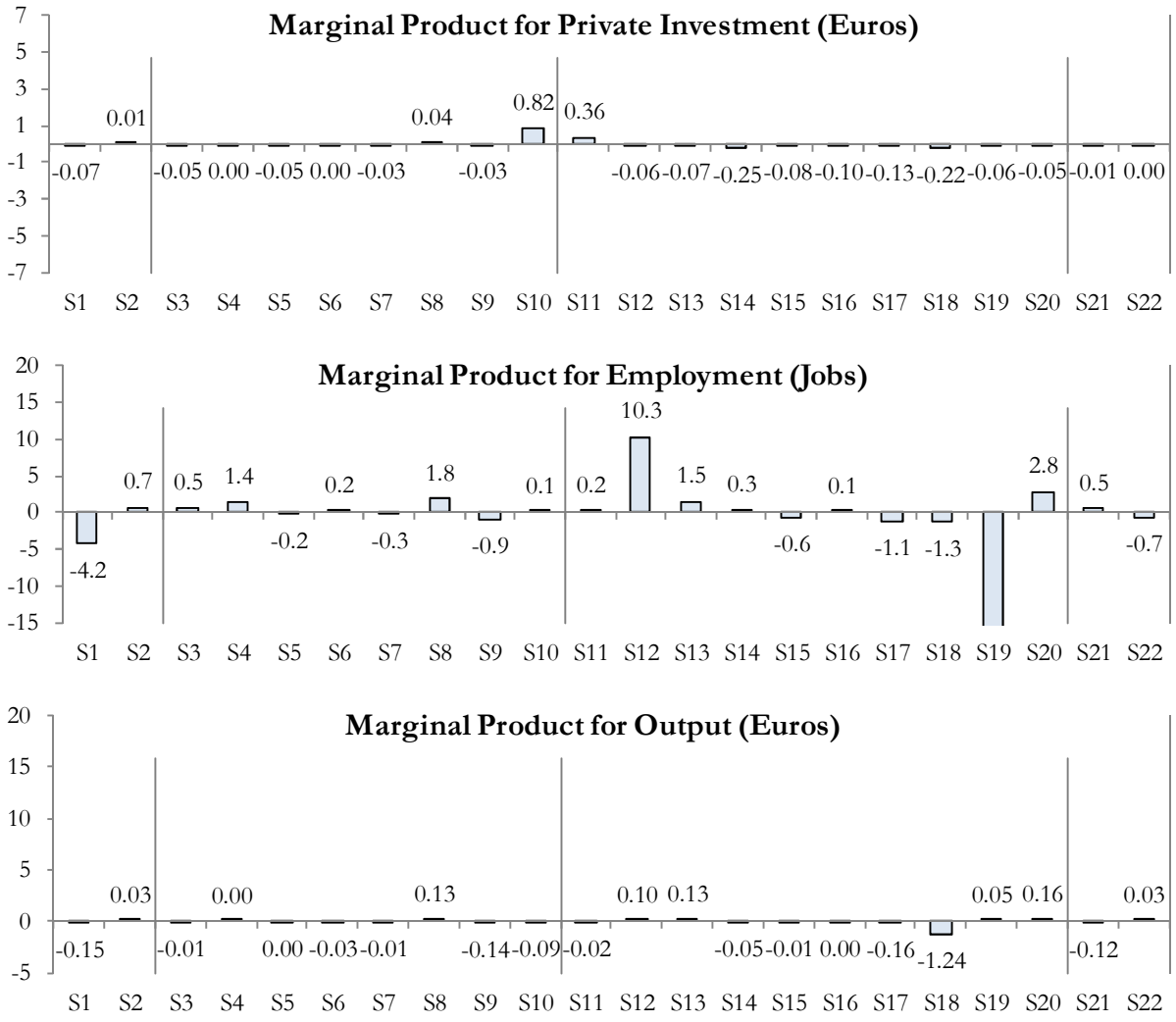


Table 8 Effects of Telecommunications Infrastructure Investment by Industry

	Elasticity			Marginal Product		
	Private Investment	**Employment**	**Output**	**Private Investment**	**Employment**	**Output**
Agriculture and Mining				**0.32**	**9.4**	**0.12**
Agriculture (S1)	**0.4452**	0.0134*	0.0126*	0.36	5.7*	0.04*
Mining (S2)	-0.3155*	**0.2457**	0.1336*	-0.04*	3.7	0.08*
Manufacturing				**2.39**	**24.4**	**1.16**
Food (S3)	**0.7388**	0.0073*	0.0194*	0.37	0.8*	0.05*
Textiles (S4)	**0.7068**	**0.0276**	-0.0146*	0.16	6.6	-0.05*
Paper (S5)	**0.7540**	**0.0405**	**0.0955**	0.35	3.2	0.20
Chemical and Pharmaceutical (S6)	**0.6313**	**0.0355**	-0.0117*	0.14	0.7	-0.01*
Non-metallic minerals (S7)	**0.5976**	**0.0384**	**0.0746**	0.30	3.1	0.17
Basic metals (S8)	**0.6244**	**0.0584**	**0.1609**	0.20	5.3	0.33
Machinery and equipment (S9)	**0.7399**	**0.0280**	0.0276*	0.69	4.8	0.12*
Private Services				**8.91**	**183.6**	**10.88**
Electricity and gas (S10)	**-0.6879**	**-0.0317**	0.0283*	-0.83	-0.3	0.07*
Water (S11)	**-1.3333**	**-0.0643**	0.0294*	-0.96	-2.1	0.03*
Construction (S12)	**0.7664**	**0.1114**	**0.1994**	0.99	55.6	1.79
Wholesale and retail trade (S13)	**0.5943**	**0.0515**	**0.0701**	1.17	35.5	1.16
Transportation and storage (S14)	**0.8416**	**0.0463**	0.0327*	2.07	7.0	0.17*
Hospitality (S15)	**1.1400**	**0.0699**	**0.0946**	0.79	16.4	0.52
Telecommunications (S16)	**0.6483**	0.0003*	**-0.0397**	0.64	0.0*	-0.11
Finance (S17)	**0.3142**	**-0.0282**	**0.2044**	0.36	-2.6	1.59
Real estate (S18)	**0.2806**	**0.0939**	**0.4793**	2.39	2.9	4.47
Professional services (S19	**0.7542**	**0.1509**	**0.1112**	2.29	76.2	1.19
Public Services				**0.98**	**20.5**	**1.82**
Public administration (S20)	0.1216*	0.0253*	**0.1024**	0.40*	7.4*	1.04
Education (S21)	**0.3463**	**0.0176**	0.0671*	0.19	5.0	0.54*
Health (S22)	**0.3045**	0.0264*	0.0355*	0.39	8.1*	0.24*
TOTAL				**12.60**	**237.9**	**13.98**

(*) The estimates marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Figure 5 Effects of Telecommunications Investment by Sector of Economic Activity

