*European Journal of Management Issues*

*Volume 30(4), 2022, pp. 224-234*

*DOI: 10.15421/192220*

*Received: 18 September 2022*
*Revised: 22 October 2022*
*Accepted: 01 November 2022*
*Published: 08 November 2022*

**JEL Classification: E01, E22, E24, H54**

# The Effect of Public and Private Sector Fixed Capital Investments on Gross Domestic Product and Employment in Turkey

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**Purpose:** The aim of this study is to analyze the effects of public and private sector investments on gross domestic product (GDP) and employment econometrically with the panel data method in order to determine the efficiency of investments in Turkey.

**Design/Method/Approach:** In the study, the possible effects of public and private sector investments on GDP and employment in Turkey are examined by dividing them into sectors. Sectors are included in the analysis as agriculture and other non-agricultural sectors. Since the data of various sectors within a certain time period are used, time series and horizontal cross-sectional data are analyzed using the panel data method, which allows them to be used together. Four different models are created in the research. Among them, the effects of public investment expenditures on GDP in the period of 2004-2020 in Model 1, private investment expenditures on GDP in the same period in Model 2, public investment expenditures on employment in the period of 2014-2021 in Model 3 and private investment expenditures on employment data in Model 4 are investigated.

**Findings:** The results obtained from the analyses show that public and private sector investments have a significant and positive impact on GDP and employment in Turkey.

**Practical Implications:** It is generally accepted in the public finance literature that investments will positively affect economic growth, production level, employment and regional development if they are used in productive areas.

**Originality/Value:** What makes this study different from others is that the relationship of public and private sector investments with both GDP and employment is analyzed separately. In this way, a comparison can be made from the point of public and private sector investments in Turkey in terms of the contribution of investments to both GDP and employment, and an answer can be sought to the question of how correct the policy of increasing the share of the private sector in investments, especially in recent years, is in Turkey.

**Research Limitations/Future Research:** This study will make a significant contribution to the literature on the economic effects of public and private sector investments. It will be determined how accurate the idea of increasing the share of private investments in Turkey in recent years is. According to the results obtained from the study, new studies will be conducted on what can be done to increase the efficiency of public or private sector investments.

**Disclaimer:** This article was produced from the doctoral thesis prepared by Özgür Mustafa Ömür at Bursa Uludağ University Social Sciences Institute, Department of Finance, under the supervision of Prof. Dr. Filiz Giray.

**Paper Type:** Empirical

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***Keywords:*** Public Investments, Private Sector Investments, Gross Domestic Product, Employment.

**Reference** to this paper should be made as follows:
Giray, F., & Ömür, Özgür M. (2022). The Effect of Public and Private Sector Fixed Capital Investments on Gross Domestic Product and Employment in Turkey. *European Journal of Management Issues*, 30(4), 224-234. doi:*10.15421/192220*.

# Вплив інвестицій в основний капітал державного та приватного секторів на валовий внутрішній продукт та зайнятість в Туреччині

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**Мета роботи:** Метою цього дослідження є економетричний аналіз впливу інвестицій державного та приватного секторів на валовий внутрішній продукт (ВВП) та зайнятість за допомогою методу панельних даних для визначення ефективності інвестицій в Туреччині.

**Дизайн / Метод / Підхід дослідження:** У дослідженні розглядається можливий вплив інвестицій державного та приватного секторів на ВВП та зайнятість в Туреччині шляхом розподілу їх на сектори. Сектори включені в аналіз як сільське господарство та інші несільськогосподарські сектори. Оскільки використовуються дані різних секторів за певний період часу, часові ряди та горизонтальні перехресні дані аналізуються за допомогою методу панельних даних, що дозволяє використовувати їх разом. У дослідженні побудовано чотири різні моделі. Серед них досліджується вплив державних інвестиційних видатків на ВВП у період 2004-2020 рр. у Моделі 1, приватних інвестиційних видатків на ВВП за той самий період у Моделі 2, державних інвестиційних видатків на зайнятість у період 2014-2021 рр. у Моделі 3 та приватних інвестиційних видатків на дані про зайнятість у Моделі 4.

**Результати дослідження:** Результати, отримані в результаті проведеного аналізу, показують, що інвестиції державного та приватного секторів мають значний і позитивний вплив на ВВП та зайнятість у Туреччині.

**Практична цінність дослідження:** У літературі з державних фінансів загальновизнано, що інвестиції позитивно впливають на економічне зростання, рівень виробництва, зайнятість та регіональний розвиток, якщо вони використовуються у виробничих сферах.

**Оригінальність / Цінність дослідження:** Відмінність цього дослідження від інших полягає в тому, що в ньому окремо проаналізовано взаємозв'язок інвестицій державного та приватного секторів з ВВП та зайнятістю. Таким чином, можна зробити порівняння з точки зору інвестицій державного та приватного сектору в Туреччині з точки зору внеску інвестицій як у ВВП, так і в зайнятість, а також знайти відповідь на питання, наскільки правильною є політика збільшення частки приватного сектору в інвестиціях, особливо в останні роки, в Туреччині.

**Обмеження дослідження / Майбутні дослідження:** Дане дослідження зробить значний внесок у літературу з питань економічних наслідків інвестицій державного та приватного секторів. Буде визначено, наскільки точним є уявлення про збільшення частки приватних інвестицій в Туреччині в останні роки. За результатами, отриманими в ході дослідження, будуть проведені нові дослідження щодо того, що можна зробити для підвищення ефективності інвестицій державного або приватного сектору.

