CPB Netherlands Bureau for Economic Policy Analysis

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Investment in the OECD: pre- and post-crisis developments

On request by the Ministry of Economic Affairs

CPB Netherlands Bureau for
Economic Policy Analysis

CPB Note

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Subject: Investment in the OECD: pre- and post-crisis developments

Summary

Investment suffered a severe blow during the global financial crisis. The investment volume in the OECD fell by 5.5%, in the EU15 by 15.6% and in the US by almost 6.5%. The OECD average investment rate, i.e. the ratio of investment to GDP, fell by more than 2 percentage points to one of its lowest levels since World War II.

Shortfall mainly due to private investment, notably residential

Business and residential investment are mainly responsible for the drop in the OECD average investment rate. Each accounted for 40 percent of the drop in the investment rate since the crisis. Public investment remained relatively firm and accounted for the remaining 20 percent. Growth-enhancing investments such as R&D-investments were less affected. The average OECD R&D investment rate rose from 2.2 percent in 2003 to 2.5 percent in 2013.

Investment rate will return to its optimal value

The strong decrease in the investment rate is not exceptional given the historical co-movement of business investment and output. As the economy recovers, we expect the investment rate to pick up. However, the long-term investment rate may settle at a value lower than during the pre-crisis years, due to the unsustainable nature of investment in housing in the run-up to the financial crisis. Furthermore, output levels are known to suffer structural damage after a financial crisis. Therefore, long-term investment levels may need to be adjusted downwards, independent of the fall in the investment rate.

Several factors affect the speed of recovery

By now, investment levels are slowly recovering, lagging behind the recovery of GDP. Several factors affect this speed of adjustment. First, the legacy of the crisis still casts its shadow, i.e. the large debt overhang of households, firms and governments and low inflation and a low interest rate close to the zero lower bound. Second, the large role of residential investment in the decline of investment volumes prolongs the adjustment period, as its cycle is considerably longer than that of business investment. Third, credit supply has become more restricted. Finally, due to higher perceived uncertainty, firms became more reluctant to invest, although by now this effect has become less prominent.

Investment crucial to labour productivity growth

Intangible investments, such as R&D, account for about 25% of labour productivity growth. R&D and human capital expenditure are especially relevant for increasing an economy's long-term growth perspective. R&D and educational expenditure levels have held up relatively well during the crisis. The average OECD R&D investment rate

rose from 2.2 percent in 2003 to 2.5 percent in 2013. The real expenditure on education, measured per student, increased as well.

The role of policy in growth enhancing investment

Governments have a role in alleviating market failures and creating friendly macro-economic conditions, stimulating investment from a long-term growth perspective. A government can deploy several strategies: it can improve market conditions, provide financial support or increase public investment.

1 Motivation

In June 2015, the Netherlands will chair the Ministerial Council Meeting. This year's edition will address investment topics. In preparation, the Ministry of Economic Affairs asked the Netherlands Bureau for Economic Policy Analysis (CPB) to make an international comparison of OECD countries distinguishing investment along several dimensions and to account for these developments, e.g. pre- and post-crisis developments, developments by means of a decomposition by private and public investment and housing. In addition we investigate developments in investment in R&D and human capital. Finally, the analysis should address the role of policy in stimulating investment in the long run.

This document reports our findings based on descriptive statistics and a (short) literature review. It is organized to easily guide participants at the MCM through the economic facts and theory for the debate at hand. It consists of two parts. Chapter 2 sets the scene providing a short introduction into investment theory and presenting the relevant investment data for the OECD, EU15, US and Japan. It elaborates on notable developments over the recent decades and the differences between pre- and post-crisis developments. Chapter 3 and chapter 4 discuss three important questions in the current policy debate:

- Which economic developments might affect the speed of recovery of investment?
- Will investment recover and return to pre-crisis levels?
- What role do governments have to play in stimulating investment in the long run?

2 Investment developments in the OECD

2.1 The role of investment in an economy

Investment is a key factor in short- and long term economic development.

In the long run, investment fosters economic growth. Firms invest in new machinery, computers, R&D, office buildings and plants, as well as in inventories to be sold at a future date. Most investment goods enable future production. If effective, investments increase the capital stock and thus the productive capacity of the economy.

The optimal capital stock and thus the optimal investment rate depends on the (relative) costs and returns of capital. The main components of the user cost of capital are the real interest rate and the depreciation rate. First, a firm foregoes interest when it decides to invest rather than to save, or it has to pay interest on its loans.

Second, the value of a firm's capital stock decreases with age and usage. The capital stock only increases over time when investment exceeds the depreciation rate. The return on investment depends on the marginal productivity of capital. In other words, when a production process becomes more productive, a firm benefits more with the same capital stock. Firm may influence this productivity by investing in R&D or by purchasing new or improved production technologies.

In the short run, investment is strongly pro-cyclical. It is volatile and key to business cycle fluctuations as it makes up about 20% of gdp. During a downturn, such as the current crisis, an increase in investment signals better times. Firms seize the opportunity to benefit from future demand and the prospect of increased future profits. Financial constraints might hamper this increased level of investment, when firms are unable to lend the required funds. In this way, credit markets can amplify real and monetary shocks.[1] Empirical research shows that the expected level of output and profits, uncertainty and the interest rate are key determinants of investment.[2] Surprisingly, both the cost of investment products and the availability of external funds have a relatively small effect on the level of investment.

2.2 Decomposing total investment

This section sets the scene by describing investment developments between 1995 and 2013. It first elaborates on total investment, then focussing on a sectoral decomposition (housing, private non-residential and public non-residential). Each subsection distinguishes between pre-, during and post-crisis developments and covers average developments in the OECD, the US, the EU15 or EU28 and Japan. We also include a discussion of the developments at the country level.

2.2.1 Total investment in the OECD

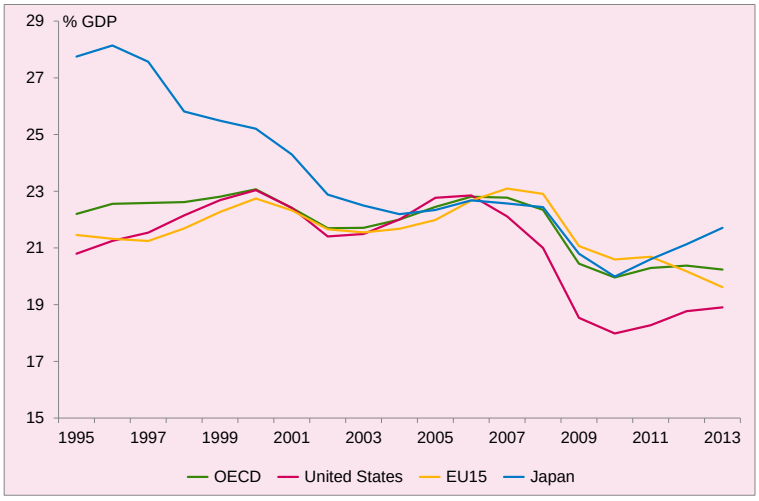
Since 2008, total investment as percentage of GDP has contracted sharply in many OECD countries. Firms had to deal with falling demand for their goods and services and credit became tight amidst the financial crisis. During the height of the crisis, the financial and construction sector were hit the hardest. In most European countries a second crisis, the sovereign debt crisis emerged, deepening the crisis in the EU even further.