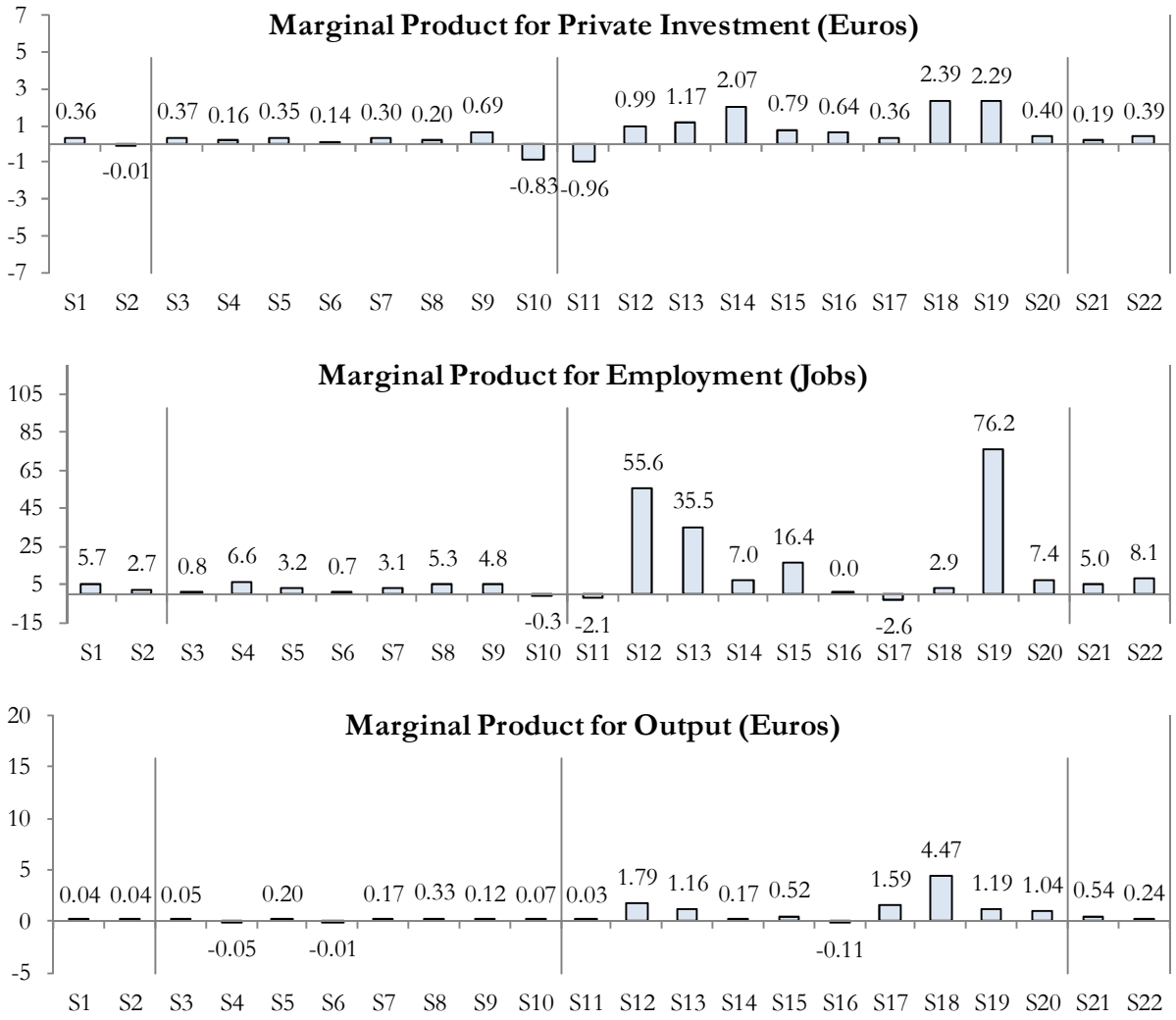


Table 9 Effects of Road Infrastructure Investment on the Industry Mix

	Private Investment				Employment				Output			
	Marginal Product	Share of Benefits	Share of GFCF	Ratio	Marginal Product	Share of Benefits	Share of Emp	Ratio	Marginal Product	Share of Benefits	Share of Private Output	Ratio
Agriculture and Mining	**-**	**-**	**4.8**	**-**	**0.9**	**0.1**	**15.5**	**0.0**	**-**	**-**	**8.6**	**-**
Agriculture (S1)	0.1*	1.2*	3.8	0.3*	0.5*	0.6*	14.5	0.0*	-	-	6.7	-
Mining (S2)	-	-	1.0	-	0.4*	0.5*	1.0	0.5*	-*	-*	1.9	-*
Manufacturing	**0.60**	**11.6**	**13.1**	**0.9**	**2.0**	**2.9**	**21.8**	**0.1**	**0.41**	**6.9**	**18.1**	**0.4**
Food (S3)	0.0*	0.4*	1.4	0.3*	-	-	2.7	-	0.1	2.0	2.1	1.0
Textiles (S4)	0.0*	0.7*	1.3	0.5*	-*	-*	7.4	-*	0.1*	1.4*	3.7	0.4*
Paper (S5)	0.0*	0.5*	1.4	0.4*	1.4	1.9	2.3	0.8	-*	-*	2.2	-*
Chemical and Pharm.(S6)	0.1	2.2	2.0	1.0	0.1*	0.1*	0.8	0.2*	-	-	1.7	-
Non-metallic minerals (S7)	0.1	1.9	2.0	1.0	1.6	2.1	2.0	1.0	0.2	2.5	2.7	0.9
Basic metals (S8)	0.1	1.0	1.1	1.0	0.7*	0.9*	2.3	0.4*	-*	-*	2.5	-*
Machinery and equipment (S9)	0.3	5.0	4.0	1.2	0.2*	0.3*	4.3	0.1*	0.2*	3.0*	3.3	0.9*
Private Services	**3.62**	**70.2**	**67.8**	**1.1**	**55.1**	**79.9**	**45.2**	**1.8**	**4.16**	**70.7**	**56.3**	**1.3**
Electricity and gas (S10)	0.2*	3.0*	4.9	0.6*	-	-	0.4	-	-*	-*	2.1	-*
Water (S11)	0.3*	5.3*	3.4	1.5*	-	-	0.9	-	-*	-*	0.6	-*
Construction (S12)	0.2*	2.9*	5.3	0.5*	2.8*	3.7*	10.7	0.4*	0.6	9.2	7.1	1.3
Wholesale & retail trade (S13)	0.4	7.1	5.6	1.3	19.7	26.1	13.9	1.9	0.7	11.4	15.4	0.7
Transportation & storage (S14)	0.5*	9.7*	5.8	1.7*	0.2*	0.3*	3.5	0.1*	0.0*	0.1*	4.6	0.0*
Hospitality (S15)	0.2	3.1	1.9	1.6	8.5	11.3	4.4	2.6	0.4	6.2	3.7	1.7
Telecommunications (S16)	0.2	3.3	2.7	1.2	0.0*	0.0*	0.4	0.0*	-*	-*	1.9	-*
Finance (S17)	0.3	5.3	4.8	1.1	-*	-*	2.3	-*	0.2*	3.4*	6.3	0.5*
Real estate (S18)	0.9	18.0	26.6	0.7	0.1*	0.1*	0.5	0.2*	2.5	38.9	7.5	5.2
Professional services (S19)	0.6	11.7	6.7	1.8	28.3	37.5	8.1	4.6	-*	-*	7.2	-*
Public Services	**0.93**	**18.0**	**14.4**	**1.3**	**10.9**	**15.8**	**17.5**	**0.9**	**1.31**	**22.3**	**17.0**	**1.3**
Public administration (S20)	0.6	11.9	10.8	1.1	8.1	10.8	8.0	1.3	0.5	8.0	8.5	0.9
Education (S21)	0.1	2.4	1.7	1.4	1.7*	2.2*	5.7	0.4*	0.5	8.0	5.3	1.5
Health (S22)	0.2*	3.6*	1.9	1.9*	1.1*	1.5*	3.8	0.4*	0.3	4.5	3.2	1.4
		100.0	100.0			100.0	100.0		-	100.0	100.0	

(*) The effects marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Table10 Effects of Other Infrastructure Investment on the Industry Mix

	Private Investment				Employment				Output			
	Marginal Product	**Share of Benefits**	**Share of GFCF**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Emp**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Private Output**	**Ratio**
Agriculture and Mining	**0.21**	**1.2**	**4.8**	**0.3**	**38.9**	**13.3**	**15.5**	**0.9**	**-**	**-**	**8.6**	**-**
Agriculture (S1)	0.6	2.9	3.8	0.8	32.3	9.7	14.5	0.7	-*	-*	6.7	-*
Mining (S2)	-	-	1.0	-	6.6	2.0	1.0	2.0	0.0*	0.0*	1.9	0.0*
Manufacturing	**1.93**	**11.3**	**13.1**	**0.9**	**-**	**-**	**21.8**	**-**			**18.1**	
Food (S3)	0.4	2.0	1.4	1.5	-	-	2.7	-	0.3	1.2	2.1	0.6
Textiles (S4)	0.1	0.8	1.3	0.6	5.1*	1.5*	7.4	0.2*	0.1*	0.7*	3.7	0.2*
Paper (S5)	0.4	2.2	1.4	1.6	2.1*	0.6*	2.3	0.3*	-*	-	2.2	-
Chemical and Pharm.(S6)	0.3	1.4	2.0	1.3	0.0*	0.0*	0.8	0.0*	-	-	1.7	-
Non-metallic minerals (S7)	0.3*	1.4*	2.0	0.7*	0.0*	0.0*	2.0	0.0*	-*	-	2.7	-
Basic metals (S8)	0.1*	0.4*	1.1	0.3*	-*	-*	2.3	-*	-*	-	2.5	-
Machinery and equipment (S9)	0.8	4.4	4.0	1.1	-	-	4.3	-	-	-	3.3	-
Private Services	**13.68**	**79.8**	**67.8**	**1.2**	**245.6**	**83.9**	**45.2**	**1.9**	**17.16**	**82.3**	**56.3**	**1.5**
Electricity and gas (S10)	1.2*	6.4*	4.9	1.3*	-	-	0.4	-	0.7	3.0	2.1	1.4
Water (S11)	-*	-*	3.4	-*	-*	-*	0.9	-*	0.2	1.0	0.6	1.5
Construction (S12)	1.2	6.3	5.3	1.2	72.8	21.8	10.7	2.0	2.4	10.9	7.1	1.5
Wholesale & retail trade (S13)	1.5	7.7	5.6	1.4	52.3	15.7	13.9	1.1	2.5	11.3	15.4	0.7
Transportation & storage (S14)	4.1	21.9	5.8	3.8	4.0*	1.2*	3.5	0.3*	-*	-*	4.6	-*
Hospitality (S15)	1.0	5.1	1.9	2.7	29.3	8.8	4.4	2.0	1.1	4.9	3.7	1.3
Telecommunications (S16)	0.5	2.8	2.7	1.1	-*	-*	0.4	-*	-	-	1.9	-
Finance (S17)	-	-	4.8	-	-	-	2.3	-	-*	-*	6.3	-*
Real estate (S18)	2.4*	12.7*	26.6	0.5*	4.7*	1.4*	0.5	2.9*	10.4	46.6	7.5	6.3
Professional services (S19)	2.9	15.5	6.7	2.3	102.7	30.8	8.1	3.8	0.4*	1.6*	7.2	0.2*
Public Services	**1.33**	**7.7**	**14.4**	**0.5**	**8.3**	**2.8**	**17.5**	**0.2**	**3.68**	**17.7**	**17.0**	**1.1**
Public administration (S20)	1.0*	5.1*	10.8	0.5*	15.4	4.6	8.0	0.6	1.7	7.6	8.5	0.9
Education (S21)	0.2*	1.1*	1.7	0.6*	6.4	1.9	5.7	0.3	1.8	8.0	5.3	1.5
Health (S22)	0.2*	0.9*	1.9	0.5*	-	-	3.8	-	0.2	0.9	3.2	0.3
		100.0	100.0			100.0	100.0		-	100.0	100.0	

(*) The effects marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Table 11 Effects of Social Infrastructure Investment on the Industry Mix