**Заява про відмову від відповідальності:** Ця стаття була підготовлена на основі докторської дисертації, підготовленої Озгюром Мустафою Омюром в Інституті соціальних наук Університету Бурси Улудаг, кафедра фінансів, під керівництвом професора, доктора Філіз Ґірей.

**Тип статті:** Емпіричний

***Ключові слова:*** Іержавні інвестиції, інвестиції приватного сектору, валовий внутрішній продукт, зайнятість.

## 1. Introduction

Investments are one of the economic factors that determine the amount of national income. Since the amount of national income is also a determinant of economic growth, investments are one of the keys to national economic growth (*Sundari & Ariani, 2020*). Since investments are one of the important macroeconomic variables in creating economic growth, investments have a multiplier effect on other macroeconomic variables such as employment, exports and consumption (*Yuliana et al., 2019*). However, while the increase in weak private and public investments leads to the increase in public debt, the increase in public debt is one of the factors that puts a brake on growth (*Jalles & Medas, 2022*). The economic effects of investments depend on whether they are used efficiently or not. Investments made in effective and productive areas will be effective in ensuring sustainable growth and development by increasing production capacity and employment.

The theory of investment and economic growth has been explored by many authors around the world using different times and models. The results of the studies showed that there are different statements about the effect of investment on economic growth (*Nguyen & Nguyen, 2021*). For example, from recent research: *Du (2022); Özen & Köse (2022); Karakaya and Şahinoğlu (2021)* argue that public investments positively affect economic growth; *Nguyen and Nguyen (2021)* argue that it has negative effects especially in the long term.

What makes this study different from others is that the relationship of public and private sector investments with both GDP and employment is analyzed separately. In this way, a comparison can be made from the point of public and private sector investments in Turkey in terms of the contribution of investments to both GDP and employment, and an answer can be sought to the question of how correct the policy of increasing the share of the private sector in investments, especially in recent years, is in Turkey. In this study, a panel data method is used to analyze the effects of public and private sector investments on GDP and employment in Turkey. In the first part of the study, the economic effects of public investments are emphasized. In the second part, the literature on the economic effects of public investments is examined. In the following section, the trend of public and private sector investments in Turkey are examined. In the fourth section, where the analysis results of the study are included, after the data set and model of the research are explained, the analysis results and interpretations of these results are given. In the conclusion section, the results of the analysis are evaluated and recommendations are made for Turkey.

## 2. Economic Effects of Public Investments

In general, investment is the transfer of existing resources to areas that are considered to be efficient for the production of goods and services in order to earn more in the future or to provide services to society (*Arrow, 1968*). In general, the financial return on public investments may be lower than the social return it creates for citizens. If the social benefit of investment is high, the cost can be kept in the second plan and investment can be considered appropriate. The private sector will not want to be interested in such investments because they are for profit (*Toigo & Woods, 2007*). The private sector invests in order to make a profit. On the other hand, the public sector has different goals except for earning money. For example, in addition to being an important tool for achieving economic growth, public investment expenditures are one of the fiscal policy tools that the state can use to guide the market in order to achieve basic economic and social goals. In addition, public investments play a positive role in providing basic public services and ensuring that all citizens in the country can benefit equally from these services and opportunities (*IMF, 2015a*).

Investments made in fertile areas and properly managed in terms of budgeting, in addition to the benefits they provide for citizens socially, financial profitability can be achieved, and the positive effects that this investment adds to the economy can increase even more.

Although economic development and growth are different concepts, the growth of the economy is very important for development to take place. Investments are one of the main supporting factors in driving economic growth. In particular, physical infrastructure investments are an important factor in promoting economic growth (*Yuliana et al., 2019*). Since investment expenditures are expenditures to increase the existing production capacity, it has important effects on economic growth in developing countries. Investment expenditures increase the national income and employment rate with the effect of expanding the production capacity. It is for this reason that the benefit of investment expenditures is long-term and continuous (*Özen & Köse, 2022*). In addition to physical infrastructure investments, significant developments in industrialization and technology in recent years and the importance of human capital investments are also increasing significantly. It has also been proven by empirical studies conducted in this field that such investments will make positive contributions to production capacity and therefore economic growth by increasing labor productivity (*Barro, 1999; Abrigo, Lee & Park, 2018*). It is also argued that, in the long run, investments in human capital are more effective in achieving economic development than investments in infrastructure (*Buffie et al., 2020*).

Especially after the 2000s, in most countries, including the EU countries, states have allocated resources specifically for infrastructure investments in order to increase the production potential in backward regions. In addition to physical infrastructure investments, it is aimed to develop the regions by implementing educational programs in the regions and by applying incentives for private sector investments (*De la Fuente, 2004*). Also, having the positive impact of public investments on production, they will also have a positive contribution to the development of backward regions within the country.

In order to close the development gap between regions, states prefer transferring public expenditures, especially physical and social infrastructure investments, to less developed regions. In this way, with the resources transferred to the underdeveloped regions, private sector investment costs are reduced and private investments are encouraged to come to these regions, so that investment and production in the regions can be increased.

In addition to social benefit provided to society by public investments made in fertile areas, the expansion of a tax base with the growth effect it creates and the cash flow obtained from them after investments are put into operation can contribute positively to the state's revenues, and investment financing can be provided spontaneously (*Toigo & Woods, 2007*). Investment in physical and social infrastructure, as it can be considered an important tool in achieving sustainable growth, especially in developing countries with low income, is among the main problems of ensuring development that is regarded as a very important tool (*Dabla-Norris et. al., 2012*).