The OECD average investment rate fell by more than 2 percentage points to one of its lowest values since World War II, see figure 2.1. For the EU, this decline was about 2.5 percentage points. As stated earlier, investment is pro-cyclical: before the crisis, investment fluctuated only moderately, while the decrease during the crisis was substantial. The investment rate is now about 1 percentage point lower than in earlier downturns, e.g. at the beginning of 2000 or in the mid '90s.

[1] This amplification mechanism is called the financial accelerator.
[2] Banjeree et al. (2015)

Figure 2.1 shows the investment rate for the US, Japan, EU15 and the OECD average, in current prices.[3] All figures presented concern gross investment. For more information on country differences in net investment, we refer to OECD (2010).[4] The textbox "real and nominal investment rates are more or less equal" motivates why we omit a distinction between nominal and real investment.

Figure 2.1 The global financial crisis had significant impact on the nominal investment rate.[5]



Investment rate in current prices.OECD countries are weighted using GDP at PPP rates.
Source: OECD, Economic Outlook 96 database and own calculations.

At the country level, the investment patterns are more diverse, although many countries saw their investment patterns change due to the crisis. In 2008, investment in the southern European countries experienced one of the severest blows in history, see figure 2.2. Their investment volumes fell by 40 to 50 percent, whereas the investment volume of the OECD contracted by only 5.5 percent. The US and The Netherlands also experienced a steep decline in their investment levels. The investment rate in the US dropped by slightly more than 3 percentage points which corresponds to a decrease in volume of 6.5% of total investment in 2007. Not all countries saw a decline in their investment volumes. E.g. in Australia and Canada total investment maintained their upward trend partly driven by a relatively small dependence on investment in housing and a large share of investment in the resources sector. The investment levels in Chili, Israel, Poland and Turkey also increased. Figure 2.2 shows the changes in investment levels for all OECD countries as percentage change of their 2007 value.

[3] For a brief discussion on differences between investment rates in current and constant prices we refer to the textbox "real and nominal investment rates are more or less equal".
[4] Net investment corrects gross investment for wear and tear of the capital stock. As such it provides an informative picture of the changes in the value of the productive capital stock.
[5] EU15 consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Figure 2.2 Between 2008 and 2013 investment contracted sharply in almost all OECD countries.

Change in investment levels between 2008 and 2013 as percentage of total investment in 2007.
Source: OECD, Economic Outlook 96 database.

2.2.2 An industry decomposition of investment

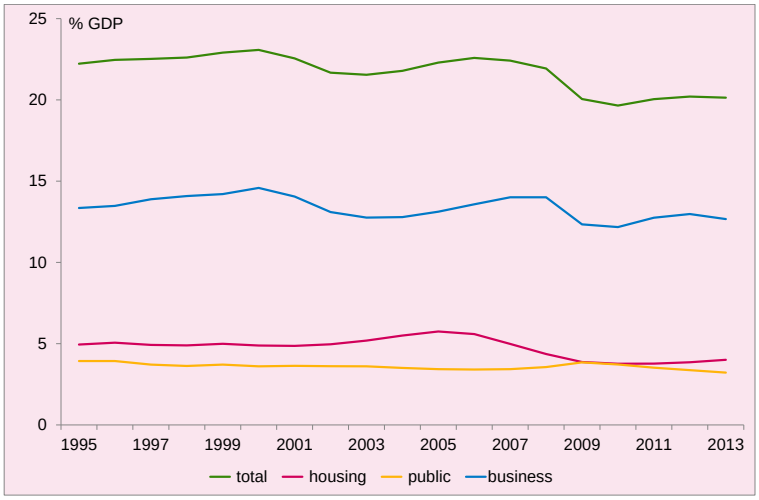
Business investment and investment in housing are responsible for the large drop in the OECD average investment rate, see figure 2.3. Business investment and investment in housing together accounted for 80 percent of the drop in total investment over the crisis, both individually accounting for 40 percent of this decline see Table 2.1. Public investment accounted for about 20% of the drop in the total investment rate.

Investment declined as aggregate demand imploded. Firms became reluctant to invest given their lower expectations of future returns. In many countries, a housing bubble burst. Investment in the housing market fell rapidly as firms lost part of their former interest in this sector. In addition, assets prices fell leading to significant debt overhang. Firms saw their level of debt soar, although in various ways depending on the country, which in turn was partly due to differences in national institutions.[6] The financial position of firms weakened substantially, further hurting investment. Ireland and Spain stood out. But not only southern European countries were hit, net assets declined in e.g. Sweden and Norway as well.

At the beginning of the crisis public investment as a percentage of GDP did not decline. Government spending increased in an attempt to stimulate the economy resulting in an increase in public investment. In later years, governments lowered their investments in order to meet consolidation targets. Figure 2.3 shows the average investment rate of 18 OECD countries in housing, business, public and total investment between 1995 and 2013.

[6] Gelauff et al. (2014)

Figure 2.3 Within the OECD18 both business investment and investment in housing were responsible for the drop in total investment[7]



Based on data for 18 OECD countries for which all components of investment are available.
Source: OECD, National Accounts at a Glance and own calculations.

Table 2.1 disentangles total investment by sector (housing, public and business) for OECD18, EU28, US and Japan. We distinguish average investment rates over four time periods pre-crisis (1995-2007), crisis (2008-2010), after crisis/second dip (2011-2013) and 2013. The final column gives the difference between the pre-crisis average investment rate and the investment rate in 2013. For instance, the average investment rate in the US declined from 22.0 percent before the crisis to 18.9 percent, its difference being 3.1 percentage points. These time periods are chosen to be able to compare pre-crisis averages to the current level of investment (2013).[8] The global financial crisis is cut in two. The first period (2008-2010) covers the global financial crisis, the second period (2011-2013) covers either the first signs of recovery (e.g. US) or a further deepening as a result of the euro crisis.