	Private Investment				Employment				Output			
	Marginal Product	**Share of Benefits**	**Share of GFCF**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Emp**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Private Output**	**Ratio**
Agriculture and Mining	**-**	**-**	**4.8**	**-**	**-**	**-**	**15.5**	**-**	**-**	**-**	**8.6**	**-**
Agriculture (S1)	0.1*	0.7*	3.8	0.2*	-	-	14.5	-	-	-	6.7	-
Mining (S2)	-*	-*	1.0	-*	1.0*	0.3*	1.0	0.3*	-	-	1.9	-
Manufacturing	**2.91**	**15.7**	**13.1**	**1.2**	**16.2**	**6.8**	**21.8**	**0.3**	**1.46**	**7.4**	**18.1**	**0.4**
Food (S3)	0.1*	0.5*	1.4	0.3*	1.5*	0.5*	2.7	0.2*	0.1*	0.6*	2.1	0.3*
Textiles (S4)	0.0*	0.1*	1.3	0.1*	-	-	7.4	-	-	-	3.7	-
Paper (S5)	0.3	1.8	1.4	1.3	0.0*	0.0*	2.3	0.0*	0.3	1.3	2.2	0.6
Chemical and Pharm.(S6)	0.3	1.6	2.0	1.4	0.9	0.3	0.8	0.5	-	-	1.7	-
Non-metallic minerals (S7)	0.4	2.3	2.0	1.1	7.6	2.7	2.0	1.3	0.6	2.5	2.7	0.9
Basic metals (S8)	0.4	2.2	1.1	2.1	10.0	3.5	2.3	1.5	0.1*	0.3*	2.5	0.1*
Machinery and equipment (S9)	0.7	3.8	4.0	0.9	9.7*	3.4*	4.3	0.8*	1.2	5.5	3.3	1.7
Private Services	**12.4**	**66.9**	**67.8**	**1.0**	**191.2**	**80.2**	**45.2**	**1.8**	**13.58**	**69.2**	**56.3**	**1.2**
Electricity and gas (S10)	1.5*	7.8*	4.9	1.6*	-	-	0.4	-	-	-	2.1	-
Water (S11)	0.5*	2.8*	3.4	0.8*	-	-	0.9	-	-	-	0.6	-
Construction (S12)	1.0	5.3	5.3	1.0	84.2	29.4	10.7	2.8	3.4	15.2	7.1	2.1
Wholesale & retail trade (S13)	1.8	9.5	5.6	1.7	43.7	15.3	13.9	1.1	1.2	5.4	15.4	0.4
Transportation & storage (S14)	0.3*	1.5*	5.8	0.3*	11.6	4.0	3.5	1.1	1.4	6.1	4.6	1.3
Hospitality (S15)	-*	-*	1.9	-	-	-	4.4	-	-*	-*	3.7	-*
Telecommunications (S16)	0.0*	0.1*	2.7	0.0*	-*	-*	0.4	-*	-*	-*	1.9	-*
Finance (S17)	1.3	7.0	4.8	1.4	1.9*	0.7*	2.3	0.3*	2.1	9.2	6.3	1.5
Real estate (S18)	3.1	16.5	26.6	0.6	5.7	2.0	0.5	4.1	5.3	23.7	7.5	3.2
Professional services (S19)	3.0	16.2	6.7	2.4	77.6	27.1	8.1	3.3	2.2	9.8	7.2	1.4
Public Services	**3.21**	**17.4**	**14.4**	**1.2**	**31.1**	**13.0**	**17.5**	**0.7**	**4.58**	**23.4**	**17.0**	**1.4**
Public administration (S20)	1.6	8.4	10.8	0.8	2.6*	0.9*	8.0	0.1*	1.6	7.1	8.5	0.8
Education (S21)	0.6	3.5	1.7	2.0	17.1	6.0	5.7	1.1	2.0	8.7	5.3	1.7
Health (S22)	1.0	5.3	1.9	2.9	11.4	4.0	3.8	1.0	1.0	4.6	3.2	1.5
		100.0	100.0			100.0	100.0		-	100.0	100.0	

(*) The effects marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

Table 12 Effects of Public Utilities Investment on the Industry Mix

	Private Investment				Employment				Output			
	Marginal Product	**Share of Benefits**	**Share of GFCF**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Emp**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Private Output**	**Ratio**
Agriculture and Mining	**-**	**-**	**4.8**	**-**	**-**	**-**	**15.5**	**-**	**-**	**-**	**8.6**	**-**
Agriculture (S1)	0.4	2.5	3.8	0.7	5.7	2.3	14.5	0.2	0.0	0.3	6.7	0.0
Mining (S2)	-*	-*	1.0	-*	3.7	1.5	1.0	1.5	0.1	0.5	1.9	0.3
Manufacturing	-	-	**13.1**	-	2.3	+	**21.8**	+	-	-	**18.1**	-
Food (S3)	0.4	2.5	1.4	1.8	0.8*	0.3*	2.7	0.1*	0.0*	0.3*	2.1	0.2*
Textiles (S4)	0.2*	1.1*	1.3	0.8*	6.6	2.7	7.4	0.4	-*	-*	3.7	-*
Paper (S5)	0.3	2.4	1.4	1.7	3.2*	1.3*	2.3	0.6*	0.2*	1.4*	2.2	0.6*
Chemical and Pharm.(S6)	0.1*	1.0*	2.0	0.9*	0.7	0.3	0.8	0.4	-	-	1.7	-
Non-metallic minerals (S7)	0.3	2.1	2.0	1.0	3.1*	1.2*	2.0	0.6*	0.2*	1.2*	2.7	0.4*
Basic metals (S8)	0.2*	1.4*	1.1	1.3*	5.3	2.2	2.3	0.9	0.3	2.3	2.5	0.9
Machinery and equipment (S9)	0.7*	4.8*	4.0	1.2*	4.8*	1.9*	4.3	0.5*	0.1	0.8	3.3	0.3
Private Services	**0.21**	**+**	**67.8**	**+**	**-**	**-**	**45.2**	**-**	**-**	**-**	**56.3**	**-**
Electricity and gas (S10)	-	-	4.9	-	-*	-*	0.4	-	0.1	0.5	2.1	0.3
Water (S11)	-	-	3.4	-	-*	-*	0.9	-	0.0*	0.2*	0.6	0.3*
Construction (S12)	1.0*	6.9*	5.3	1.3*	55.6*	22.4*	10.7	2.1*	1.8*	12.7*	7.1	1.8*
Wholesale & retail trade (S13)	1.2*	8.1*	5.6	1.4*	35.5*	14.3*	13.9	1.0*	1.2	8.2	15.4	0.5
Transportation & storage (S14)	2.1*	14.3*	5.8	2.5*	7.0*	2.8*	3.5	0.8*	0.2*	1.2*	4.6	0.3*
Hospitality (S15)	0.8	5.5	1.9	2.9	16.4*	6.6*	4.4	1.5*	0.5*	3.7*	3.7	1.0
Telecommunications (S16)	0.6	4.4	2.7	1.7	0.0*	0.0*	0.4	0.0*	-*	-*	1.9	-*
Finance (S17)	0.4*	2.5*	4.8	0.5*	-	-	2.3	-	1.6*	11.3*	6.3	1.8*
Real estate (S18)	2.4*	16.5*	26.6	0.6*	2.9	1.2	0.5	2.4	4.5	31.6	7.5	4.2
Professional services (S19)	2.3*	15.8*	6.7	2.4*	76.2	30.7	8.1	3.8	1.2*	8.4*	7.2	1.2*
Public Services	**-**	**-**	**14.4**	**-**	**2.6**	**53.1**	**17.5**	**+**	**0.07**	**+**	**17.0**	**+**
Public administration (S20)	0.4*	2.7*	10.8	0.3*	7.4	3.0	8.0	0.4	1.0	7.4	8.5	0.9
Education (S21)	0.2*	1.3*	1.7	0.8*	5.0*	2.0*	5.7	0.4*	0.5*	3.8*	5.3	0.7*
Health (S22)	0.4*	2.7*	1.9	1.4*	8.1*	3.2*	3.8	0.8*	0.2*	1.7*	3.2	0.5*
		100.0	100.0			100.0	100.0		-	100.0	100.0	

(*) The effects marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

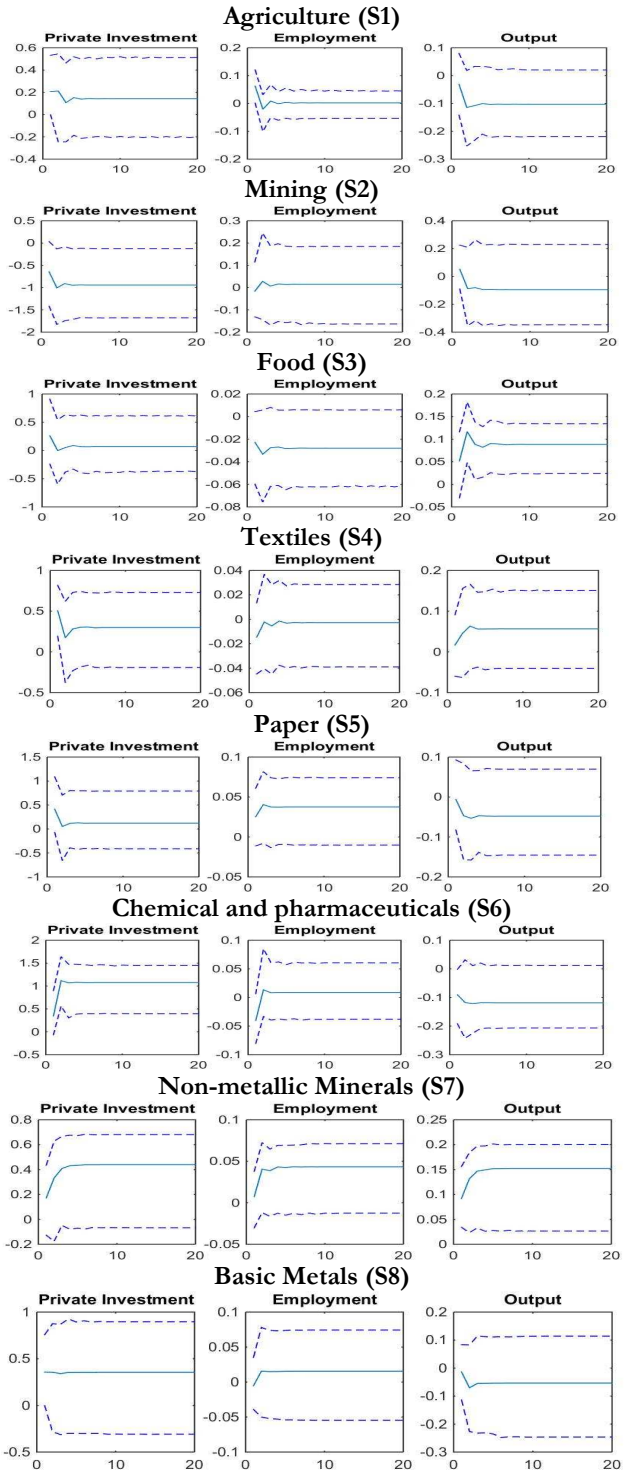
Table 13 Effects of Telecommunication Infrastructure Investment on the Industry Mix