Although public investments have many beneficial features in terms of economic development, they also have some negative features. The main purpose of private investments in public investment, such as the lack of gain, gain community providing benefits beyond providing the feature of highlighting the effectiveness and efficiency of these investments is not easily identifiable as it has been in private investments. In addition, public investments are carried out in accordance with the will and preferences of the political power in the country. The fact that public investment decisions depend on the will of the political power makes them move away from rationality by acting in a populist way when making these decisions. Therefore, public investments may not be as effective and efficient as private sector investments in terms of their economic effects (*Kalem, 2015*).

Also, the excessive increase in public investment expenditures in countries does not mean that the investments made will have a positive impact on production and service capacity continuously. As the main reason for this situation, it can be shown that public resources cannot be used effectively and efficiently, especially in economies where corruption is high (*Uzay, 2002*). It should not be forgotten that physical and social positive effects of public investments on the economy depend on whether they are used in productive areas (*IMF, 2015b*). In the study conducted by *Schwartz (2015)* on the subject, it is determined that the use of public investments in inefficient areas will reduce approximately one-third of the profit to be obtained from these investments. In the study, it is argued that the positive impact of investments on the economy in efficient and correct areas will increase significantly (even twice as much in some cases).

The fact that public investments make positive contributions to the economy undoubtedly depends on the fact that these investments are made in productive areas. In this respect, it is necessary to examine whether investments are efficient or not in order to investigate the impact of investment on economic development. Mistakes made in public investment decisions, especially in developing countries, lead to insufficient returns on public and private sector investments. There are many reasons for these errors in investment decisions, and one of the most important reasons is the lack of knowledge and technical expertise in these countries (*Dabla-Norris et al., 2012*). In addition, another important reason that negatively affects the efficiency of public investments is high corruption in the public sector, which cannot be prevented. In the study conducted on this subject, it was found that high corruption negatively affects the efficiency of public capital, hinders specialization and development (*Chakraborty & Dabla-Norris, 2009*).

Low productivity in public investments is a problem that seems to be more common, especially in developing countries (*Berg et al., 2013*). In countries where public investments are managed more efficiently, more productive, efficient, reliable and predictable investments emerge than in other countries. Strengthening the institutions related to public investment management is expected to increase the economic effects of public investments by about two-thirds (*IMF, 2015b*). In order to manage public investments more efficiently and effectively, Public Investment Management (PIM) is being established in many countries in order for governments to manage public investment expenditures (*Miller & Mustapha, 2016*). *Schwartz (2015)*, in his study, indicates that strengthening public investment management is one of the factors affecting efficiency in public investments. According to the study, developing countries especially should be stricter and more transparent in the evaluation, selection and management of investment projects. These countries should focus on strengthening their institutions related to public investment management. In addition, the central government and local governments should work in coordination to determine the investments to be made in regions. Only in this way can efficient investments be determined according to regional conditions and thus, by increasing efficiency in public investments, the positive effects of investments on the economy can be increased (*Miller & Mustapha, 2016*).

Public investments, such as private sector investments, are some negative aspects to the exclusion of the economy, although the citizens of these investments benefit from long years of physical and human infrastructure services that will emerge and make life easier, and it should be noted that these services have a positive impact on productivity. Public investments are extremely important in providing social and economic infrastructure and achieving sustainable development (*IMF, 2015b*).

## 3. Related Literature

When empirical studies on the economic impact of investments are examined, it can be said that while there are many studies in the literature on the relationship between public investments and economic growth, there are limited studies on the effect of public investments on employment or unemployment.

In the literature, the studies about the effect of investments on economic growth and employment will be divided into two groups as Turkey and the international field. First of all, the studies included in the literature in the international field are given in *Tab. 1*.

When the studies carried out are examined, it is seen that most studies in the international field reach conclusions that public investments have a significant and positive impact on growth. In some studies, it is concluded that public investments have a negative effect on growth. When the studies carried out in the national field are examined, it is seen that similar results are reached. In most of the studies carried out, it is concluded that there is a positive relationship between public investments and economic growth or employment. These studies are given in *Tab. 2*.

When the studies performed for Turkey are examined, it is seen that public investments have a positive effect on economic growth and employment in general. However, in some studies, albeit quite limited, conclusions are also reached in the direction that public investments do not positively affect growth or negatively affect it.

## 4. The Trend of Public and Private Sector Investments in Turkey

With the transition to a planned economic period in Turkey, especially since 1960, the weight of the public sector in the economy has been increased as a result of taking important steps in the direction of infrastructure, industrialization and education, and emphasis has been put on policies that support and encourage the private sector (*Kesik, 2006*). Public investment expenditures also have received their share from this increase. However, in line with the general economic policies adopted with the widespread transition to a free market economy since the 1980s, the state has mostly concentrated on infrastructure and fixed capital investments, while the remaining areas have been left to the private sector. Important steps have started to be taken in terms of encouraging private sector investments. The saving measures taken as a result of the crises experienced in the 1990s and 2000s caused public investments to slow down. At the same time, this situation has led to the acceleration of private sector investments with models such as conditional liabilities, build-operate-transfer or build-operate (*Ulusoy, 2013*).