Moreover, table 2.1 illustrates that the declines in business investment and housing are mainly responsible for the drop in total investment. In all regions, the investment rate declined, although the investment rate in Europe dropped more slowly, possibly due to the better initial financial positions of its firms. As for the OECD, housing and business investment make up an equal amount of the drop in total investment within Europe. In the US, it is the drop in investment in housing that stands out. Public investment as a percentage of gdp increased in the first crisis period in the OECD. This is partly a denominator effect (gdp fell more). Only in the case of Japan did public investment contribute substantially to the drop in the total investment rate.

[7] OECD18 consists of Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Portugal, Slovakia, Slovenia, Sweden, Switzerland and the United States
[8] Data is available from 1995 onwards.

Table 2.1 Average investment per industry (total, housing, public and business) as percentage of gdp per country group and over different time periods.[9]

	Pre-crisis average (1995-2007)	Crisis average (2008-2010)	After crisis average (2011-2013)	2013	Post- and pre-crisis difference
OECD investment rate total (a)	22.5	20.9	20.3	20.2	-2.3
OECD18 total (b)	22.4	20.5	20.1	20.1	-2.3
OECD18 housing	5.1	4.0	3.9	4.0	-1.1
OECD18 public	3.6	3.7	3.4	3.2	-0.4
OECD18 business	13.6	12.8	12.8	12.7	-0.9
EU28 total (c)	22.0	21.6	20.1	19.5	-2.4
EU28 housing	6.2	5.9	5.3	5.1	-1.1
EU28 public	3.1	3.4	2.9	2.8	-0.3
EU28 business	12.7	12.2	12.0	11.7	-1.0
US total	22.0	19.2	18.7	18.9	-3.1
US housing	5.1	2.9	2.8	3.1	-2.0
US public	3.7	4.1	3.6	3.3	-0.4
US business	13.2	12.1	12.3	12.5	-0.8
Japan total	24.6	21.1	21.1	21.7	-2.8
Japan housing	4.2	3.0	3.1	3.3	-0.9
Japan public	4.8	3.2	3.3	3.5	-1.3
Japan business	15.6	14.8	14.8	14.9	-0.7

(a) OECD countries are weighted by GDP using PPP rates.
(b) OECD18 is based on data for 18 OECD countries for which all components of investment are available.
(c) The pre-crisis period of the EU28 is 2002-2007
Source: OECD, National Accounts at a Glance and own calculations.

2.2.3 An industry decomposition of investment at the country level

At the country level the aforementioned picture of the substantial contribution of investment in housing and business investment to the decline in total investment, and the relatively small contribution to the decline made by public investment is apparent in figures 2.4 to figure 2.6. For most countries, investment in housing contracted, declining by a staggering 80% of its 2007 level in the case of Greece. The decline in non-residential investment was less dramatic, but was still exceptionally large, fall by up to 40% for some countries. During the crisis, public investment exhibited various patterns depending on the country. The changes in public investment by country were generally more modest, sometimes negative or even positive over the full period. Within the EU for instance, some countries increased their government spending substantially in an attempt to rescue their national banks or stimulate their economy. Others were forced to cut their expenditures due to their substantial debt

[9] The EU28 consists of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom.

levels. After the second dip, governments that stimulated their economy at the beginning of the crisis, had to consolidate to meet EU fiscal policy targets. The net effect for the OECD18 average public investment rate therefore only showed a slight decline between 2008 and 2013.

Figures 2.4 to figure 2.6 provide the percentage change in investment volumes between 2008 and 2013 for all OECD countries as a percentage change of their 2007 investment levels. For some countries the data is missing. Note that these figures show changes in investment levels, whereas table 2.1 focuses on investment rates. In other words, as non-residential investment makes up a larger share of total investment than investment in housing, the more modest percentage decline in non-residential investment yields a share in the reduction of the total investment equal to the share due to the decline in investment in housing.

Figure 2.4 Investment levels in housing declined in almost all OECD countries

Change in investment in housing between 2008 and 2013 as percentage of investment in housing in 2007.
Source: OECD, Economic Outlook 96 database.

2.2.4 A further decomposition of business investment

When we take a closer look at business investment we see that in countries that were hit severely by the crisis almost all sectors lowered their investment levels, see Table 2.2. Table 2.2 depicts the percentage change in investment volume between 2008 and 2013 for total, public and non-residential investment, with non-residential investment further decomposed into financial and non-financial sectors. Additionally, two important industries of the private non-financial industry, manufacturing industry and services, are presented.

Most of the country and industry differences in investment growth are related to differences in production. For instance, total investment in Greece decreased by 62 percent and production decreased by 22 percent. Furthermore, in countries where the non-financial industry was confronted with low demand, and therefore

production (Greece, Italy, Slovania, Finland and Hungary), the investment levels in that industry also decreased substantially. Similar results are more or less visible in the service and industrial sectors as well.

Figure 2.5 Non-residential investment also contributed significantly to the drop of investment levels

Change in non-residential investment between 2008 and 2013 as percentage of non-residential investment in 2007.
Source: OECD, Economic Outlook 96 database.

Figure 2.6 Some countries consolidated, others stimulated. Reductions in public investment are the exception.

Change in public investment between 2008 and 2013 as percentage of public investment in 2008.
Source: OECD, Economic Outlook 96 database.

The global financial crisis hit the manufacturing industry slightly harder than the service industry. Countries differ significantly in which industry is affected the most. We are uncertain whether this result can be attributed to country specific industrial structure. In most countries financial corporations invested less following the crisis, as their financial positions weakened. The weakening of their balance sheets and

subsequent deleveraging targets diminished their investment volumes. Some countries, e.g. Australia and Israel, were able to sustain their former investment levels. The impact of the global financial crisis in these countries was less profound. E.g. Australia benefitted from its industrial structure, which is largely driven by its resource sector.

Countries with considerable declines in their level of investment in housing (Denmark, Greece, Hungary and Slovania) also saw a substantial decrease in investment in the non-financial industry. On the other hand investment in housing in Israel increased notably as did the volume of investment in the non-financial industry.

Still some numbers stand out. For instance, Germany and Austria saw a substantial increase in investment in their financial industries. This is, however, most likely a reaction to the low investment rates in the years before 2008. In both countries investment in the financial industry decreased by roughly 30 percent in volume between 2002 and 2007. The decrease for other industries in Germany and Austria is relatively modest. Both countries recovered relatively quickly from the severe downturn of 2009 and the investment in housing was almost stable. A further analysis of these developments requires substantial knowledge on a country basis and is not contained in this communication report.