	Private Investment				Employment				Output			
	Marginal Product	**Share of Benefits**	**Share of GFCF**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Emp**	**Ratio**	**Marginal Product**	**Share of Benefits**	**Share of Private Output**	**Ratio**
Agriculture and Mining	**0.32**	**2.5**	**4.8**	**0.5**	**9.4**	**4.0**	**15.5**	**0.3**	**0.12**	**0.1**	**8.6**	**0.0**
Agriculture (S1)	0.7	2.6	3.8	0.7	-*	-	14.5	-	0.5*	1.9*	6.7	0.3*
Mining (S2)	-*	-*	1.0	-*	-	-	1.0	-	-*	-*	1.9	-*
Manufacturing	**2.39**	**19.0**	**13.1**	**1.4**	**24.4**	**10.3**	**21.8**	**0.5**	**1.16**	**8.3**	**18.1**	**0.5**
Food (S3)	0.5	1.9	1.4	1.4	-*	-	2.7	-	0.2*	0.6*	2.1	0.3*
Textiles (S4)	0.3	1.0	1.3	0.8	-	-	7.4	-	0.5*	2.0*	3.7	0.5*
Paper (S5)	0.7	2.6	1.4	1.9	-	-	2.3	-	0.3	1.0	2.2	0.5
Chemical and Pharm.(S6)	0.3	1.1	2.0	1.0	0.4	0.1	0.8	0.2	-*	-*	1.7	-*
Non-metallic minerals (S7)	0.6	2.4	2.0	1.2	9.4	3.3	2.0	1.6	0.9	3.4	2.7	1.3
Basic metals (S8)	0.1	0.5	1.1	0.5	5.6	2.0	2.3	0.8	-	-	2.5	-
Machinery and equipment (S9)	0.1	0.5	4.0	0.1	20.7	7.2	4.3	1.7	1.9*	7.7*	3.3	2.3*
Private Services	**8.91**	**70.8**	**67.8**	**1.1**	**183.6**	**77.2**	**45.2**	**1.7**	**10.88**	**77.8**	**56.3**	**1.4**
Electricity and gas (S10)	-	-	4.9	-	-	-	0.4	-	-*	-*	2.1	-*
Water (S11)	0.6	2.5	3.4	0.7	-	-	0.9	-	-*	-*	0.6	-*
Construction (S12)	1.8	7.2	5.3	1.3	-	-	10.7	-	3.1	12.2	7.1	1.7
Wholesale & retail trade (S13)	1.4	5.6	5.6	1.0	37.3	13.0	13.9	0.9	1.5*	6.0*	15.4	0.4*
Transportation & storage (S14)	4.5	17.9	5.8	3.1	1.8	0.6	3.5	0.2	0.4	1.5	4.6	0.3
Hospitality (S15)	0.9	3.5	1.9	1.9	20.6	7.2	4.4	1.6	0.6	2.2	3.7	0.6
Telecommunications (S16)	0.9	3.7	2.7	1.4	-*	-	0.4	-	-	-	1.9	-
Finance (S17)	0.9	3.4	4.8	0.7	-	-	2.3	-	-	-	6.3	-
Real estate (S18)	4.1	16.1	26.6	0.6	4.9	1.7	0.5	3.6	7.5	29.8	7.5	4.0
Professional services (S19)	1.8	7.2	6.7	1.1	157.6	55.0	8.1	6.8	1.9	7.5	7.2	1.1
Public Services	**0.98**	**7.8**	**14.4**	**0.5**	**20.5**	**8.6**	**17.5**	**0.5**	**1.82**	**13.0**	**17.0**	**0.8**
Public administration (S20)	3.5*	14.0*	10.8	1.3*	8.2*	2.9	8.0	0.4	1.2	4.9	8.5	0.6
Education (S21)	0.6	2.3	1.7	1.4	20.0	7.0	5.7	1.2	3.2*	12.6*	5.3	2.4*
Health (S22)	1.0	3.8	1.9	2.1	-*	-	3.8	-	1.0*	3.9*	3.2	1.2*
		100.0	100.0			100.0	100.0		-	100.0	100.0	

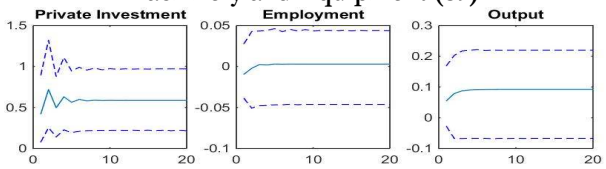
(*) The effects marked with asterisk are not significantly different from zero as implied by the standard deviation bands around the accumulated impulse response functions.

APPENDIX

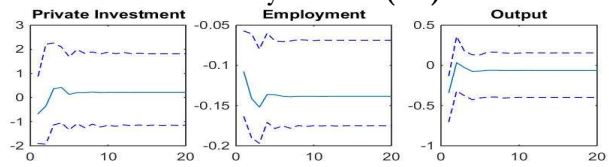
Figure A1 – Effects of Road Transportation Invesments



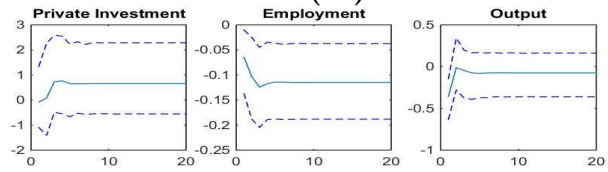
Machinery and Equipment (S9)



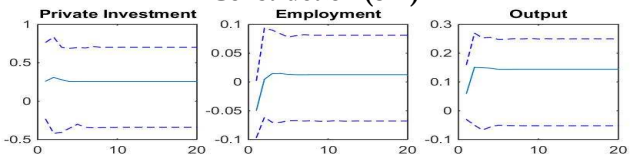
Electricity and Gas (S10)



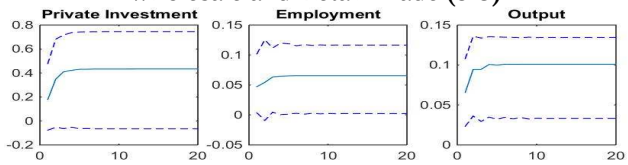
Water (S11)



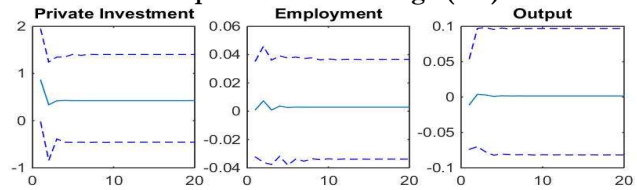
Construction (S12)



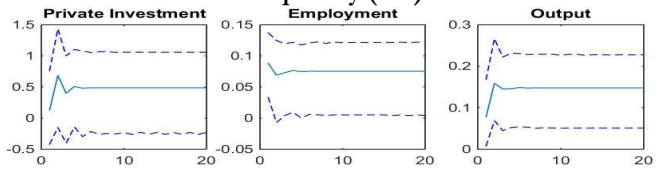
Wholesale and Retail Trade (S13)



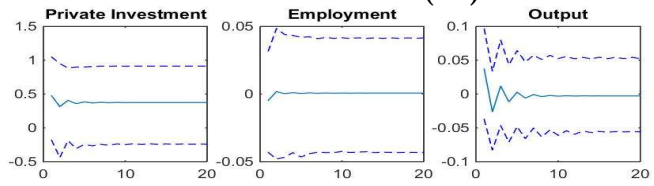
Transportation and Storage (S14)



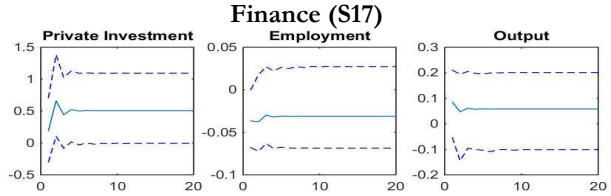
Hospitality (S15)



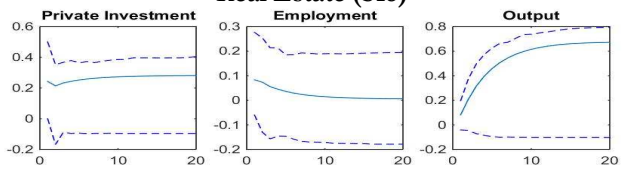
Telecommunications (S16)



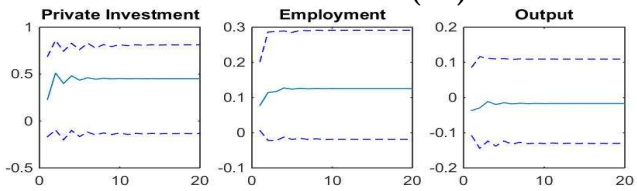
Finance (S17)



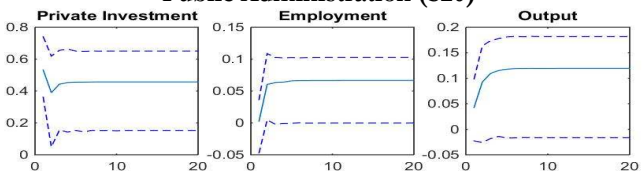
Real Estate (S18)