*Fig. 1* shows public, private and total fixed capital investments in Turkey between the years 1998-2022. Total fixed capital investments in Turkey have been increasing continuously since 1998. Only in 2009, a decline was observed due to the impact of the global crisis, and since this year, the rate of increase has risen even more. Accordingly, it can be stated that private sector investments were higher than public investments in the specified years and that the difference between private sector and public investments has increased by Decelerating, especially since 2010. While public investments increased from 3.3 Billion to 268 Billion Turkish Lira in the specified years, private investments increased from 13.5 Billion to 2.1 Trillion Turkish Lira.

*Tab. 3* shows the percentage distribution of public fixed capital investments in Turkey by sectors in the period between 2014 and 2022. Accordingly, the sector with the highest share in total fixed capital investments in Turkey is a transportation sector. While the share of the sector was at the level of 40.7% in 2020, it decreased to 32.5% in 2022. Other sectors with a high share in total investments are an education sector with a share of 10.6%, an energy sector with a share of 9.1%, and a mining sector with a share of 8.7%.

**Table 1:** International Literature on Economic Effects of Public Investments

| Writers (Date) | Working time period | Scope | Findings |
|---|---|---|---|
| *Wai and Wong (1982)* | 1960-1975 | Greece, Thailand, Korea, Mexico and Malaysia | Public investments have a positive impact on private investments. |
| *Aschauer (1989)* | 1949-1985 | United States | Expenditures other than defense have positive effects on productivity. In addition, infrastructure investments such as streets, highways, airports, sewers and water are very effective in increasing productivity. |
| *Barro (1991)* | 1960-1985 | 98 countries | It is determined that there is no positive effect of total public expenditures on growth, but public investment expenditures have a positive effect on economic growth. |
| *Easterly and Rebelo (1993)* | 1970-1988 | 28 countries | A positive relationship is determined between transportation and communication investments and economic growth. |
| *Ramirez (1994)* | 1950-1990 | Mexico | Large-scale investments have a positive impact on private sector investments. |
| *Odedokun (1997)* | 1970-1990 | 28 countries | It is determined that public investments support private investments in the long term and have more positive contributions to economic growth. |
| *Zhang and Fan (2004)* | 1978-1995 | People's Republic of China | It is found that public investments have a positive effect on economic growth for each sector, but this effect varies depending on the type of investment and regional differences. In addition, investments, especially in underdeveloped regions, reduce regional inequalities, while investments in coastal and central regions further increase regional differences. |
| *Pereira and Andraz (2006)* | | | It is determined that investments made in transportation infrastructure do not positively affect economic growth. |
| *Bose, Haque, and Osborn (2007)* | 1970-1980 | 30 countries | The absence of any relationship between current spending and economic growth, in contrast, identifies a positive relationship between public investment share of GDP spending and economic growth. |
| *Değer and Doğanay (2015)* | 1994-2013 | Countries with many different levels of development | Positive and significant relationships are identified between energy investments and economic growth in countries, and investments in transport infrastructure meaningfully affect economic growth in low-income countries, albeit to a limited extent. Investments in communication infrastructure have a significant and positive impact on economic growth in high-income countries. In addition, infrastructure investments in general have a positive impact on economic growth. |
| *Warmedinger, Westphal and de Cos (2015)* | | EU member states | It is concluded that the multiplier effect of public investment expenditures is greater than the tax multiplier, and according to this conclusion, it is determined that financing additional public investments with taxes will have a positive effect on growth by increasing production output. |
| *Manga et al. (2015)* | 1995-2011 | Turkey, Brazil, Russia, India, China and South Africa | It is determined that there is a positive relationship between human capital and economic growth. |
| *Canh and Phong (2018)* | 1990-2016 | Vietnam | It is determined that public investments have a positive effect on economic growth in most sectors in the short and medium term, but there is no significant relationship in the long term. |
| *Riaz and Riaz (2018)* | 2000-2014 | South Asian Association of Regional Cooperation countries | Investment, government expenditures have a positive impact on economic progress. |
| *Meyer and Sunasi (2019)* | 1995-2016 | South Africa | While domestic investments have a positive effect on employment in the long run, no significant relationship is found between investments and growth. |
| *Nguyen and Nguyen (2021)* | 2000-2020 | Vietnam | In the long run, while public investments negatively affect economic growth, domestic private investments have a positive effect. |
| *Du et al. (2022)* | 2004-2019 | China | It shows that new infrastructure investments contribute to improving the quality of economic growth in terms of the state, process and results of economic growth by promoting technological innovation, improving the industrial structure and increasing production efficiency. |

