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An Examination of the Effects of an Investment Stimulus

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Executive summary¹

An investment stimulus is regularly proposed as a response to the recent dramatic fall in domestic demand in the Irish economy. In contrast, critics of an investment stimulus cite the high import share in the Irish economy as a reason for why the benefits of a stimulus would leak from the Irish economy.

Using the HERMIN model, which was originally developed to measure the effects of European Cohesion Funds, this paper examines what effect an investment stimulus would have on employment, GDP, and net exports. The research finds that an investment stimulus of €1bn for one year would create approximately 16,750 short term jobs and between 675 and 850 long term sustainable jobs. The GDP multiplier in the first year of a stimulus is 1.6. Crowding out effects are reduced due to the high level of unemployment and the direct effects of an investment stimulus are increased by the fall in construction prices. Though imports rise during the construction phase of a stimulus, this is short lived, and there is a long term increase in exports due to enhanced productivity and competitiveness. Due to greater tax revenues resulting from higher GDP, the up-front net cost of a €1bn investment is €575 million. This is found to be self-financing, as the long term increase in tax revenue more than offsets the interest payments on the initial capital outlay.

The paper compares these findings to other previously published research. The findings are consistent with previous research, in showing a positive effect of government investment on the Irish economy.

¹ We wish to thank John Bradley for facilitating access to the HERMIN model. Any errors or omissions are the sole responsibility of the author.

Introduction

Ireland has suffered large falls in domestic demand and employment in recent years. The construction sector stands out as being hardest hit, with employment in building and construction having fallen by approximately 60 per cent from its peak (Central Statistics Office, 2012). While construction employment was above its sustainable level during the boom, it can be argued that it has now undershot a long term sustainable level of employment. At the same time, staff from the IMF have given Ireland's infrastructure a 'red light' (Allard and Everaert, 2010) and Forfás (2012) has indicated infrastructural deficits in areas such as energy infrastructure, fibre optic cable (for use in broadband), and environmentally sustainable transport; amongst others. An investment stimulus is put forward as a way to deal with these issues.

However, an investment stimulus is not without its critics. There are three main strands of criticism of an investment stimulus. The first is not a criticism of a stimulus per se, but of its feasibility, namely how would it be financed. This problem is dealt with in a forthcoming paper to be published by NERI (Collins et al., 2012). It is also worth recognising that if an investment stimulus is found to be beneficial, such evidence can be used to convince the Troika to permit borrowing to finance it. The second main criticism is that Ireland has a surplus of capital stock. While this may be true of some areas, such as housing in some rural areas, Forfás (2011) has shown clear infrastructural deficits in other areas. The third main criticism is that, due to the open nature of the Irish economy, the benefits of an investment stimulus would simply leak from the Irish economy. In the Summer 2012 ESRI Quarterly Economic Bulletin it has been stated

"We would be very cautious about a domestic fiscal stimulus in Ireland, however funded, as history and experience shows that such a stimulus would have little effect on the domestic economy, but would lead to a worsening of the balance of payments. The crises of the 1950s and the 1970s-1980s provide sufficient cautionary evidence that, given the openness of the Irish economy, a large portion of any stimulus would go directly into imports" (Duffy, Durkan, and Casey, 2012).

The direct benefits of an investment stimulus are clear. Department of Finance (2010) figures show that for every €1bn of investment in construction between 8,000 and 12,000 jobs are directly created during the construction phase. Data from the European Commission's AMECO database shows similar direct effects. Table 1 shows the number of construction workers employed per €1bn spent on construction investment (in both public and private sector). The number of jobs has increased since the peak of 2007 due to the fall in tender prices.

Table 1 Number of construction jobs per €1bn spend on construction investment

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
10,771	10,106	9,242	8,259	7,673	7,402	7,229	7,756	8,728	10,227	12,265

Source: AMECO and own calculations

However, data also shows that for every €1 spent on construction work, 26.5 cents is spent on imports² (such as fuel for construction machinery, or the import content of other industries which serve construction). It should be noted that in addition to construction work, an investment programme generally requires investment in machinery and equipment, which tends to be imported and so does not create as many jobs in the local economy. These are the direct effects. However, what are the spin-off effects of an investment stimulus? Does the competitiveness enhancing effects of improved infrastructure which leads to increased exports offset the increase in imports due to an increase in demand? These questions are the subject of this paper.

Theory and Literature review

The effects of an investment stimulus can be broken into two main areas. First, there is the short term effect of an increase in demand. This has a ‘multiplier’ effect as increased employment in the construction sector leads to increased spending in the wider economy (and on imports). This is sometimes referred to as the Keynesian effect. Second, there is a long term supply side effect. An increase in the stock of infrastructure increases the productivity and output capacity of the Irish economy. The intuition of Keynesian multiplier effects can be gained by a simple example.