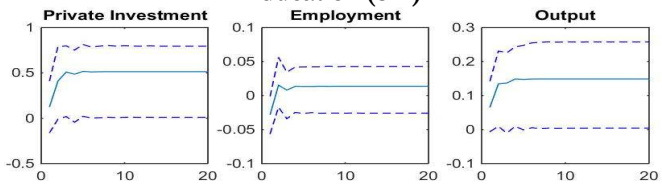
Professional services (S19)



Public Administration (S20)



Education (S21)



Health (S22)

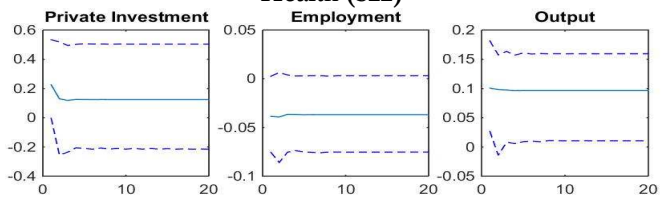
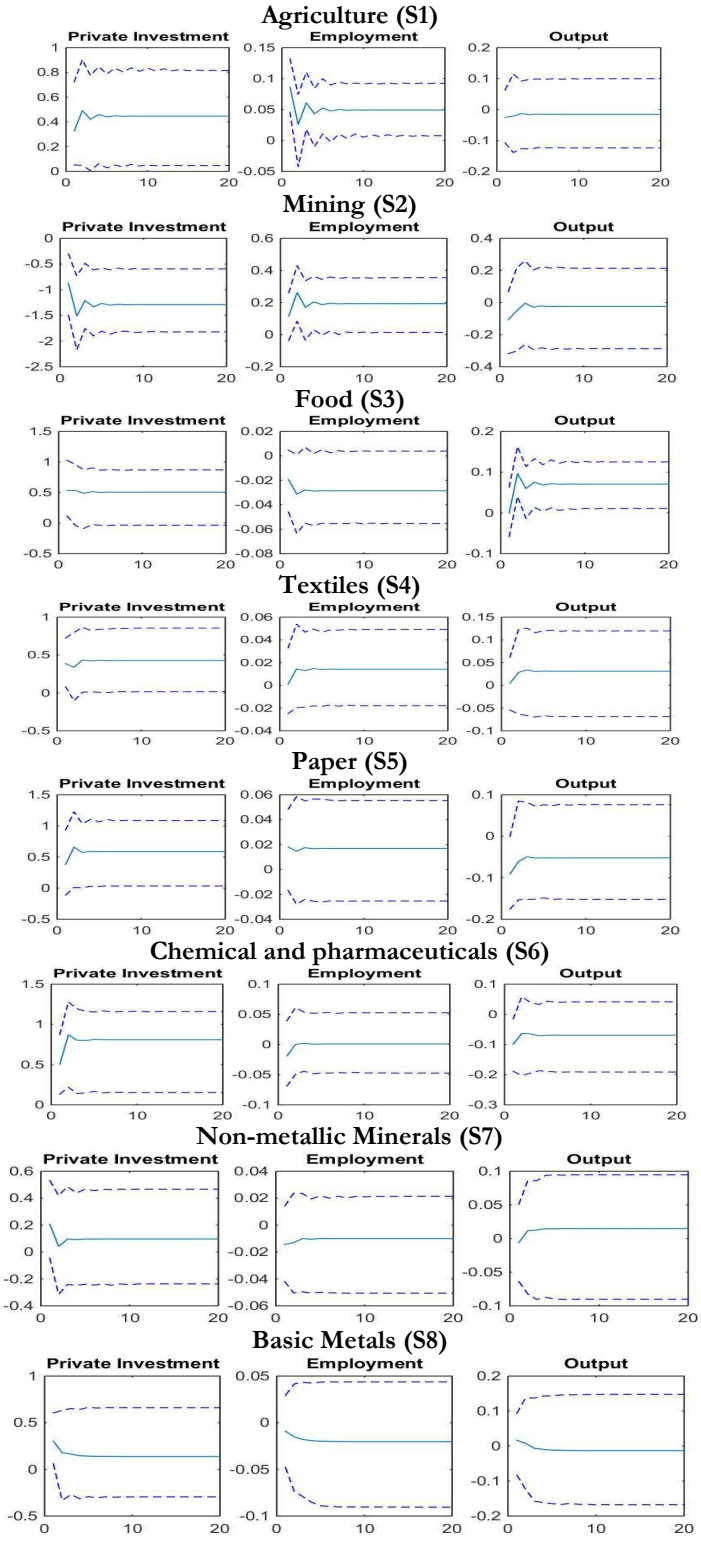
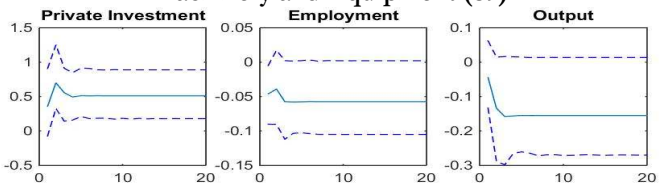


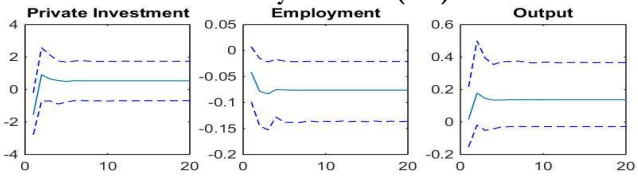
Figure A2 – Effects of Investments in Other Transportation Infrastructures



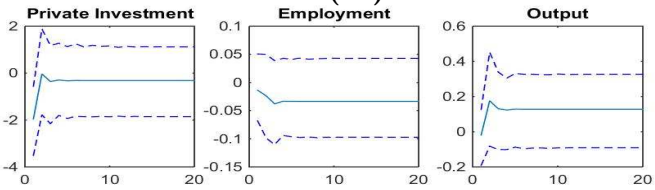
Machinery and Equipment (S9)



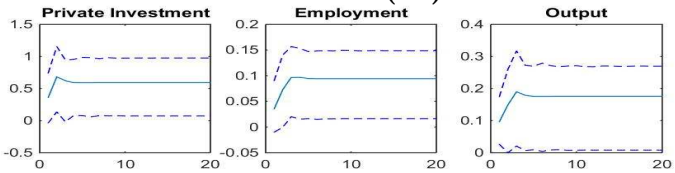
Electricity and Gas (S10)



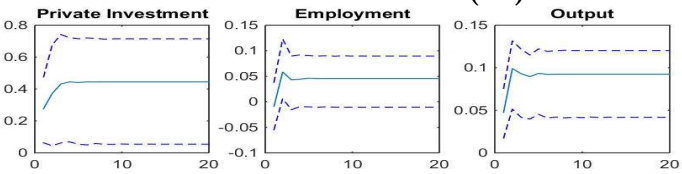
Water (S11)



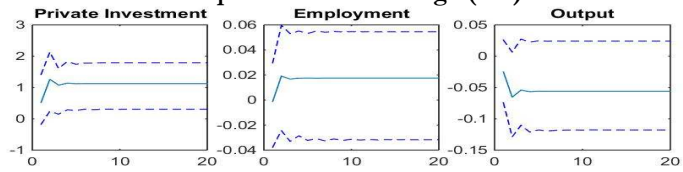
Construction (S12)



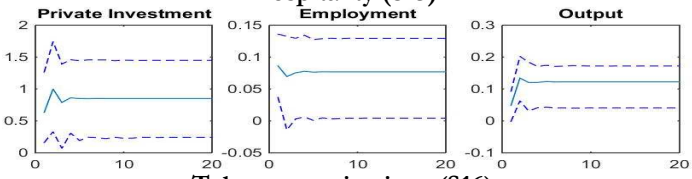
Wholesale and Retail Trade (S13)



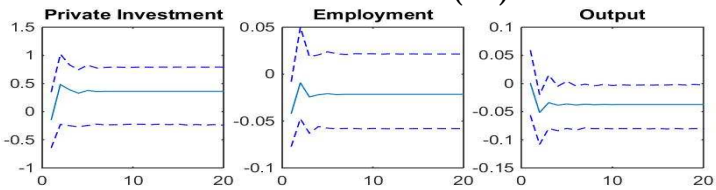
Transportation and Storage (S14)



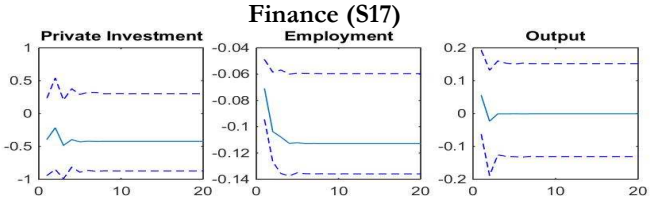
Hospitality (S15)



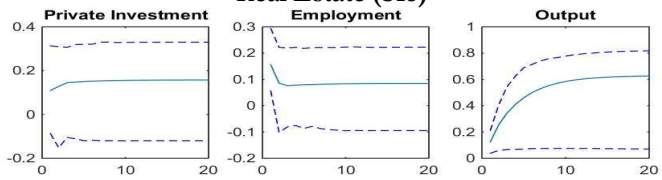
Telecommunications (S16)



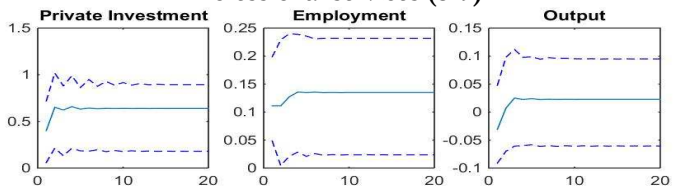
Finance (S17)