***Source:*** developed by authors

**Table 2:** Related Literature on Economic Effects of Public Investments for Turkey

| Writers (Date) | Working time period | Scope | Findings |
|---|---|---|---|
| *Yavuz (2001)* | 1990-2000 | Turkey | It is determined that public investments have a negative impact on private sector investments. |
| *Kar and Taban (2003)* | 1971-2000 | Turkey | There is no meaningful relationship between infrastructure investments and Deceleration. Health expenditures have a negative impact on growth, too. |
| *Bayraktutan and Arslan (2008)* | 1980-2006 | Turkey | It is concluded that fixed capital investments have a positive effect on economic growth in the long term. |
| *Tan, Mert and Özdemir (2010)* | 1969-2003 | Turkey | It is concluded that there is a causal relationship between infrastructure and education expenditures and GDP, although there is no causal relationship between health expenditures and GDP. |
| *Altunç (2011)* | 1960-2009 | Turkey | While no relationship is found between consumption expenditures and growth, it is concluded that public investments have a positive effect on economic growth. |
| *Şahbaz (2014)* | 1991-2011 | Turkey and 27 EU Countries | It is concluded that physical capital expenditures have a positive effect on economic growth with the increase in labor force in the long term. |
| *Selim, Koçtürk and Eryiğit. (2014)* | 2001-2012 | Turkey | It is determined that fixed investments have a statistically significant and positive effect on employment. |
| *Kanca and Bayrak (2015)* | 1980-2013 | Turkey | It is determined that public investment expenditures have a reducing effect on the unemployment rate. |
| *Çelik (2016)* | 1975-2013 | Turkey | It is concluded that public investments have a significant and positive impact on private investments in the short term. |
| *Değer and Recepoğlu (2018)* | 2004-2014 | Turkey | Both public investment incentives and public investment expenditures are important determinants of local economic growth. |
| *Karakaya and Şahinoğlu (2021)* | 1975-2017 and 1984-2017 | Turkey | While current expenditures, health expenditures and defense expenditures negatively affect economic growth in the long run, education expenditures, housing expenditures and investment expenditures have a positive impact. |
| *Özen and Köse (2022)* | 1980-2017 | Turkey | One unit increase in investment expenditures increases economic growth by 0.13%. |

***Source:*** Developed by authors

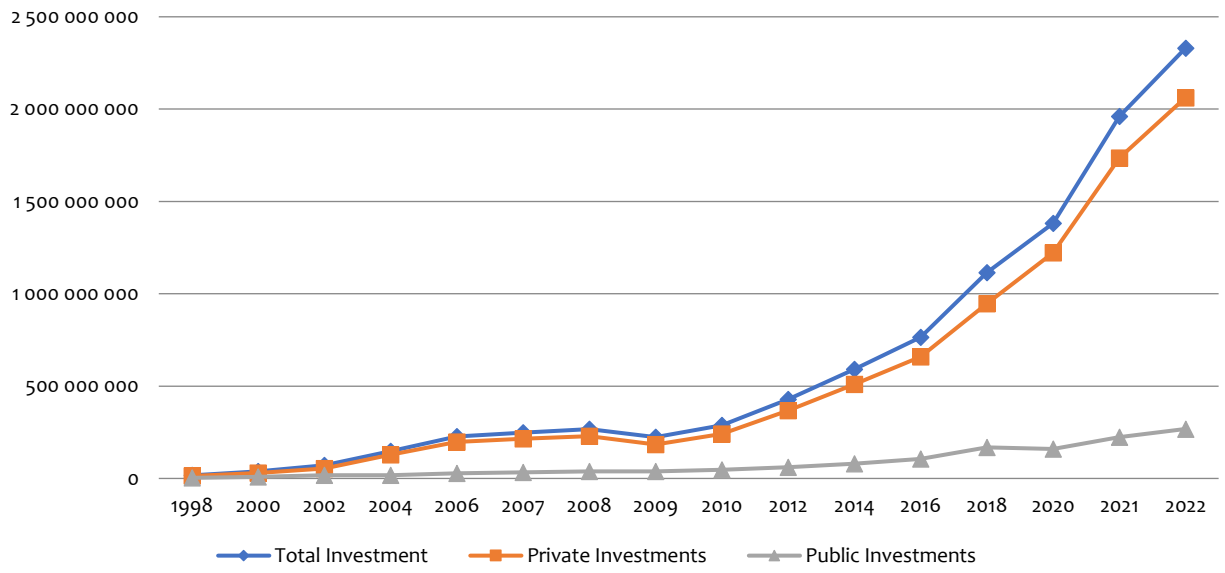



**Figure 1:** Fixed Capital Investments of Public and Private Sectors (1998-2022, Billion Turkish Lira)

***Source:*** *Presidency of Strategy and Budget, Basic Economic Indicators, 2022*

After examining the distribution of public investments to sectors, the distribution of private investments according to sectors is shown in *Tab. 4*. As in public investments, the transportation sector in private investments is in the first place with a share of approximately 30.5% in total investments. The second place is occupied by the housing sector with 29%, while the manufacturing sector is in the third place with about 26.5%. The share of these three sectors in total investments in 2022 is at the level of 86%.

**Table 3:** Distribution of Public Fixed Capital Investments by Sectors in Turkey (%)

| Sectors | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 8.8 | 9.1 | 8.8 | 8.9 | 8.6 | 6.6 | 5.4 | 6.6 | 8.0 |
| Mining | 1.6 | 1.7 | 0.9 | 1.0 | 2.6 | 4.1 | 7.3 | 5.9 | 8.7 |
| Manufacturing | 0.7 | 0.7 | 0.6 | 0.5 | 0.4 | 0.6 | 1.1 | 0.5 | 1.1 |
| Energy | 5.6 | 4.5 | 3.5 | 3.7 | 3.6 | 7.0 | 12.3 | 7.3 | 9.1 |
| Transport | 37.6 | 38.6 | 35.1 | 35.9 | 40.7 | 35.4 | 40.7 | 34.5 | 32.5 |
| Tourism | 0.5 | 0.8 | 0.5 | 0.5 | 0.6 | 0.3 | 0.3 | 0.1 | 0.2 |
| House | 1.0 | 0.8 | 0.8 | 1.3 | 1.0 | 1.3 | 0.9 | 1.3 | 1.4 |
| Education | 16.0 | 13.0 | 12.0 | 11.3 | 9.6 | 13.2 | 8.0 | 12.0 | 10.6 |
| Health | 5.6 | 5.8 | 5.4 | 5.3 | 4.4 | 4.9 | 1.2 | 8.1 | 7.0 |
| Other Services | 22.6 | 25.1 | 32.5 | 31.7 | 28.5 | 26.7 | 22.9 | 23.6 | 21.4 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