Table 2.2 Percentage change in the volume of investment between 2008 and 2012

	Total investment	Public investment	Non-residential business investment			
			Non-financial industry	Manufacturing Industry	Service Industry	Financial Industry
	(1)	(2)	(3)	(3a)	(3b)	(4)
Countries						
Australia	23.0	23.6	25.0	-25.1	15.7	43.0
Austria	-1.5	-2.6	0.4	8.1	-1.2	21.7
Belgium	-1.0	17.5	-4.2	-13.5	1.8	-1.7
Denmark	-19.6	28.6	-21.5	-21.3	-10.0	30.6
Finland	-9.8	6.1	-12.4	-30.1	-4.6	-29.9
Germany	2.5	7.0	-3.7	-0.3	-15.3	59.5
Greece	-62.0	-51.4	-53.8	-20.1	-53.5	-45.9
Hungary	-19.6	-16.1	-10.5	2.0	-2.9	-27.5
Israel	33.6	3.1	29.9	11.0	10.1	-34.0
Italy	-21.2	-17.7	-20.9	-16.6	-27.6	-29.5
Netherlands	-11.0	-6.5	4.1	-4.7	-1.3	-6.6
Norway	1.5	9.1	8.5	-26.8	-17.9	-41.5
Slovak Republic	-9.5	6.7	-17.3	-5.0	-8.2	-7.6
Slovenia	-37.4	-22.7	-38.3	-22.5	9.3	-13.6
United States	-9.1	-4.9	1.9	-4.0	10.6	-12.3

Note: Public investment consists of investment done by the following industries: public administration, defence, compulsory social security, education, human health and social work . It differs slightly from the public sector which is used in the other figures and tables. The service industry consists of professional, scientific, technical, administrative and support service activities.
Source: OECD, National Accounts at a Glance and own calculations

Real and nominal investment rates are more or less equal

The investment rate is the level of investment as a percentage of gdp. It can be measured in nominal or in real terms. The nominal rate is obtained by dividing investment measured in current prices by gdp also measured in current prices. The real rate is calculated by dividing investment measured in prices of a constant base year by gdp measured in prices of a constant base year. Any difference in the evolution of the nominal and real investment rate over time is therefore the result of the difference in the development in the price level of investment relative to the price level of gdp.

In practice these price related deviations are small compared to the dynamics of real investment and gdp. The figure shows the nominal and real investment rate for the OECD. As 1995 is the base year used for calculating the real investment rate, the nominal and real investment rates are equal in that year. In the nearly 20 years that follow, both rates exhibit substantial co-movement, which is driven by changes in real investment and gdp. The slowly growing deviation between the real and nominal rates occurred as the price of domestic production rose at a faster pace than the price of investment. When examined on a country basis, it turns out these differences are to a large extend driven by developments in the largest OECD member state, the US. The observed difference between the real and nominal investment rates for the OECD excluding the US is therefore even smaller.

Real and nominal investment rates for the OECD

OECD countries are weighted using GDP at PPP rates.
Source: OECD, Economic Outlook 96 database and own calculations.

2.3 Different types of investment: human capital and R&D

Let us change views and focus on different types of investment. In particular we concentrate on investment and expenditure stimulating long-term economic growth,

i.e. R&D investment and educational expenditure and analyse whether and in what way the crisis has impacted these investments.[10]

Governments have a particular interest when it comes to these types of investments or expenditures. R&D investment is a key factor to technological change. New technologies can boost productivity and raise income. Human capital expenditure directly influences productivity. R&D investment and educational expenditure are partly common goods, i.e. non-excludable and non-rivalrous. Both investors as well as others can benefit from newly obtained technology and knowledge. As these gains are unaccounted for by investors, underinvestment might occur from a social welfare point of view. Policy might be needed to stimulate private investment decisions.

Table 2.3 Contributions to growth of output per hour, 1995 to 2007.

	Labour productivity growth	Total Capital Deepening	Contribution of components			
			Tangibles	Intangibles	Labour Composition	Multifactor Productivity
	(1)	(2)	(2a)	(2b)	(3)	(4)
Countries						
Austria	2.4	0.8	0.3	0.5	0.2	1.4
Belgium	1.8	0.7	0.2	0.5	0.1	0.9
Czech Republic	4.2	2.4	1.9	0.5	0.3	1.5
Denmark	1.4	1.2	0.7	0.5	0.2	-0.1
Finland	3.8	0.9	0.2	0.7	0.2	2.6
France	1.9	1.0	0.4	0.6	0.4	0.4
Germany	1.7	1.0	0.7	0.3	0.0	0.7
Ireland	3.8	1.4	0.8	0.6	0.1	2.2
Italy	0.6	0.7	0.5	0.2	0.2	-0.4
Netherlands	2.3	0.9	0.4	0.5	0.4	1.0
Slovenia	5.3	1.7	1.2	0.5	0.7	2.8
Spain	0.8	1.0	0.7	0.3	0.5	-0.6
Sweden	3.7	1.9	1.1	0.8	0.3	1.4
United Kingdom	2.9	1.5	0.8	0.7	0.4	1.1
United States	2.7	1.7	0.8	0.9	0.2	0.8
		Average percentage contribution of components				
EU countries		47.0	27.1	19.9	11.0	42.0
United States		64.5	30.8	33.7	6.0	29.5

Note: Figures in column (1) are annual percent changes and figures in columns (2) through (6) are percentage points.
Source: Corrado et al. (2012)

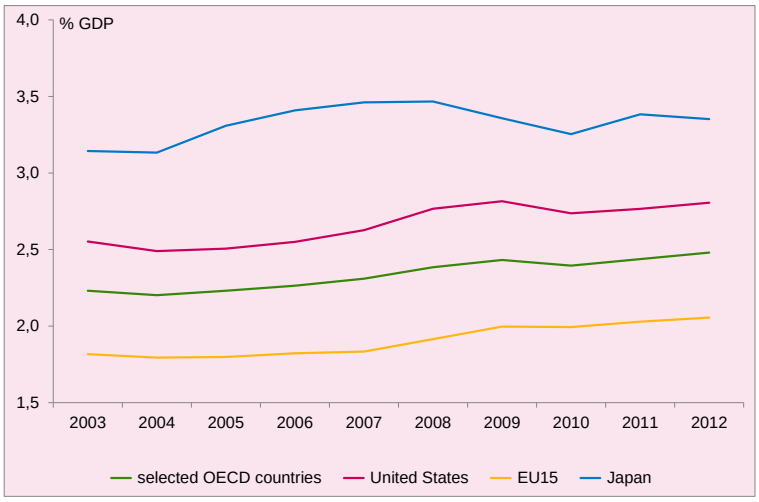
The role of R&D investment and human capital expenditure in labour productivity growth is substantial. For instance, Corrado et al. (2012) showed that, before the crisis, intangible investments, such as R&D investment, accounted for about 25% of total labour productivity growth, see table 2.3. Overall, investment contributes to labour productivity growth by means of capital deepening, which is estimated to be

[10] Educational expenditures are in National Account terms not referred to as investments. As far as it concerns individual investments it is attributed to private consumption.

around 47% of the average annual growth rate for EU15. For the US, this estimate is about 65%. Capital deepening or capital intensity refers to the amount of capital stock per hour worked. As capital per hour worked increases, more output can be produced. In other words, labour productivity increases with rising investment.