Chart 1 Example of multiplier effects

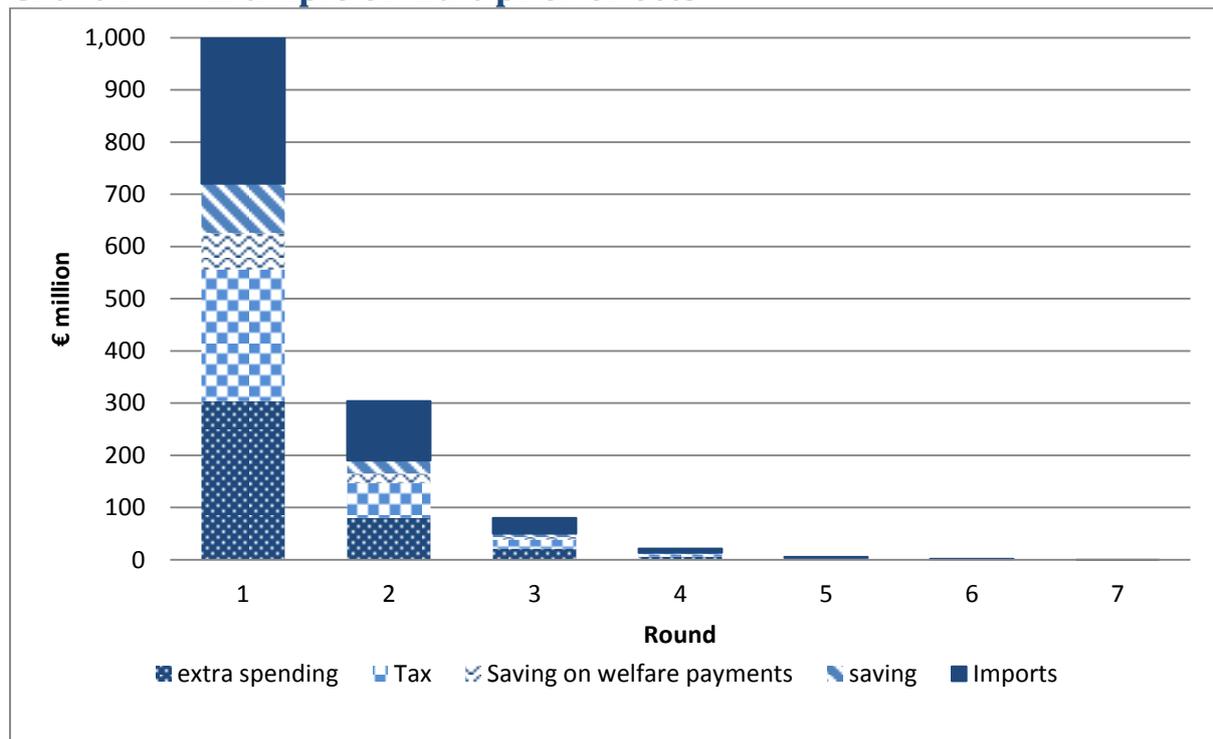


Chart 1 gives a simplified example of a €1bn investment stimulus³. Of the initial €1bn spent, approximately €280m leaks from the economy, with the rest staying in the domestic economy. Of

² This is an average figure. For example improving the gas pipeline network is estimated to use 40% imports (DKM Economic Consultants, 2008). Other projects would be considerably lower, leading to an average import content of 26.5%

³ In this example the import share of construction is estimated to be 28% (based on data from the Input/Output Tables), the import content of domestic demand is assumed to be 37.5% (based on OECD STAN database and national accounts), tax share of GDP is assumed to be 35% (based on Stability Programme

the money that stays in the domestic economy, approximately €300m is spent, while the rest is either saved/used to pay down debt, or returned to the government in the form of taxes or savings on social welfare payments. In the second round, part of the money that is spent goes on imports, and the rest stays in the local economy. This continues until the multiplier effect peters out.

Standard text book economics shows that the Keynesian effects depend on the amount of slack in an economy and the openness of an economy. During a period of low unemployment the multiplier effects are likely to be small. In such a situation the economy does not have the capacity to absorb the increase in demand, leading to higher inflation and a decrease in exports, and a displacement of private sector investment, which serves to reduce the Keynesian effects. This is referred to as 'crowding out'. However, in a period of high unemployment this is less likely to be the case as the economy has the spare capacity to absorb an increase in demand. Also, if an economy is very open, a large amount of the increase in demand will be satisfied by imports, so reducing the effect on the domestic economy.

There are two main approaches to measuring the impact of a fiscal stimulus on an economy. The first approach makes use of structural models of the economy. These models make use of economic theory and are calibrated to real world data, and can show how multipliers differ depending on the state of the economy. The second main approach is to simply use past data to find the average effect during the period for which data is available. Coenen et al., (2012) surveyed seven structural economic models (of the DSGE type) used by central banks and major international institutions (including the European Commission Directorate General for Economic and Financial Affairs' *QUEST* model), and two used by academics. These models imply that a fiscal stimulus is most effective if it lasts for a moderate length of time and if monetary policy is accommodative. This is likely to be the case for Ireland as infrastructure projects are temporary in nature and the ECB is pursuing an accommodative monetary policy (though the effects of monetary policy are distorted by the problems in the Irish banking sector). Coenen et al. (2012) also show that models of this type show positive effects from government investment with the effects of investment boosted by supply side effects and that their findings are broadly in line with those reported in the empirical literature. There are two main caveats in applying this research to Ireland. First is that, as Coenen et al., (2012) point out, the effects in an open economy are weaker, and the simulations were calibrated to the US economy and to the EU. The second main caveat is that the baseline simulations were based on a steady state, rather than the major recession that is currently experienced. As mentioned previously, during a recession the effects of an investment stimulus are likely to be larger. Another major review of international evidence was conducted by Ilzetzki et al. (2011). Their approach differs in looking at the average effects of past investment, in contrast with the more theoretically based approach of Coenen et al. (2012). Ilzetzki et al. (2011) find that in very open economies there is a government investment multiplier of 0.51 on impact and -0.23 in the long run. However, the authors note that measuring the effect of government investment leads to a smaller sample size, and the results are "significantly less accurate". Also, VAR models perform poorly when estimating long term effects than impact effects (due to a lack of available data). Given that the Irish economy may differ from the *average* small open economy, and that the current state of the economy may differ from the

Update), it is assumed 13% of income is saved abroad/used to pay off debt, and that 10,000 jobs are created for every €1bn increase in GDP.

average of previous states; it is necessary to look at studies that specifically measured the effect on the Irish economy.