***Source:*** *Presidency of Strategy and Budget, Basic Economic Indicators, 2022.*

**Table 4:** Distribution of Private Sector Investment Expenditures by Sectors in Turkey (%)

| Sectors | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 1.0 | 1.1 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 |
| Mining | 2.0 | 1.8 | 1.6 | 1.7 | 1.7 | 2.0 | 1.7 | 1.8 | 1.8 |
| Manufacturing | 21.7 | 20.8 | 20.9 | 22.4 | 23.0 | 25.6 | 23.9 | 25.7 | 26.5 |
| Energy | 1.7 | 1.4 | 1.2 | 1.3 | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 |
| Transport | 28.0 | 32.6 | 32.8 | 32.1 | 30.7 | 28.3 | 31.6 | 31.3 | 30.5 |
| Tourism | 4.5 | 3.2 | 2.0 | 1.8 | 2.2 | 3.0 | 1.1 | 1.0 | 0.9 |
| House | 33.9 | 31.9 | 33.6 | 32.6 | 32.2 | 29.5 | 31.2 | 29.5 | 29.1 |
| Education | 2.1 | 2.1 | 1.9 | 2.0 | 2.3 | 2.6 | 2.2 | 2.2 | 2.2 |
| Health | 2.7 | 2.7 | 2.5 | 2.5 | 2.9 | 3.3 | 3.1 | 3.4 | 3.5 |
| Other Services | 2.5 | 2.4 | 2.5 | 2.6 | 2.9 | 3.3 | 2.9 | 2.6 | 2.8 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

***Source:*** *Presidency of Strategy and Budget, Basic Economic Indicators, 2022*

## 5. Purpose and Hypotheses of the Research

In the study, the possible effects of public and private sector investments on GDP (2004-2020 period) and employment (2014-2021 period) in Turkey were examined using a panel data method. Public investments, private sector investments, GDP and employment data were divided into sectors and included in the analysis in order to be suitable for analysis with panel data. Sectors were divided into agricultural and non-agricultural sectors (industry, manufacturing, service, etc.). The reason for establishing a panel by dividing the sectors into two groups as the agricultural sector and all sectors other than the agricultural sector is to create balanced panels in order to obtain more accurate results in panel data analysis in the determined periods, and informality is quite high in the agricultural sector in Turkey.

Four different hypotheses were developed in the scope of this study in *Tab. 5*.

**Table 5:** Research Hypotheses

| Hypotheses | |
|---|---|
| $H_1$ | Public fixed capital investment expenditures are effective on GDP. |
| $H_2$ | Private sector fixed capital investment expenditures are effective on GDP. |
| $H_3$ | Public fixed capital investment expenditures are effective on employment. |
| $H_4$ | Private sector fixed capital investment expenditures are effective on employment. |

***Source:*** developed by authors

### 5.1. Model and Data Set

The panel data set allows collecting and analyzing both cross-sectional data and time series data. With panel data sets, it is very easy to collect and analyze data of sectors, regions, cities and countries for various years. Policy analyses are also generally explored using a balanced panel data set (*Wooldridge, 2013*).

In the panel data method, the observations of the variables constitute the horizontal section of the panel, and the values of the variables in a certain period constitute the time series of the panel.

In the study, since the sectors in Turkey are divided into two groups and data from more than one year is used, it requires the use of both time series data and cross-section data together. Since the data of various sectors within a certain period is used, time series and horizontal cross-sectional data are analyzed using the panel data method that allows them to be used together.

In similar studies on this subject (*Selim et al., 2014; Şahbaz, 2014; Manga et al., 2015; Değer & Doğanay, 2015; Riaz &Riaz, 2018; Nguyen & Nguyen, 2021; Du et al., 2022*) the panel data method was used.

A general panel data equation is set up as in equation 1 to include unit and time (*Cameron & Pravin, 2005*):

$$Y_{it} = \alpha_{it} + \beta_1 PUIE_{it} + \varepsilon_{it} \qquad i=1,\dots,N;\ t=1,\dots,T \quad (1)$$

In studies using the panel data method, random effects model units, or the changes that occur with time with units are included in the model as a component of an error term. In this case, the regression equation to be created is shown in equation 2. As can be seen in the equation, the new equation was created by adding "u" (random error) to equation 1 (*Cameron & Pravin, 2005*):

$$Y_{it} = \alpha_o + \beta_1 PUIE_{it} + \mu_{it} + \varepsilon_{it} \qquad i=1,\dots,N;\ t=1,\dots,T \quad (2)$$

Regression equations are shown in equations 3, 4, 5 and 6 in accordance with the hypotheses in *Tab. 5*. In the research, four different research models were created based on the panel data method, which allows analyzing data from a large number of countries within a certain time period. Among them, the effects of public investment expenditures on GDP in the period 2004-2020 in Model 1, private investment expenditures on GDP in the same period in Model 2, public investment expenditures on employment in the period 2014-2021 in Model 3 and private investment

expenditures on employment data in Model 4 were investigated. The econometric models established in this study are as follows:

$$Model\ 1:\ GDP_{it} = \alpha_o + \beta_1 PUIE_{it} + \mu_{it} + \varepsilon_{it} \quad (3)$$

$$Model\ 2:\ GDP_{it} = \alpha_o + \beta_1 PRIE_{it} + \mu_{it} + \varepsilon_{it} \quad (4)$$

$$Model\ 3:\ Employment_{it} = \alpha_o + \beta_1 PUIE_{it} + \mu_{it} + \varepsilon_{it} \quad (5)$$

$$Model\ 4:\ Employment_{it} = \alpha_o + \beta_1 PRIE_{it} + \mu_{it} + \varepsilon_{it} \quad (6)$$

In this study models:

$\alpha_{it}$: The constant coefficients of the model,
$\beta_1$: The coefficients of the model,
$\mu_{it}$: The error term components in the model according to unit or time,
$\varepsilon_{it}$: The error terms of the model.