Table 2.3 depicts the estimates of a growth accounting exercise by Corrado et al. (2012) on pre-crisis data, viz. 1995 to 2007. The table should be read as follows. Austria experienced an average annual labour productivity growth rate of 2.4%. This growth rate consisted for one third of capital deepening made up by investment in tangibles and intangibles (columns (2a) and (2b)), i.e. 0.8 percentage points (0.3 percentages points to investment in tangibles and 0.5 percentage points to investment in intangibles). Changes in labour composition accounted for 0.2 percentage points and multifactor productivity for 1.4 percentage points of its annual labour productivity growth rate. The bottom two rows show the average percentage contributions of capital deepening, labour composition and multifactor productivity to the average annual growth rates of the EU and the US. The labour composition effect reflects the following mechanism: when more people work, there is more growth. Multifactor productivity accounts for the unexplained part of labour productivity, mostly referred to as the state of technology.

Figure 2.7 Gross R&D expenditures as a percentage of gdp have increased even during the crisis.

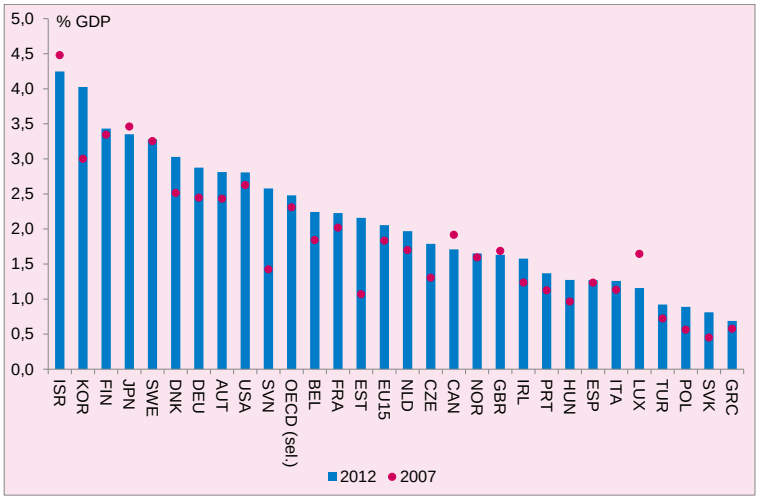


Selected OECD countries is based on data for countries for which data is available. Source: OECD, Research and development database and own calculations.

R&D investment as percentage of gdp increased during the crisis not only due to a denominator effect. The absolute R&D level of many OECD countries also increased, and in other countries declined less than production. On the other hand, R&D was favoured over general investment in physical capital, which fell even further below gdp. The average OECD R&D investment as a percentage of gdp rose from 2.2 percent

in 2003 to 2.5 percent in 2013, see figure 2.7.[11] Only Israel, Canada, Japan and Luxembourg saw a decline in their R&D expenditure as a percentage of gdp. Figure 2.7 shows gross R&D expenditure from 2003 to 2012 as a percentage of gdp for a selection of OECD countries, EU15, the US and Japan. Figure 2.8 contains a further split depicting each OECD country separately.

Figure 2.8 **Between 2007 (red dots) and 2012 (blue bars) gross R&D expenditures as a percentage of gdp rose for almost all OECD countries.**



Selected OECD countries is based on data for countries for which data is available.
Source: OECD, Research and development database and own calculations.

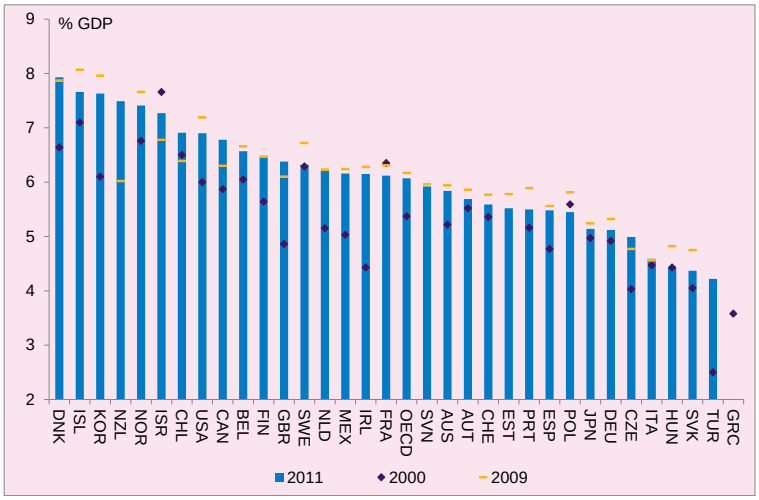
Apparently, firms preferred investments with a long-term perspective for which several explanations might hold. First, the crisis did not seem to lead to more myopic behaviour among firms. Instead, firms held off investment in equipment to cut expenses in the short term. For instance, firms who normally would have aimed for replacement of their current machinery decided to keep their old machinery. Maintenance budgets increased but not by as much as the expenses associated with renewal. In addition, innovation might have been just a matter of survival of the fittest keeping an eye on future growth perspectives. Second, physical capital was used less intensively during the crisis given low demand reducing the need for renewal due to depreciation. Third, at the beginning of the crisis some governments stimulated R&D-expenditure as a means of accelerating the economic recovery.

The crisis had an impact on expenditure on education as well. For most countries expenditure on education as a percentage of gdp accelerated up to 2009, see figure 2.9. After the second dip, expenditure on education as a percentage of gdp declined in many OECD countries. Countries had difficulties maintaining their educational budgets due to consolidation pressures. In half of the OECD countries teachers'

[11] This average concerns a selection of OECD countries given data limitations. Individual countries within this selection are given in Figure 2.8.

salaries were frozen.[12] Only the UK and Chili could sustain an increase in their investment rate. Note that in this case, a denominator effect is also apparent. Figure 2.9 shows the expenditure on education to gdp ratio in the years 2000, 2005, 2009 and 2011 for all OECD countries.