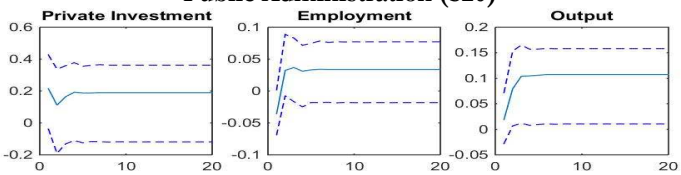
Real Estate (S18)



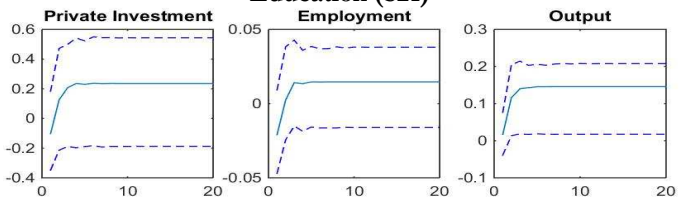
Professional services (S19)



Public Administration (S20)



Education (S21)



Health (S22)

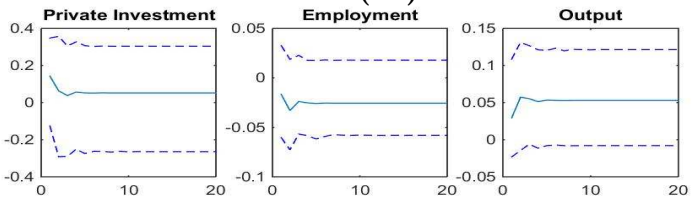
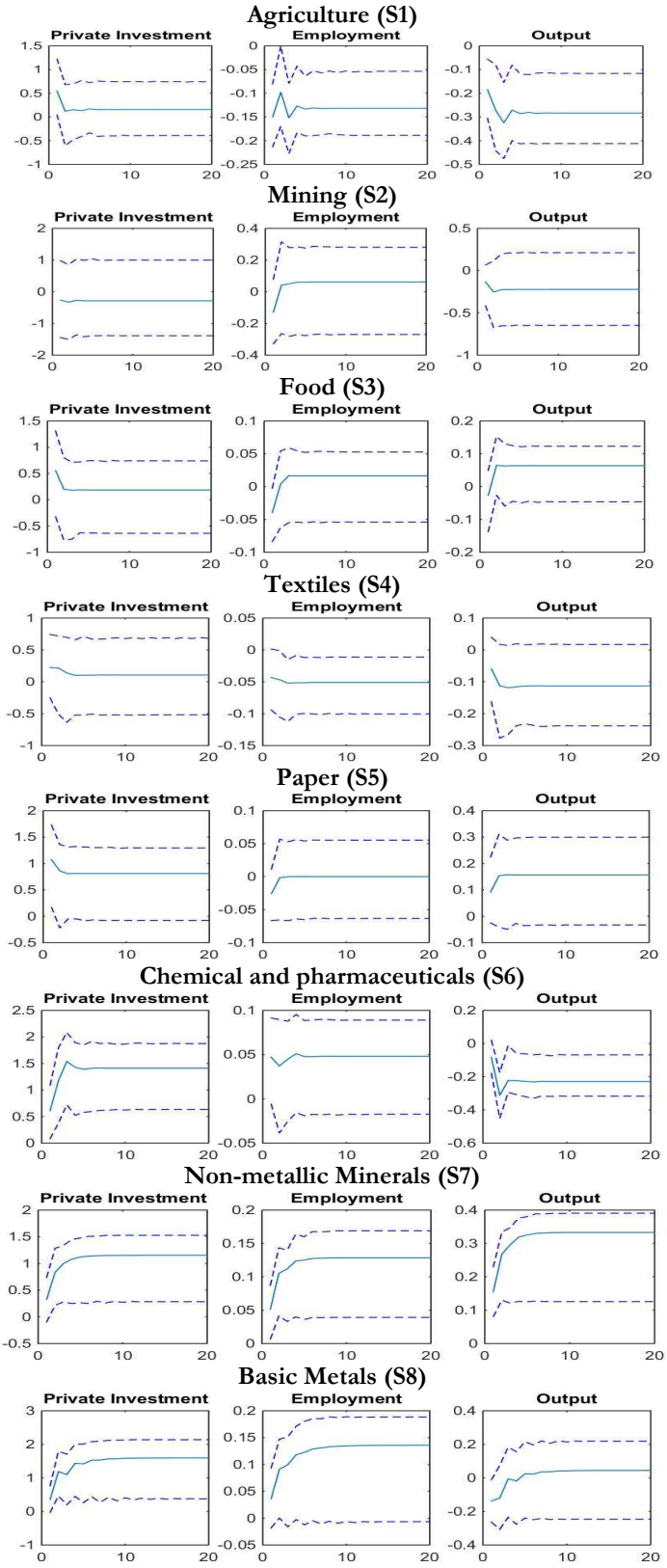
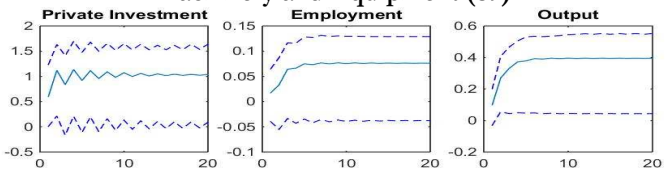


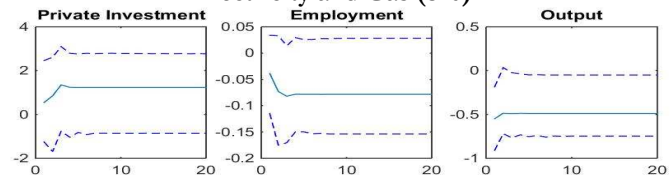
Figure A3 – Effects of Investments in Social Infrastructures



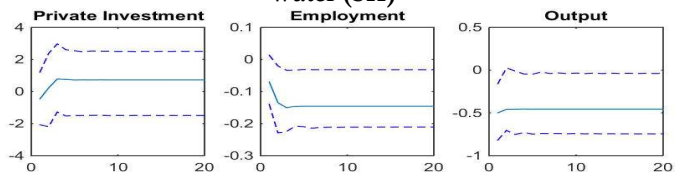
Machinery and Equipment (S9)



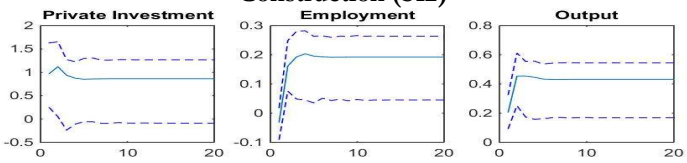
Electricity and Gas (S10)



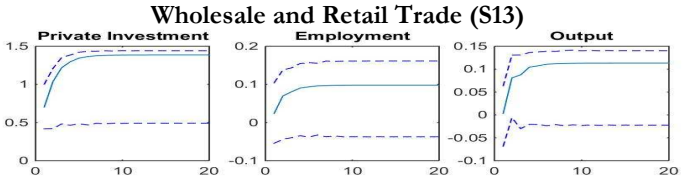
Water (S11)



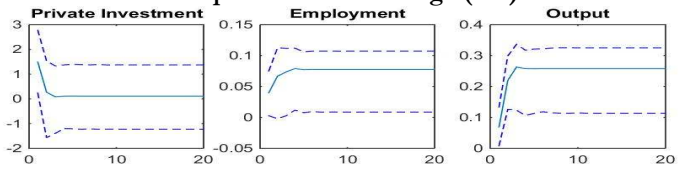
Construction (S12)



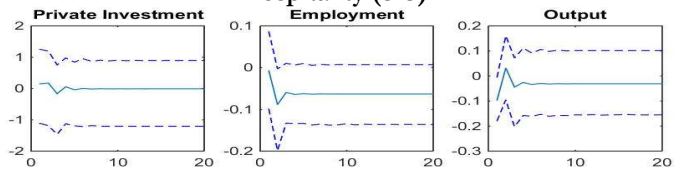
Wholesale and Retail Trade (S13)



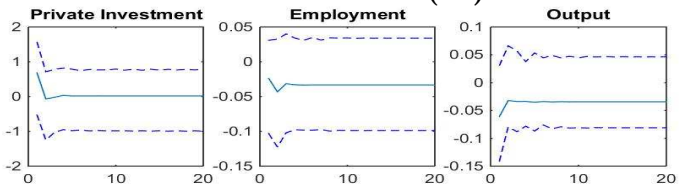
Transportation and Storage (S14)



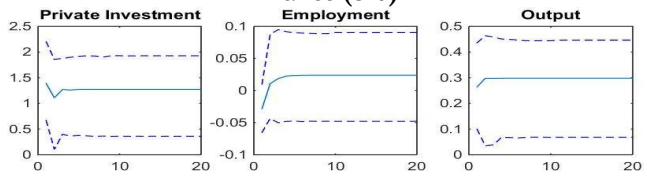
Hospitality (S15)



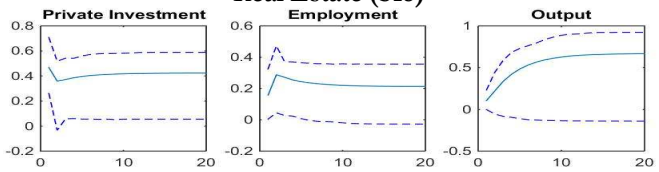
Telecommunications (S16)



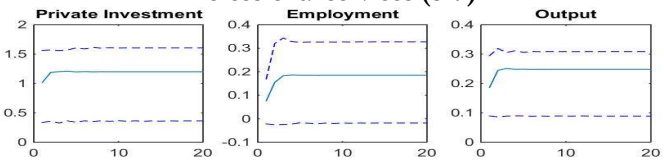
Finance (S17)