Studies specific to Ireland

There have been numerous studies of investment multipliers for the Irish economy and these have taken the form of either of the two main methodologies outlined above. When reading such studies one must note the difference between multipliers based on the one-period effect, and cumulative multipliers (which sum the total amount of investment and the total change in GDP over a long term horizon). If one uses one-period multipliers it is difficult to compare a project with a large initial effect which peters out and a project with a smaller initial effect but which is more sustained. Therefore using cumulative multipliers may allow for better comparisons. Unfortunately cumulative multipliers are not always reported in studies (and there are conceptual difficulties as to how to deal with the time value of money).

Estimates based on average past effects typically use some variation of VAR analysis, a technique which relies heavily on past data rather than economic theory. These are reliable only for measuring the short run Keynesian effects, and are less reliable at calculating the longer term supply side effects. Also, the specification of VAR models tend to estimate *average* effects over a time period and ignore the level of unemployment in an economy, which is likely to affect the multiplier.

Pereira and Pinho (2011) investigated the long run effects of investment for twelve countries, including Ireland, using a VAR model and data from 1980 to 2003. As can be seen from Table 2, despite being a small open economy, the long run effects in Ireland have been reasonably large, though as mentioned above such results must be treated with caution.

Table 2 Cumulative multipliers due to Public Investment

	Cumulative Multiplier
Austria	0.277
Belgium	0.192
Finland	1.700
France	3.627
Germany	7.013
Greece	4.307
Ireland	3.727
Italy	8.631
Luxembourg	-0.514
Netherlands	-6.549
Portugal	3.235
Spain	2.096

Source: Pereira and Pinho (2011)

In their research they conclude that in Ireland public investment pays for itself, and leads to an increase in GDP, so reducing public investment is an ineffective way to close the deficit. They also find that a €1million investment (in year 2000 Euros) leads to an accumulated job creation total of 84 jobs, equivalent to 2.8 permanent full time jobs lasting 30 years.

Perhaps the most detailed VAR analysis was conducted by Bénétrix and Lane, in research reported in several papers. This is the most detailed study for the Irish economy, and contains the caveat (as do all VAR analyses) that it represents an average over the time period 1970 to 2006. Government investment has a positive impact on output (with impact multipliers ranging from 0 to 2) in the traded and non-traded sector (though greater in the non-traded sector), though the results are insignificant in some specifications (Bénétrix and Lane, 2009). In a similar paper (Bénétrix and Lane, 2010), an increase in investment shows a beneficial impact to GDP. There is an insignificant effect on exports and a significant increase in imports (which is to be expected as the model analysis measures the short run impact). The range in estimates over the medium term (up to five years) is larger, with both positive and negative effects reported depending on the estimation procedure. This is due to the general inability of VAR models to accurately estimate the long term impacts.

Two macroeconomic models have been used to assess the impact of government investment in Ireland, HERMES and HERMIN. The HERMIN model is explained in greater detail below. Bergin, Conefrey, FitzGerald, and Kearney (2010) use the HERMES model to assess the effects of a *cut* of €1bn in investment in 2009, leading to an impact multiplier of approximately 0.5. Due to fiscal drag, the cut only reduces government borrowing by €689m. However the authors state that as the supply side effects of investment are ignored and ‘the longer-term impact of this cut on output and employment would be substantially greater’. As the model is calibrated with data from the 1970s up to 2005 and 2006, this may explain the comparatively low multiplier. Though the scenario used assumed high unemployment of 13.3 per cent for 2009 (Bergin et al., 2009) the large fall in prices was underestimated.

The HERMIN model

The model that is used in this paper, and which has been used many times to measure the effects of investment in Ireland, is the HERMIN model. Though the models examined in the paper of Coenen et al. (2012) also attempt to model the structure of an economy, there are important differences. As outlined by the European Commission (2009), the HERMIN model is used by the European Commission’s Directorate General for Regional Policy while the QUEST model (as mentioned in Coenen et al. (2012)) is used by the Directorate General for Economic and Financial Affairs. The HERMIN model combines Keynesian short term features with neoclassical longer term features and was originally designed for measuring the impact of EU Cohesion Policy in Ireland. It has since been extended to other countries and regions of the EU (Bradley, Gács, Kangur, and Lubenets, 2005). The HERMIN model does not have the same micro-foundations of the QUEST model as forward-looking expectations and complete optimising behaviour were considered to be overly strong assumptions (European Commission, 2009). Indeed, the micro foundations used in models such as the QUEST model are not without their critics. Differences in models can lead to different results for the effects of investment. For example, the average effect during the implementation phase of the 2000-2006 round of cohesion funding was about 0.2 per cent above baseline according to QUEST, but 0.75 per cent above baseline according to HERMIN. However the post implementation impacts (in 2014) are about 0.6 per cent above baseline for QUEST, and 0.3 per cent for HERMIN (European Commission, 2010). So, with regard to Ireland, HERMIN has estimated larger short term impacts, but smaller long term impacts. An explanation for these differences is given by Bradley and Untiedt (2012). As HERMIN was designed with the Irish economy specifically in mind it can be argued that the

theoretical underpinnings of HERMIN model are more appropriate to measuring the effect of an investment stimulus. An outline of the HERMIN model and its equations can be found in Bradley et al. (1995), and Bradley et al. (2005).