Figure 2.9 Expenditure on education as a percentage of gdp (current prices) declined after the second dip (2010) in many OECD countries

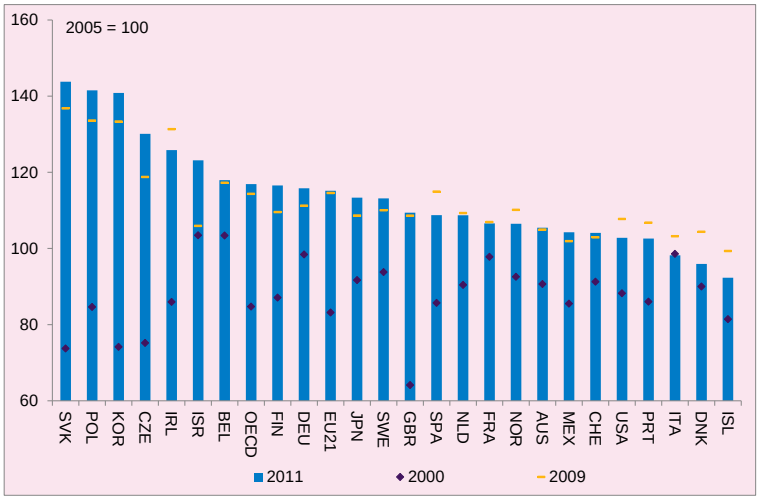


Source: OECD, Education at a Glance 2014 and own calculations.

However expenditure on education decreased in nominal terms (current prices) in almost all OECD countries, while the real expenditure on education per student did not diminish in most. Figure 2.10 shows that in almost all countries, the expenditure on education per student were increasing before the crisis. This trend became more modest during the crisis or even came to a halt. Some countries, mainly Southern European countries, experienced a decline in expenditure on education per student. Also here, consolidation pressures took their toll.

[12] OECD, The future of Science, Technology and innovation policies, 2013.

Figure 2.10 Volume expenditures on education per student show a more divers pattern.



Source: OECD, Education at a Glance 2014 and own calculations.

3 Looking ahead: future investment

The recent large decline in investment has been exceptional. Chapter 2 showed that investment contracted sharply in almost all OECD countries during the crisis. This large decline could mainly be attributed to declines in investment in housing and private non-residential investment and to a smaller extent to public investment. Currently, production has started to recover. Gdp is about 4.4% above its pre-crisis level (2007). Investment volume, on the other hand, is still 5.5% short of its pre-crisis level. As a result, the investment rate is still declining, though moderately.

Taking these historical developments as a starting point, this chapter looks ahead to future investment developments. Can investment recover and return to pre-crisis levels? Which economic factors and risks might affect the speed of adjustment? Section 3.1 discusses these factors and risks. Section 3.2 then addresses the question of whether investment levels can recover to pre-crisis levels.

3.1 Factors affecting the speed of recovery

The sluggish recovery of investment levels and investment rates can be attributed to several factors. We subsequently discuss prevailing risks, post crisis slump, the slowly adjusting housing market, financial constraints and the effects of uncertainty. We refer to Banjeree et al. (2015), Gelauff et al. (2014), IMF (2015) and Lewis et al. (2014) for more background material.

3.1.1 Prevailing risks and structural damage to gdp levels

A first explanation for the sluggish recovery of investment are several legacies of the crisis, e.g.. the large debt overhang of households, firms and governments, low inflation and close to zero lower bound interest rates. For a further discussion, we refer to Gelauff et al. (2014). A large debt overhang weakens the financial positions of firms making them more reliant on external funding for investment projects. Low inflation and low interest rates point at a relatively slow reduction of the debt to gdp ratio hampering a quick recovery as well. Finally, structural reforms might benefit labour and product markets, stimulating the economy and thus investment.

A second explanation might be that the investment gap is not as large as would be expected from pre-crisis investment levels. A financial crisis most likely induces a permanent gdp loss. As total production declines, the associated capital stock reduces as well. With this new lowered capital stock, fewer investments are necessary to recover from the losses endured. A smaller catch up in investment levels will suffice. For a discussion on structural damages endured by a financial crisis we refer to Cerra and Saxena (2008) and Smid et al. (2014). They showed that GDP will suffer a reduction in its level of about 6 percent and GDP growth will recover most likely.

3.1.2 The recovery of investment in housing

The sluggish recovery of investment might also be subject to the large component of housing investment in the decline of total investment. The cycle in the housing sector is far more stretched than these of business investment. Its range is estimated between three to 11 years for booms, while busts range from 3 to 15 years.[13] Which is far more than the average booms and busts in business investment, which is about 2 to 4 years.

Housing investments are known for their long adjustments periods after a shock.[14] In the short run, a shock in demand is almost fully absorbed by price adjustments. Even more so in case of a downward shock, as the existing housing stock can only slowly decline through depreciation. It is shown that actual market prices can persistently and substantially deviate from their fundamental values. Eventually, price changes do affect construction and a new market equilibrium will be reached. These flows are small compared to stock levels, it can take many years before a new long-term equilibrium is reached.

When it comes to the housing market, the global financial crisis is different from other recessions. Households and firms had obtained large debt levels, which, due to declining house prices, no longer resembled the values of their homes. If possible, movements were postponed, even further reducing house prices, by the additional cut in demand. In addition, financial corporations and banks tighten their loan conditions further hampering residential investments.

The aforementioned key factors describing historical development, manifest themselves as the three key uncertainties to recovery of the housing markets, i.e., weakened financial positions of firms, changed availability of mortgage lending and reduced consumer confidence. We shortly elaborate on all of these uncertainties. In addition, it might take some time before confidence in the housing market is restored. This sentiment is crucial in recovery of the housing market.

A further recovery of macroeconomic conditions and global financial stability would be helpful, both in reducing the aforementioned uncertainties. Increasing house prices and high inflation will benefit the housing market, as the value of the collateral increases and the real value of debt decreases.

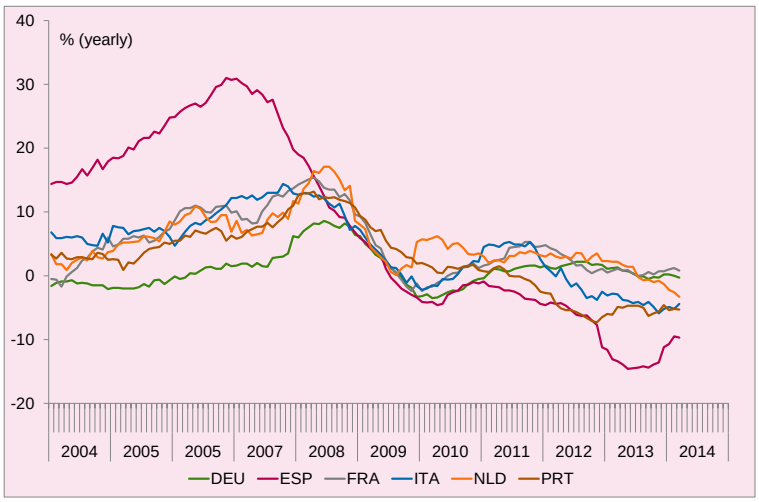
3.1.3 Financial constraints

Bank lending has declined, either as a result of limited investment demand or due to financial constraints. Either, firms expect the demand for their products to decrease, so they cut down on their production. Or, given (perceived) increased risks, banks are more reluctant to supply credit and tighten their credit conditions. Figure 3.1 shows

[13] Van Dijk et al. In Gelauff et al. (2014)
[14] Van Dijk et al. in Gelauff et al. (2014)

that growth in bank lending to firms has decreased significantly since the beginning of the global financial crisis. Both channels are relevant.