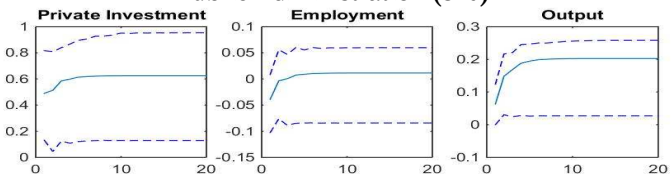
Real Estate (S18)



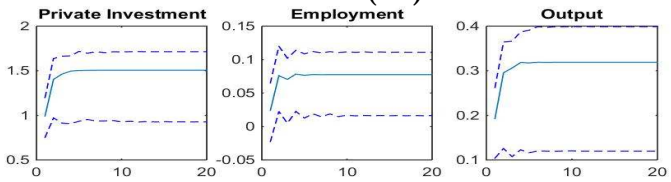
Professional services (S19)



Public Administration (S20)



Education (S21)



Health (S22)

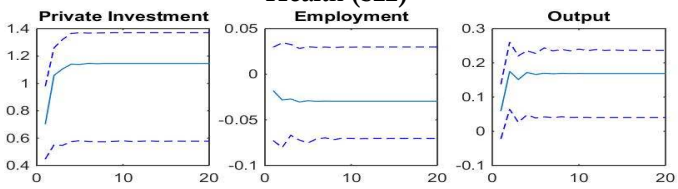
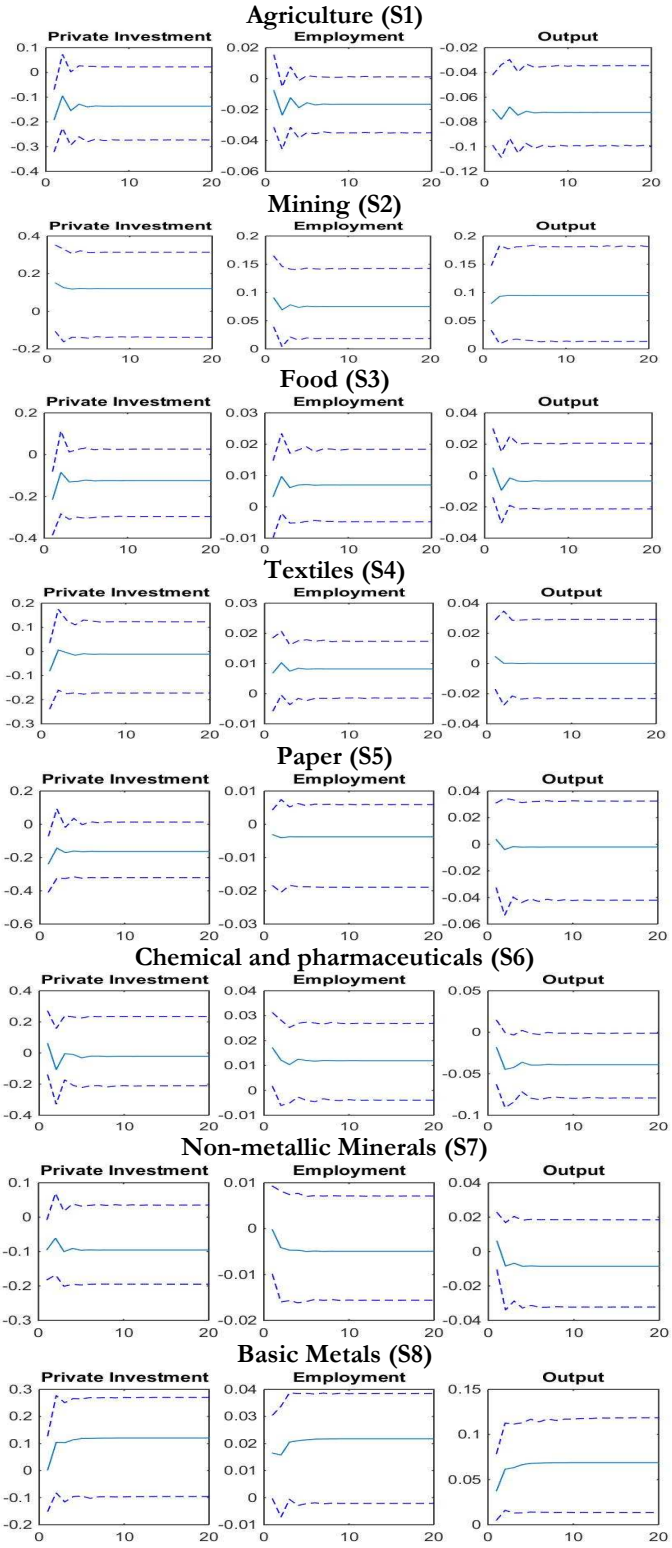
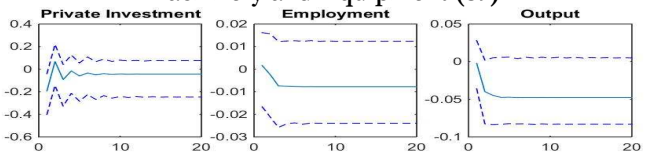


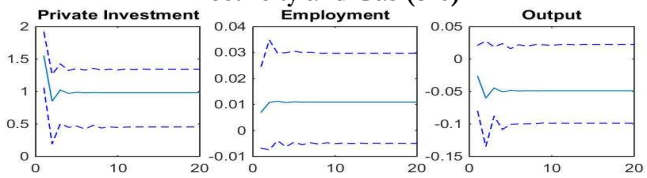
Figure A4 – Effects of Investments in Utilities



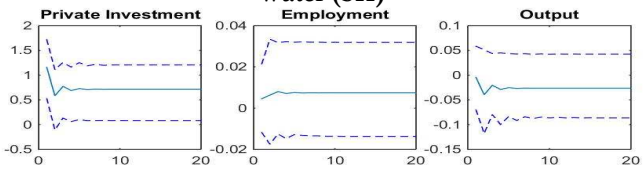
Machinery and Equipment (S9)



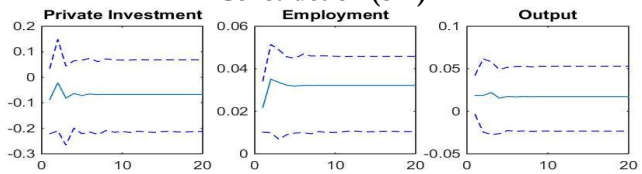
Electricity and Gas (S10)



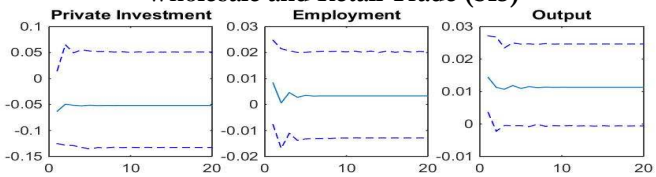
Water (S11)



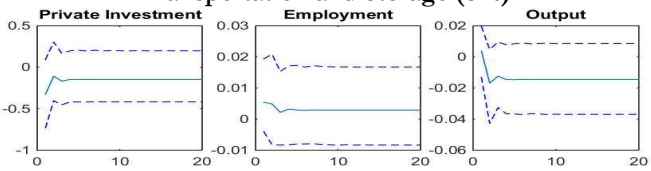
Construction (S12)



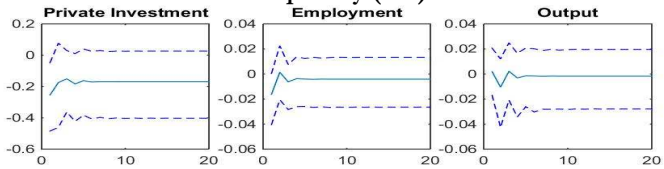
Wholesale and Retail Trade (S13)



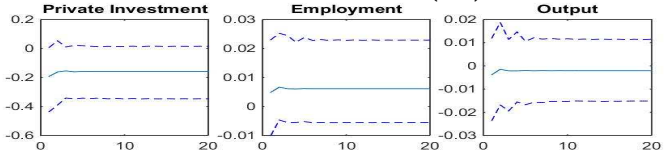
Transportation and Storage (S14)



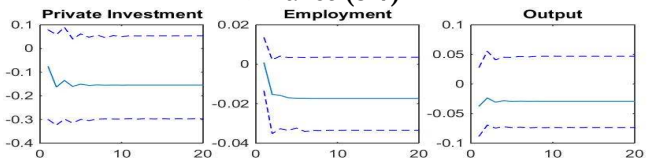
Hospitality (S15)



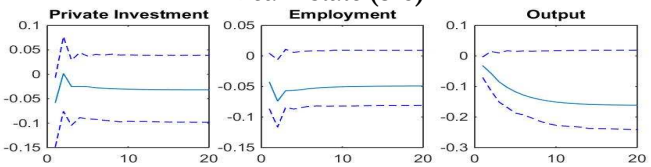
Telecommunications (S16)



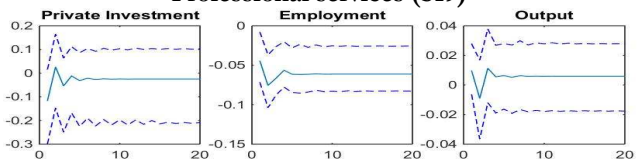
Finance (S17)



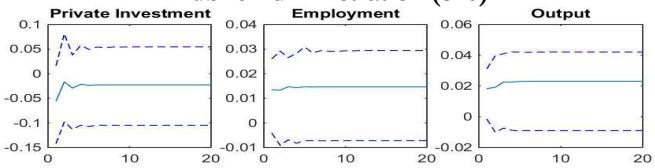
Real Estate (S18)



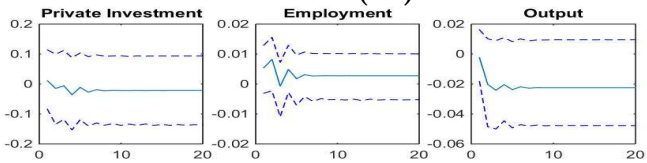
Professional services (S19)