There have been many multipliers produced from the HERMIN model. It must be noted that estimates of an investment multiplier given by HERMIN will change over time as the state of the economy changes. An early example is given in Bradley et al. (1995). A 1 per cent (of baseline GDP) permanent increase in public investment (starting in 1989) leads to some crowding out of the manufacturing sector. An initial GDP multiplier of 1 rises over the long run to 1.3. Bradley et al. (2005) conduct a similar simulation, raising public investment by 1 per cent of nominal GDP in the base year (1989). In the policy unconstrained case (where it is not assumed that an increase in spending must subsequently lead to an increase in taxes), the long run multipliers are in the range of 1.0 to 1.8, with Ireland at the lower end and there is a serious deterioration in the debt/GDP ratio. However, by switching on a policy feedback rule (where an assumption is made that taxes must rise to cover any deficit) one gets an approximately zero balanced budget multiplier for Ireland. In a study of the multiplier effects in the mid-2000s, Bradley (2006) finds Irish public investment impact multipliers are approximately 1.

In assessing the 2000-2006 cohesion programme, the cumulative multiplier, after 20 years, for Ireland was the highest of the countries, at 4.82 (Bradley, Untiedt, and Mitze, 2007). The results are shown in Table 3.

Table 3 Cumulative multipliers from 2000 to 2006 EU Cohesion Programme

	Cumulative Multiplier
Ireland	4.82
Romania	4.60
Czech Republic	4.38
Estonia	3.65
Lithuania	3.36
Latvia	2.78
Slovakia	2.62
Greece	2.47
Poland	2.39
Hungary	2.37
Spain	2.40
Cyprus	2.21
Bulgaria	1.87
Slovenia	1.86
Portugal	1.84

Source: Pereira and Pinho (2011)

Overall there seems to be a difference between the VAR type analyses and structural model type analyses, with VAR analyses giving larger positive effects of investment. This is in contrast with the results seen in other countries, where structural models tend to give a best case estimate if the money is spent effectively, while VAR analysis represents the reality of what has happened (Trón, 2009).

Data sources

Although the HERMIN model is based on theoretical foundations, historical data is used to calibrate the model to the Irish economy. The majority of the data is downloaded from the European Commission's AMECO database of May 2012. Data on spending on research and development and data on export shares are taken from the OECD online database. Data on sectoral branches is taken from the Eurostat database using NACE Rev. 2. As branch level data on workers compensation is not available at the time of writing, it is assumed that the workers share of income is constant for 2011, with the exception of the construction sector. Due to the large changes in construction sector the labour share of income has been unstable. However, data for the first three quarters of 2011 (from the Quarterly National Household Survey) suggests that weekly wages in construction fell by 1.7 per cent in 2011, so this data is used. Also, 2011 data on employment is taken as the seasonally adjusted 2011 figure for the second quarter of 2011. This is as the 2011 data was not available from Eurostat. As some of the data for 2011 is inferred, only data from 1996 to 2010 is used for the calibration. As the HERMIN model is structural in nature omitting the year 2011 does not have a major impact on the results.

Model Simulation

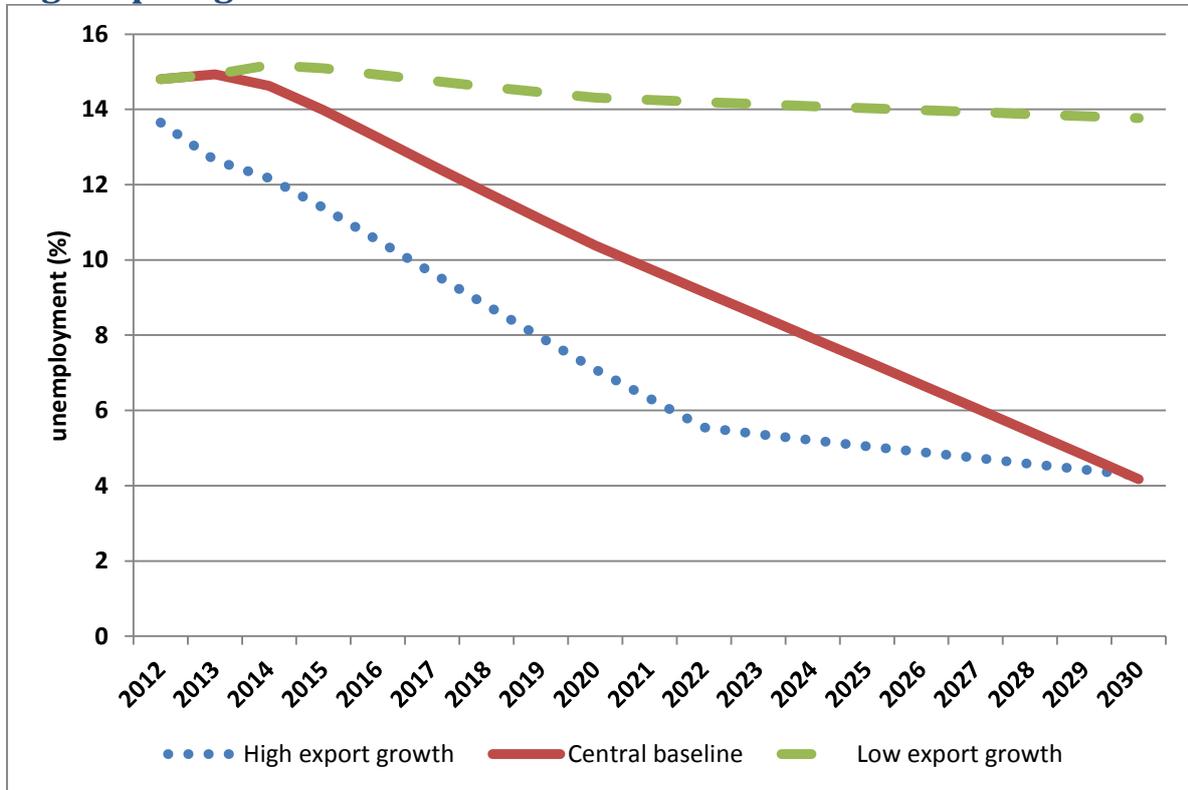
The simulations that follow examine the effect of a €1bn, once-off, increase in public investment in 2013. In total, six simulations were conducted: a 'central' simulation (with *total* imports of our trading partners remaining constant for 2012 and 2013, and growing by 4.5 per cent per annum afterward); simulations with high export growth (with *total* imports of our trading partners growing at 5 per cent per annum from 2012 and 2022, and growing by 3 per cent per annum afterward); low export growth (with *total* imports of our trading partners remaining constant for 2012 and 2013, and growing by 2 per cent per annum afterward); simulations with high (40 per cent) and low (20 per cent) levels of machinery and equipment content as part of the investment, and a simulation based on the NERI (2012) plan put forward in spring 2012.