Figure 3.1 Growth in bank lending to firms



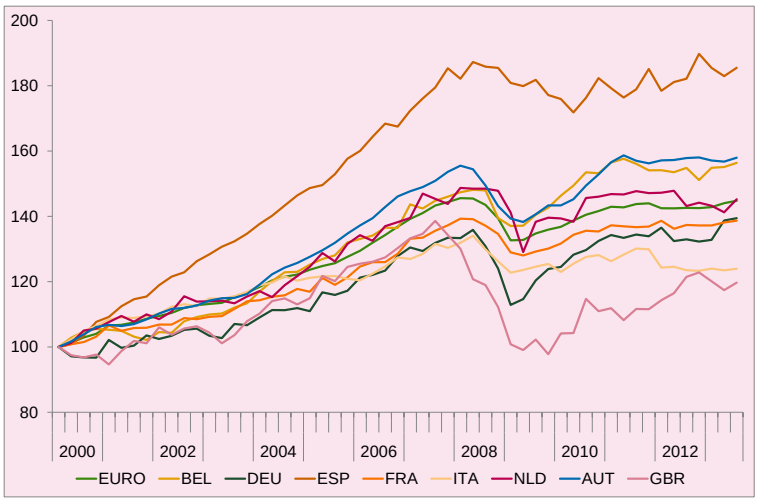
Source: ECB, Gelauff et al. (2014)

Bijlsma et al (2013) showed that credit supply did contract in the OECD in 2008 and 2009 for manufacturing industries. Given that a credit supply shock should increase the spread between the external and internal cost of financing. And, a relatively higher cost of financing should imply a slower growth for financially dependent firms, they tested whether financially dependent firms indeed experienced a period of slower growth during the crisis. Their findings indicate that manufacturing industries with higher short-term liquidity needs experienced a lower growth in countries with deeper financial markets. In case of long-term external finance, industries were impacted more severely by the crisis in countries where the banking system is more leveraged.

IMF (2015) also found evidence for impaired credit supply leading to a fall in investment rates. Financially dependent sectors saw a fall in their investment rate about 1.6 percentage points larger than that of less financially dependent sectors. In more recent years, the difference between the two groups has declined, turning insignificant after the second dip. Both Bijlsma et al (2013) and IMF (2015) adopted the method of Dell-Ariccia et al. (2008), just differing in sample period and the dependent variable being either growth in firm production or investment.

Bank lending diminished by reduced credit demand as well. Firms saw demand decline and in anticipation reduced their investments resulting in less bank lending. The financial positions of (large) firms were not that weakened that many would be constrained by lack of access to credit as suggested by IMF (2015) and Bijlsma et al (2013). Figure 3.2 supports this argument depicting one measure of firms' financial health, namely total profits. This picture shows that profits as expected fell sharply in 2008. Thereafter, the euro area recovered to a similar level as before the crisis.

Figure 3.2 Gross operating surplus for selected countries



Source: Gelauff et al. (2014)

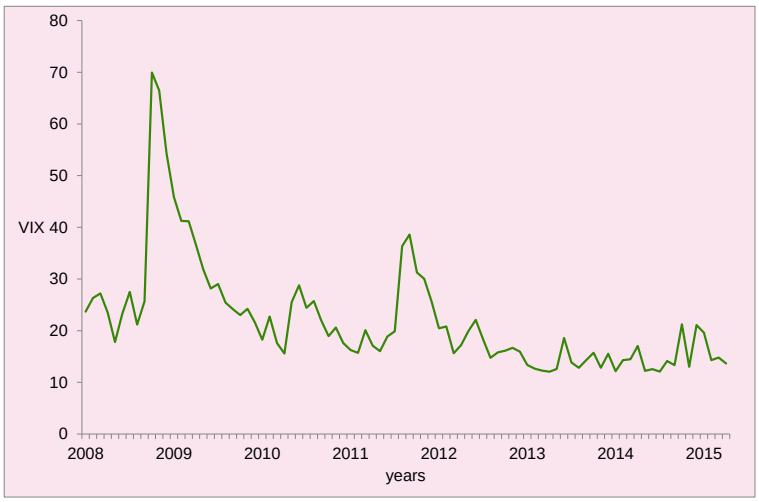
In contrast, SMEs experienced a tightening of credit conditions even with recovering profits. OECD(2015) reported that SMEs in the 2007 tot 2010 period, faced more severe credit conditions than large enterprises, in the form of higher interest rates, shortened maturities and increased requests for collateral. Between 2007 and 2013, the interest rate spread between large firms and SMEs widened considerably with the exception of Belgium, Canada, Colombia, Korea, Serbia, Sweden and the United States. Banjeree et al. (2015) also pointed at tightening bank lending for SMEs as credit conditions for these firms tightened. They argue that external funding is cheaper for firms with direct access to capital markets than for firms reliant on bank funding. In most economies, the cost of bank credit has declined by less than the cost of capital market funding. This might affect SMEs, most notably in the euro area, which have less direct capital market access.

3.1.4 Uncertainty

The sluggish recovery of investment might also be related to higher perceived uncertainty. When uncertainty increases, firms become more reluctant to invest. They rather "wait and see" than join in an uncertain action and therefore postpone investment. They become more cautious because of the increased option value of waiting. As Bloom et al. (2007) showed these uncertainty effects can be substantial. Higher uncertainty reduces the responsiveness of investment to demand shocks. For instance, a shock moving from the lower quartile to the upper quartile of the uncertainty distribution can halve the first year response to a demand shock. Figure 3.3 depicts the stock market volatility index (VIX) applied in the analysis of Bloom as measure of perceived uncertainty. During the crisis, the VIX increased significantly from about 20 in 2007 up to 90 at its peak value during the crisis. After the second dip an upswing is apparent however less pronounced as the 2009 peak corresponding with the fall of Lehman Brothers which preluded the financial crisis.

By now, uncertainty has stabilized around a low 15 and has a minor role in investment developments.

Figure 3.3 VIX index monthly basis, 2008 until 2014.