The data set for the variables included in the study is given in *Tab. 6*.

**Table 6:** Data Set for Variables

| Variables | Abbreviations | Sources |
|---|---|---|
| Public Fixed Capital Investment Expenditures | PUIE | Presidency of the Republic of Turkey Strategy and Budget Directorate official website |
| Private Sector Fixed Capital Investment Expenditures | PRIE | Presidency of the Republic of Turkey Strategy and Budget Directorate official website |
| Employment Data | Employment | Turkish Statistical Institute official website |
| Gross Domestic Product | GDP | Turkish Statistical Institute official website |

***Source:*** developed by authors

## 5.2. Analysis Results and Evaluation

When estimation process of model 1 is performed, it is understood from the cross sectional (Prob> F = 0.83) and time (Prob> F = 0.04) F values in *Tab. 7* and the Breusch-Pagan tests (Prob. 1.00) that the time effective fixed effects model is valid. The Wald Test results (Prob. 0.00) show that there is a heteroscedasticity problem in the model, while the results of Bharvaga Durbin Watson (1.16) and Baltagi Wu LBI (1.49) both show that there is an autocorrelation problem. Finally, the result of the Breusch-Pagan LM test (for T>N) (Probe 0.00) shows that there is a correlation problem between units.

**Table 7:** Model 1: The Analysis Results

| Variables: GDP | Coefficients (Robust Std. Errors) |
|---|---|
| Constant | -2.67 (4.78) |
| **PUIE** | **23.951[a] (2.116)** |
| $R^2$ | 0.95 |
| F | 128.15[a] (0.00) |
| Cross-Sectional F | 0.05 (0.83) |
| Time F | 2.45 (0.04) |
| Breusch-Pagan | 0.00 (1.00) |
| Wald Test | 365.59 (0.00) |
| Bharvaga Durbin Watson | 1.16 |
| Baltagi Wu LBI | 1.49 |
| Breusch-Pagan LM | 15.03 (0.00) |

***Note:*** a=prob<0.01; b=prob<0.05; c=prob<0.10

***Source:*** developed by authors

In order to eliminate heteroscedasticity, autocorrelation and inter-unit correlation problems in the fixed effects model, the model should be reanalyzed with the Driscoll – Kray resistant estimator. According to the resistant estimator results, a significant relationship was found between public investment expenditures and GDP at the level of 1%. Accordingly, public investment expenditures affect GDP positively. The $R^2$ value, which explains the relationship between the variables, is at a very high level with 0.95.

The analysis results of Model 2 show that fixed effects model is valid according to the Breusch-Pagan test (Prob. 1.00), while Cross-Sectional F (Prob> F = 0.05) and Time F (Prob> F = 0.01) values show that there is both unit effect and time effect in the model (*Tab. 8*). Accordingly, it is understood that "the unit and time effective fixed effects" model is valid in model 2.

**Table 8:** Model 2: The Analysis Results

| Variables: GDP | Coefficients (Robust Std. Errors) |
|---|---|
| Constant | 1.01[a] (2.23) |
| **PRIE** | **3.33[a] (0.11)** |
| $R^2$ | 0.97 |
| F | 890.33[a] (0.00) |
| Cross-Sectional F | 4.14 (0.05) |
| Time F | 3.04 (0.01) |
| Breusch-Pagan | 0.00 (1.00) |
| Wald Test | 2.93 (0.23) |
| Bharvaga Durbin Watson | 1.09 |
| Baltagi Wu LBI | 1.23 |
| Breusch-Pagan LM | 0.43 (0.51) |

***Note:*** a=prob<0.01; b=prob<0.05; c=prob<0.10

***Source:*** developed by authors

The subsequent Wald Test (Prob. 0.23), Bharvaga Durbin Watson (1.09) and Baltagi Wu LBI (1.23) tests and Breusch-Pagan LM Test (0.51) show that there is only an autocorrelation problem in the model. In order to eliminate the mentioned problem, the model was reanalyzed with a resistant estimator. The result of the analysis made with the resistant estimator shows that there is a significant and positive relationship at the level of 1% between private sector investment expenditures and GDP. The $R^2$ value of the model is 0.97.

When the analysis results of Model 3 are examined (*Tab. 9*), it is understood that the Breusch-Pagan test (Prob. 1.00), Cross-Sectional F (Prob> F = 0.00) and Time F (Prob> F = 0.40) values, "*the unit-effective fixed effects*" model is valid.

The results of the Wald Test (Prob. 0,10), Bharvaga Durbin Watson (2,50) and Baltagi Wu LBI (2,65) and Breusch-Pagan LM Test (0,16) show that there is no problem in the model. Accordingly, the results obtained from Cross-sectional F show that there is a significant and positive relationship at 1% level between public investment expenditures and the amount of employment. The $R^2$ value of the model is 0,81.