It should be noted that HERMIN is not a short term forecasting model. Nevertheless, it is necessary to set a baseline scenario, and it is assumed that there is no change in government variables from those already outlined in the Stability Programme Update of April 2012 (Department of Finance, 2012). For the central simulation, the weighting of investment given to machinery and equipment is set at 30 per cent (while the rest is composed of building and construction). This is relevant as machinery and equipment is more import intensive than building and construction. The weighting of machinery and equipment in investment (in both public and private sectors) has ranged from 41.4 per cent in 1995 dipping as low as 21 per cent in 2004, before increasing to 40.9 per cent in 2011. It is a matter for government policy whether to invest in construction intensive projects when creating a stimulus plan. Therefore 30 per cent was chosen as the central simulation, and a weighting of 20 per cent and 40 per cent were used as alternative scenarios.

A summary of the results is given in the appendix (Table A.1). Chart 2 shows the level of unemployment in the baseline (no stimulus) scenarios with low, 'central' and high export growth. As it is impossible to predict the future with any certainty (especially as far out as 2030) it is better to make use of alternative scenarios. As can be seen, in the short term the different scenarios for export growth suggest a difference in unemployment in 2013 of about 1 per cent. However, even with high export growth unemployment remains high, and it takes some time for unemployment to

return to what might be considered acceptable levels. Therefore the initial impact effect is unlikely to differ greatly, though the long term effects may differ.

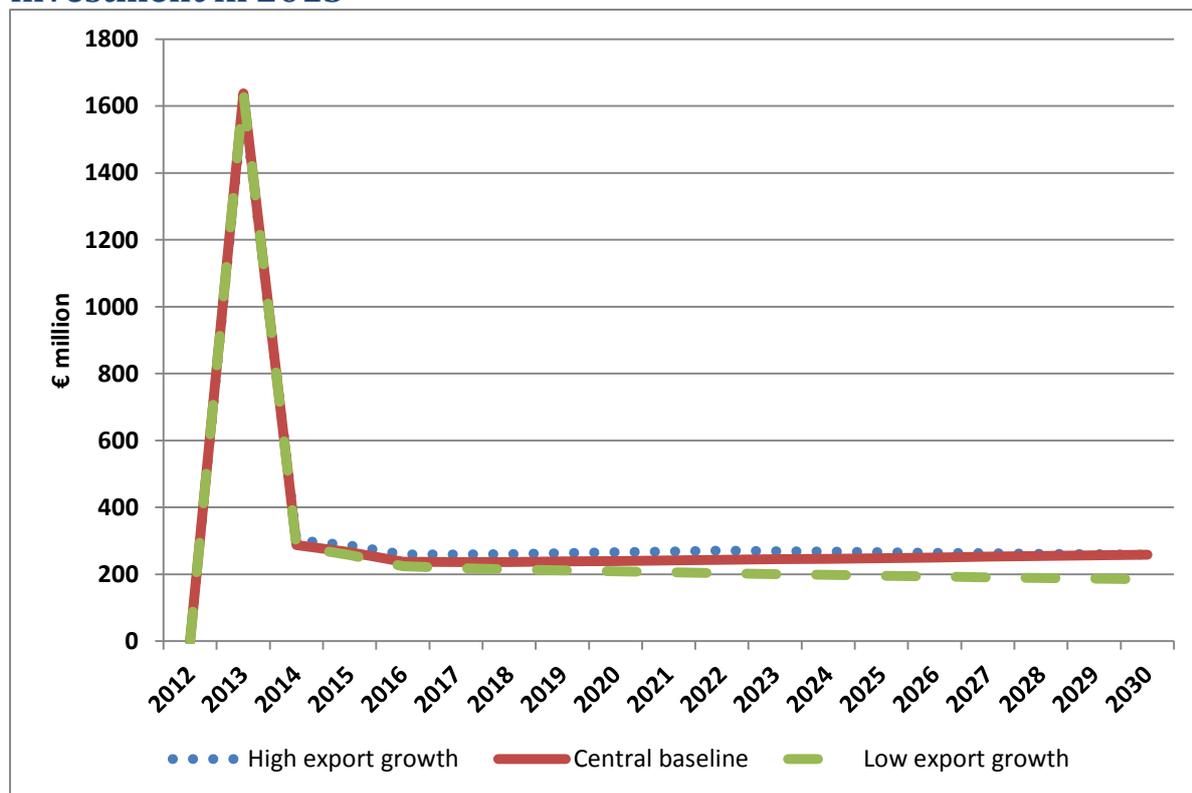
Chart 2 Baseline unemployment – scenarios of low medium and high export growth