Policy uncertainty can also inflict investment. IMF (2015) investigated the evolution of investment given increased policy uncertainty. They investigated whether investment in sectors that are more sensitive to policy uncertainty is lower during times of elevated economy wide uncertainty as measured by the stock market index. The premise is that if the policy uncertainty channel is important in suppressing investment, this should be reflected in a relatively worse performance, during times of high economy wide uncertainty, for those sectors more sensitive to uncertainty compared with those sectors that are less sensitive to uncertainty. Indeed, they found that between 2007 and 2011, investment had dropped by about 50 percent, relative to the forecast, in sectors more sensitive to policy uncertainty. This is more than twice as much as in less sensitive sectors. Since 2012, this difference wanes.

3.2 Will investment recover and return to pre-crisis levels?

Before we addressed factors affecting the speed of recovery, now we tend to the question whether investment rates and investment levels will recover to their pre-crisis values or that the recessions has left permanent marks? In other words, is the drop in investment rates and levels induced by business cycle developments or will the crisis impose structural damage?

The strong downward trend in the investment rate is not exceptional given historical co movement of business investment and output. Indeed the contraction of investment has been more severe than in other historical recessions. However, the contraction of output has been more severe as well. IMF (2015) find on a sample of

27 advanced economies, that the relative response of investment in a business cycle is about two to three times greater than that of output. A shock is thus amplified in investment and aligns the movement in output with that of investment. This elasticity coincides with earlier estimations, by e.g. Lewis et al. (2014). They found an elasticity of business investment to production of 1.7. With a more novel approach, IMF (2105) confirms this results and derives that a 1 percent decline in output is associated with a 2.4 percent decline in investment. They estimate the historical relation between business investment and output based on macroeconomic fluctuations not correlated with business cycle developments, in this case fiscal policy changes.

These studies suggest that the changes in investment levels are no more than business cycle fluctuations and just reflect the severity of the global financial crisis. In that case the investment rate can recover to its pre-crisis optimal value. The optimal investment level will be lower though, as gdp levels are expected to suffer structural damage, as described in section 3.1.

It is unclear whether pre-crisis housing investment rates will be met in the near future. Besides the well-known sluggish recovery, 2008 preluded the burst of a housing bubble, for instance Spain and Portugal have known both large demand and large supply. As it is difficult to assess which part of the pre-crisis housing investment rate was connected with inflation of the bubble, we are uncertain at which value this rate will settle.

A back of the envelope calculation shows that in a worst case scenario, the OECD average housing investment rate will increase over the coming years but will end around 1 percent below its pre-crisis level. We here assumed that in the average annual investment rate between 1995 and 2001 no housing bubble was apparent. The housing investment rate for the OECD 18 was then about 4.9 percent. The current housing investment rate (2013) amounts to 4.0 percent. Note that the country differences behind these rates are substantial. E.g. in Germany the investment level saw a moderate decline and even a raise in investment volume of 10% compared to its 2008 level. In other countries, like Spain, investment fell over 50% at the bursting of their housing bubble.

4 The role of policy in stimulating long term investment

In this section we take a different angle towards investment. We address to what extent and in which form a government has a role in stimulating investment, in particular those investments which increase long term growth perspectives. We abstract from the effects of the global financial crisis and policies to speed up

recovery and/or relieve incurred damages. Devising policies in the aftermath of the global financial crisis is beyond the scope of this communication report. It requires a clear diagnosis of current economic weaknesses and strengths on which the current (scientific) debate is still open. A forthcoming study by Kool and Lukkezen (2015) will further elaborate on policy measures in times of stagnant growth.

4.1 Market failures

Market failures are the main motive for policies enhancing long term growth.[15] In case of investment, market failures comprise market power, externalities including knowledge spillovers and business stealing effects, capital market failures (credit constraints), information asymmetries or coordination failures. A government has three main types of policy at hand: it can improve market conditions, provide financial support or increase public investment. Note that policy measures can induce negative effects (government failure) as well. For instance, additional public investment has to be financed yielding an excess burden. In addition, government failures may outweigh the benefits of resolving market failures.

Below we briefly discuss these market failures and appropriate policy measures.

Market power can yield considerable insider outsider problems. New investors have difficulties entering the market and insiders have smaller incentives to invest as competition is relatively absent. Depending on industry characteristics, a government may respond by market regulation or other competition promoting policies.

Knowledge spillovers exist when firms can benefit from knowledge creation conducted by and paid for by others. Innovative firms do not include these positive gains into account, resulting in too low investment. Business stealing effects comprise the destruction of part of the capital stock or current technologies by new and improved products or processes. These effects may counteract knowledge spillovers. A government has several tools, like subsidizing investment or facilitating the implementation of appropriate intellectual property rights.

Information asymmetry and/or coordination failure imply that some market players have access to better information in making investment decisions than others. Negative selection or moral hazard result. For instance, these problems occur when a bank has to decide whether or not to finance a private investor. The investor is better equipped for risk assessment. The bank however might be reluctant to invest when uncertain about future returns. Consequently, credit constraints might exists for

[15] Equity is another motive but less relevant in this case.

potentially successful investment projects. A government can decide to serve as lender herself, provide banking guarantees, subsidise financing corporations etc.

When market failures exist, it is not readily clear that a government should step in. Three conditions should be fulfilled. First, the market failure is persistent and markets are unable to resolve these issues themselves. Second, the social benefits should exceed the social costs. Third, the policy instrument should be effective.

Macroeconomic conditions are conducive to investment in physical capital. Fiscal or monetary policy can affect these conditions. Private investment benefits from well-developed financial markets as well. Other macro-related policies are public investments in e.g. education or infrastructure. Investment in human capital or infrastructure might yield substantial returns as it likely generates positive spillovers. Again, it is crucial that these investments are effective and come with a positive cost benefit analysis.

4.2 Public and private investment: crowding in or out?

An often heard argument in favour of public investment, like the aforementioned infrastructural investment, is that it can induce more private investment. For instance, a new road might induce all sort of new activities within a region or reduce transportation costs. As said public investment can be complementary to private investment e.g. in the case of infrastructural investments. On the other hand, public investment requires financing, which might reduce the amount of savings available for private investment. Second the tax burden on the business sector might increase.

Evidence on the macro level is undecided. Afonso and Aubyn (2009) and Voss (2002) describe attempts in estimating these effects.[16] Their results turn out statistically insignificant, although they divide countries in net crowding in or crowding out of public investment. Country differences can be explained by differences in the type of investment, the amount of public investment and its funding. Cavallo and Duade (2008) derive a simple model of business and public investment. They show that when public and business investment are more complementary, e.g. for instance in case of investment in infrastructure, the degree of crowding out will diminish. IMF (2014) and Abiad et al. (2015) points at crowding in in times of crises. When access to capital is relatively easy, crowding out is less of a problem. The same holds when capital costs are low.

[16] We replicated the analysis by Afonso and Aubyn on a more recent data sample including crisis years. Like Afonso and Aubyn our results turned out statistically insignificant.

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