**Table 9:** Model 3: The Analysis Results

| Variables: Employment | Coefficients (Robust Std. Errors) |
|---|---|
| Constant | 11608.84[a] (289.25) |
| **PUIE** | **0.00003[a] (3.84)** |
| $R^2$ | 0.81 |
| F | 55.70[a] (0.00) |
| Cross-Sectional F | 828.20 (0.00) |
| Time F | 1.22 (0.40) |
| Breusch-Pagan | 0.00 (1.00) |
| Wald Test | 4.54 (0.104) |
| Bharvaga Durbin Watson | 2.50 |
| Baltagi Wu LBI | 2.65 |
| Breusch-Pagan LM | 1.97 (0.16) |

***Note:*** a=prob<0.01; b=prob<0.05; c=prob<0.10

***Source:*** developed by authors

Finally, according to the analysis results for Model 4 (*Tab. 10*), the Breusch-Pagan test (Prob. 1,00), Cross-sectional F (Prob> F = 0,00) and Time F (Prob> F = 0,53) values, "*the unit-effective fixed effects*" model is valid.

**Table 10:** Model 4: The Analysis Results

| Variables: Employment | Coefficients (Robust Std. Errors) |
|---|---|
| Constant | 12165.29[a] (210.12) |
| **PRIE** | **3.08[a] (3.89)** |
| $R^2$ | 0.74 |
| F | 82.49[a] (0.00) |
| Cross-Sectional F | 819.57 (0.00) |
| Time F | 0.95 (0.53) |
| Breusch-Pagan | 0.00 (1.00) |
| Wald Test | 11.64 (0.00) |
| Bharvaga Durbin Watson | 1.91 |
| Baltagi Wu LBI | 2.01 |
| Breusch-Pagan LM | 2.97 (0.08) |

***Note:*** a=prob<0.01; b=prob<0.05; c=prob<0.10

***Source:*** developed by authors

The Wald Test (Prob. 0.00), Bharvaga Durbin Watson (1.91) and Baltagi Wu LBI (2.01) tests and Breusch-Pagan LM Test (0.08) results show that the model has heteroscedasticity, autocorrelation and inter-unit correlation problems. The analysis with the Driscoll – Kray resistant estimator shows that there is a significant and positive relationship at 1% level between private sector investment expenditures and the amount of employment. The $R^2$ value of the model is 0.74.

## 5.3. Results and Discussion

According to the results obtained from the analyses, there are significance positive relationships between public and private sector investment expenditures and GDP and employment. In this context, *H1*, *H2*, *H3* and *H4* hypotheses are accepted. Detailed information about the results is given in *Tab. 11*.

While the results obtained are similar to some studies in the literature, they also contradict with some studies. The results, in which a positive relationship is obtained between investments and GDP, are similar to the results obtained from studies by *Du et al. 2022; Özen and Köse (2022); Karakaya and Şahinoğlu (2021); Canh and Phong (2018); Değer and Recepoğlu (2018) and Altunç (2011)* in the literature. On the other hand, the results also contradict with studies (*Meyer & Sunasi, 2019; Nguyen & Nguyen, 2021*) that indicate a negative relationship between investments and growth in recent years, or that there is no relationship between investments and growth.

The results, which were found to have a positive relationship between investments and employment, are generally similar to the literature. Similar results have been obtained from studies by *Şahbaz (2014), Selim et al. (2014), Kanca & Bayrak (2015), Meyer & Sunasi (2019)*, which have been carried out in this field in recent years.

If investments in Turkey are compared in terms of their positive impact on GDP, the impact of public investments on GDP and therefore on growth is higher than private investments. If a comparison is made in terms of the effect of investments on job creation, it can be said that the effect of private investments on job creation is higher than public investments.

# 6. Conclusion

In this study, in order to determine the efficiency of public and private sector investments in Turkey, the relationships between these expenditures, GDP and employment level were investigated using the panel data method. The results obtained from the analyses show that there are significant and positive relationships between public and private sector investments, GDP and the employment level. In the light of these results, it can be said that public and private sector investments in Turkey positively affect GDP and employment levels. When the size of the effect is examined, the positive effect of public investments on GDP is greater than private investments, while the effect of private investments on increasing employment is greater than public investments.

The results show that conditional liabilities, build-operate-transfer or build-operate in Turkey in recent years, as models supporting and increasing the share of private sector investments in total investments, especially in creating employment, can be an effective policy tool. In terms of its impact on GDP, it can be stated that public investments are more effective than private sector investments with both a multiplier effect and the ability to encourage production and private sector investments.

According to the results, investments can be used as a policy tool in promoting growth and employment in developing economies. In future studies, researches can be made on the factors affecting productivity in investments.

**Table 11:** The Effect of Public and Private Sector Investments on GDP and Employment

| | PUIE/GDP | PRIE/GDP | PUIE/Employment | PRIE/Employment |
|---|---|---|---|---|
| Analysis Results | + 23.95 | + 3.33 | + 0.0003 | + 3.08 |
| Hypothesis | *H1 Accepted* | *H 2 Accepted* | *H 3 Accepted* | *H 4 Accepted* |

***Note:*** + Positive effect; - Negative effect; ***** No effect

***Source:*** developed by authors

## 7. Funding

This study received no specific financial support.

## 8. Competing interests

The authors declare that they have no competing interests.

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