Source: HERMIN

As can be seen from Chart 3, the effects of a stimulus on GDP are similar for different scenarios of export growth. This is as all three scenarios have a similar level of unemployment in 2013. There is a long term supply side benefit of between about €185 million and €260 million (in 2013 Euros). There is a slightly larger impact effect in the low export scenario, and a larger long term effect for the high export scenario. This is as the demand side stimulus effects are greatest when unemployment is high, but the supply side effects are of greater benefit when there is greater demand for exports. This is equivalent to an impact multiplier of 1.6 and cumulative multiplier by 2030 of 5.2, 5.9 and 6.2 for the low, central, and high export scenarios. These cumulative multipliers are higher than those reported by Bradley, Untiedt, and Mitze (2007), who reported an impact multiplier of 1.36 for the year 2000 and a cumulative multiplier of 4.35 for 17 years later (reaching 4.82 twenty years after the initial programme). The differences are likely due to the higher level of unemployment in the current situation which reduces crowding out effects. It should be noted that the ‘time value of money’ (which gives greater importance to a change in GDP today than a change in 2030) is not accounted for when calculating the cumulative multiplier.

Chart 3 Change in real GDP from a €1bn increase in public investment in 2013



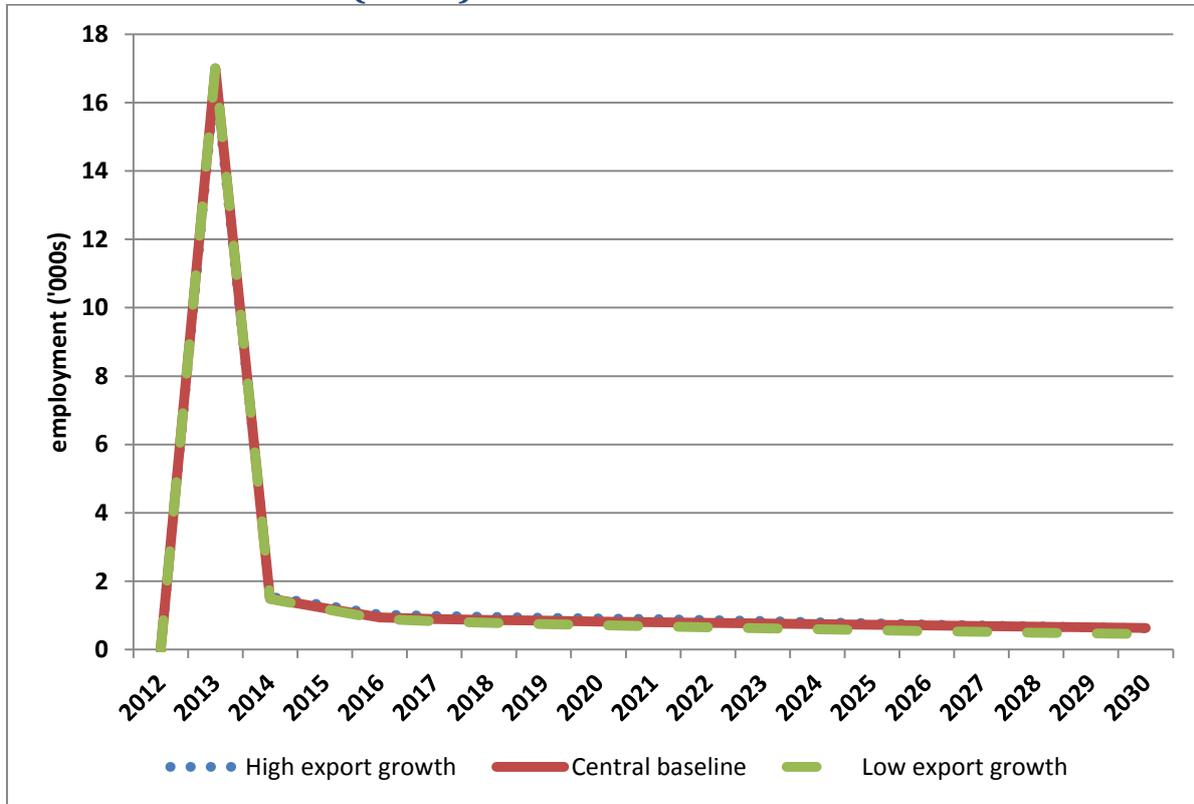
Source: HERMIN

Notes: Real changes using 2013 prices. 2013 prices are chosen as the €1bn investment is also in 2013 prices

Also of interest is the effect on employment (Chart 4). Again the results are similar for the different scenarios. It must be noted that the effect on employment is not cumulative. In the high export scenario 16,742 (temporary) jobs are created in the first year, and an average of 850 long term sustainable jobs are created for the years 2015 to 2030. For the central scenario and low export

scenario 16,997 (temporary) jobs are created in the first year and an average of 797 and 673 long term jobs are created respectively.

Chart 4 Change in employment from a €1bn increase in public investment in 2013 ('000s)