Public Administration (S20)



Education (S21)



Health (S22)

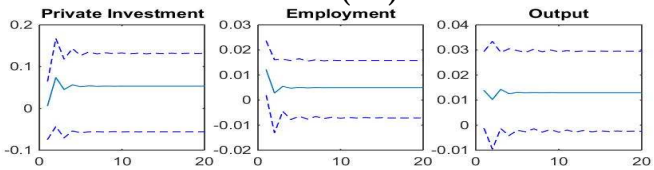
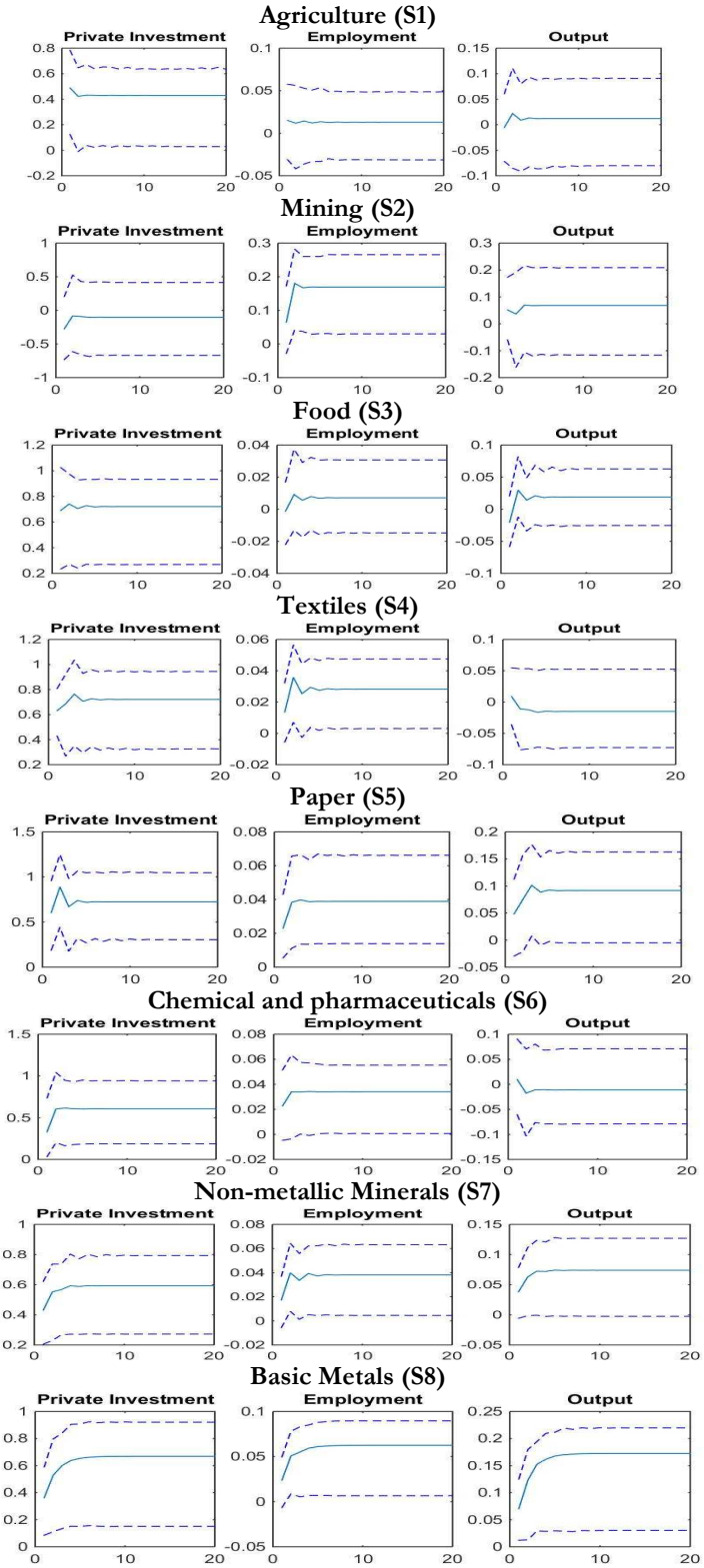
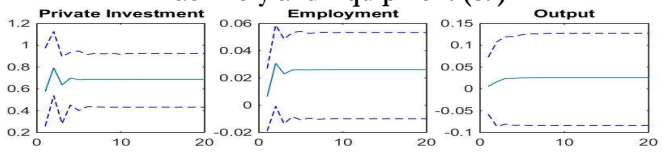


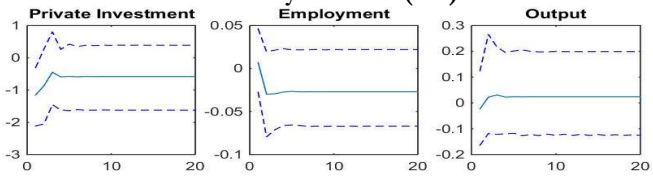
Figure A5 – Effects of Investments in Telecommunications



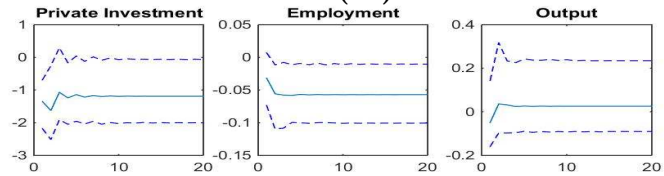
Machinery and Equipment (S9)



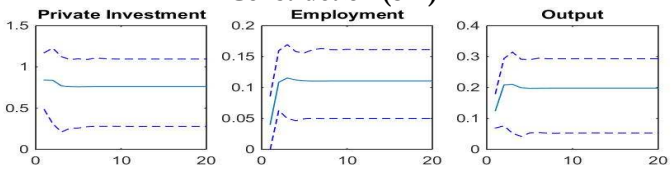
Electricity and Gas (S10)



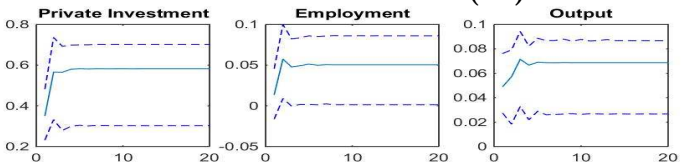
Water (S11)



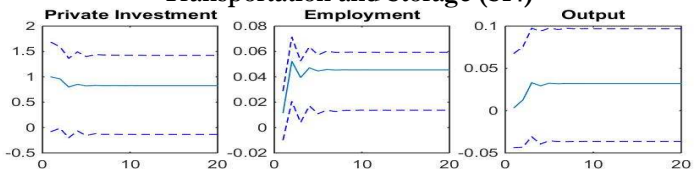
Construction (S12)



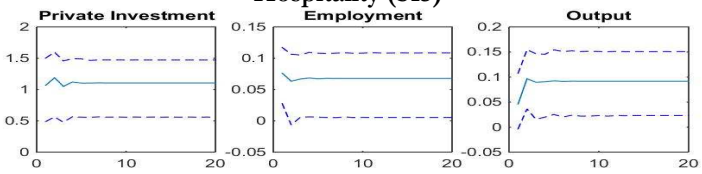
Wholesale and Retail Trade (S13)



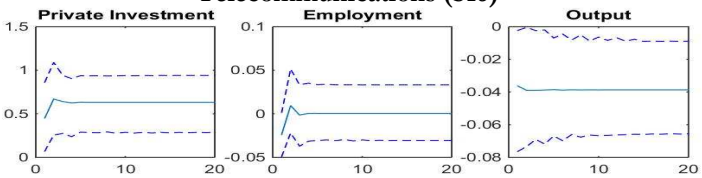
Transportation and Storage (S14)



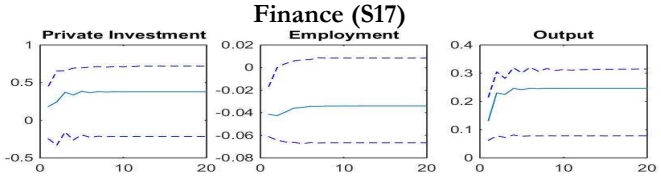
Hospitality (S15)



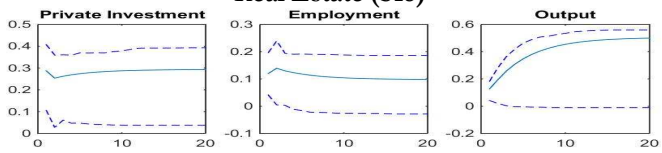
Telecommunications (S16)



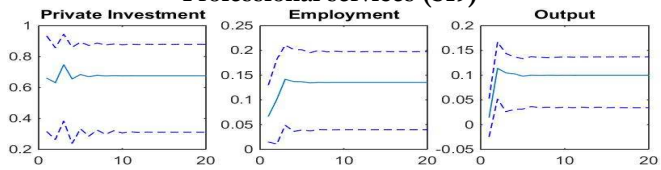
Finance (S17)



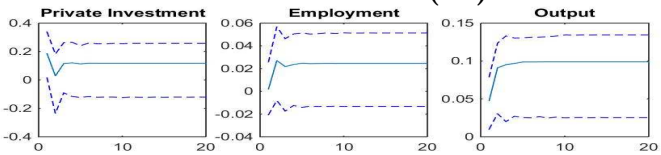
Real Estate (S18)



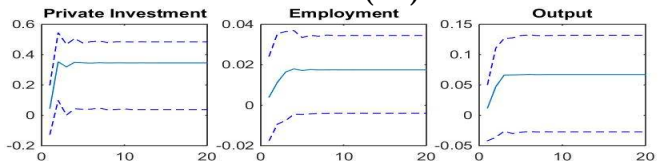
Professional services (S19)



Public Administration (S20)



Education (S21)



Health (S22)