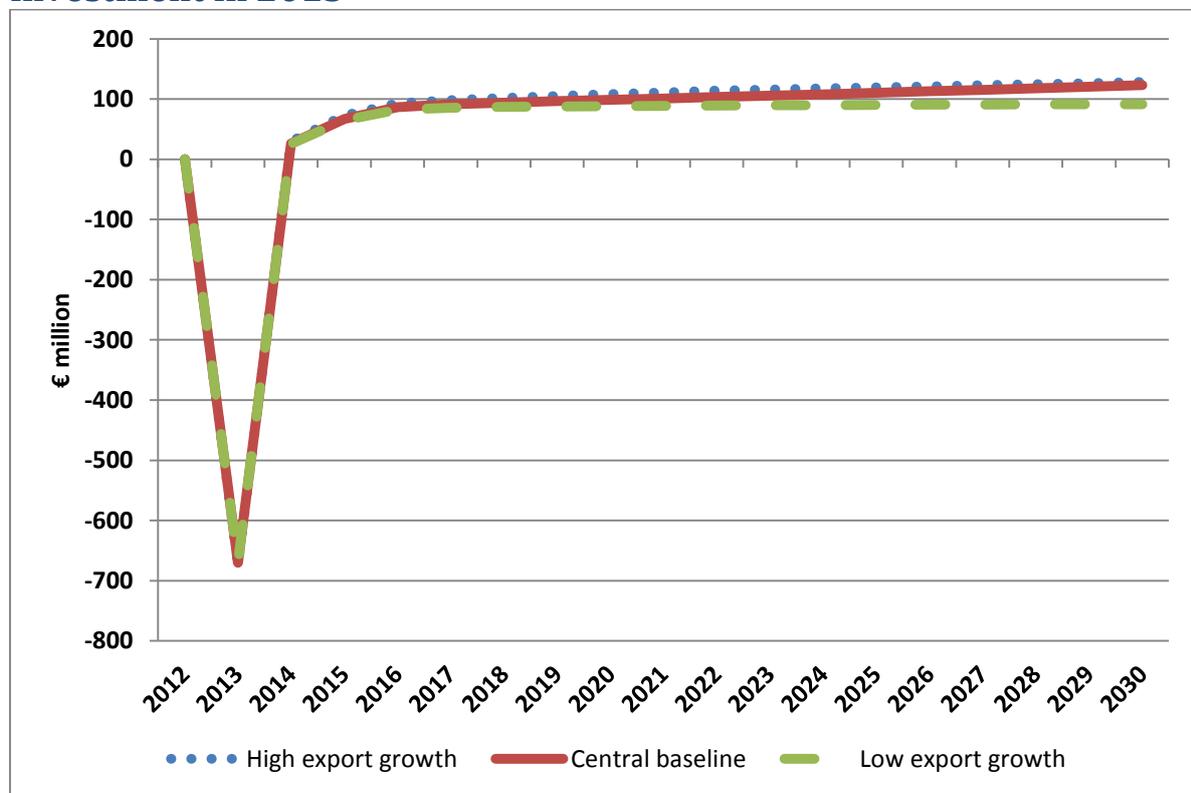


Source: HERMIN

Notes: Real changes using 2013 prices. 2013 prices are chosen as the €1bn investment is also in 2013 prices

One criticism of an investment stimulus is that it would simply lead to an increase in imports. Given that Ireland has a trade surplus and a current account balance this need not be of immediate concern, but it is still useful to see the impact on the trade balance. As can be seen from Chart 5; an investment of €1bn leads to an increase in imports of approximately €670 million. One should not interpret this as meaning the bulk of investment is spent abroad. This figure includes the direct effect (such as the import of machinery and equipment, and fuel which is used for the machines used in building and construction) and the indirect effect on imports due to higher consumer spending. The increase in net imports is only temporary however. The improvement in infrastructure improves Irelands export competitiveness which leads to a long term increase in exports. The cumulative effect on net exports is neutral by 2021 in the high export growth scenario, and neutral by 2022 in the other scenarios, and is permanently positive from that point onwards.

Chart 5 Change in trade balance from a €1bn increase in public investment in 2013



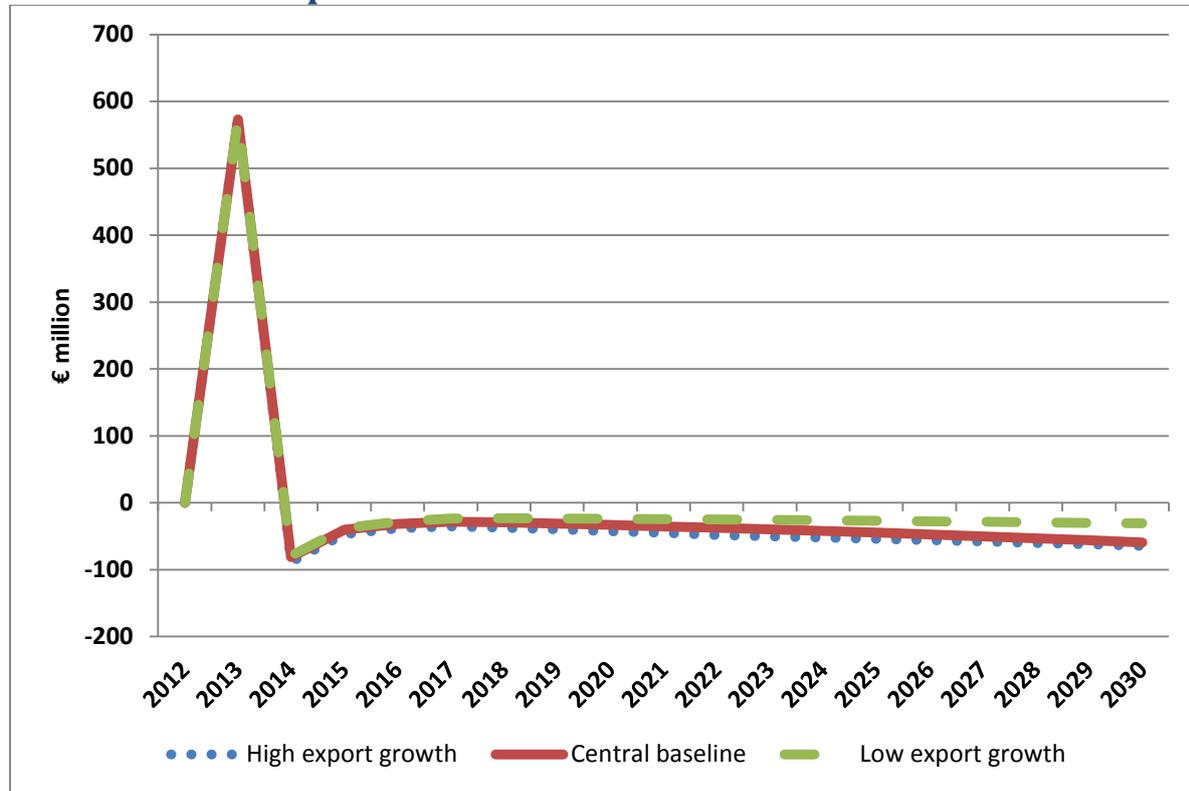
Source: HERMIN

Notes: Real changes using 2013 prices. 2013 prices are chosen as the €1bn investment is also in 2013 prices

Another criticism of an investment stimulus is its cost. When calculating the costs of a stimulus it is important to take account of the positive effect which an increase in GDP has on government revenues. Unfortunately the HERMIN model does not account for the savings made on social welfare payments or that improving people’s ability to make their mortgage payments has on reducing state support to the banking sector. Therefore, the net cost of an investment reflects an upper bound. Also, it has been proposed to use ‘off balance sheet’ methods of financing infrastructure projects. In the simulations traditional borrowing is assumed. As can be seen, the net cost of an investment

stimulus is €575 million, almost half the headline cost. The investment is also self-financing. Chart 6 shows that after the initial outlay, the increase in government revenue is enough to offset interest payments on the borrowed sum. Overall, there is a long-term permanent decrease in the government deficit as a result of an investment stimulus.

Chart 6 Change in government borrowing requirement from a €1bn increase in public investment in 2013

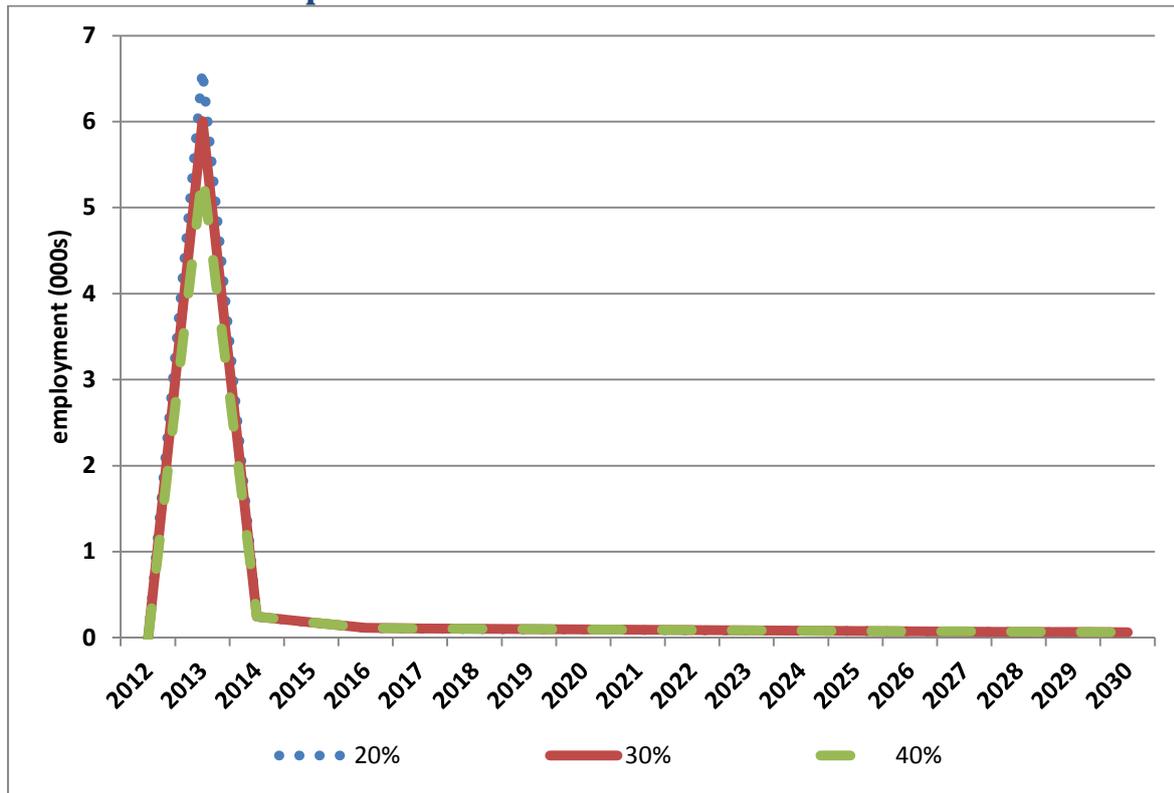


Source: HERMIN

Notes: Real changes using 2013 prices. 2013 prices are chosen as the €1bn investment is also in 2013 prices

As noted, the benefits of a stimulus may depend on the machinery and equipment content of an investment project, which is more likely to be imported. Interestingly, the differences for different weightings of machinery and equipment are minor, and predictably a lower weighting for machinery and equipment leads to higher GDP and employment. The impact multipliers for machinery and equipment weightings of 20 per cent, 30 per cent and 40 per cent are 1.7, 1.6 and 1.6 respectively. The only large differences are in the composition of employment. Temporary job creation in building and construction for 20 per cent, 30 per cent and 40 per cent shares of machinery are 6,600; 6,006; and 5,397 respectively (Chart 7). These figures are lower than those sited in the introduction due to the inclusion of machinery and equipment. It must also be noted that many workers who are employed directly as a result of an increase in construction (for example, in the renting of construction equipment) are classified as working in the services sector rather than construction sector.

Chart 7 Change in building and construction employment from a €1bn increase in public investment in 2013



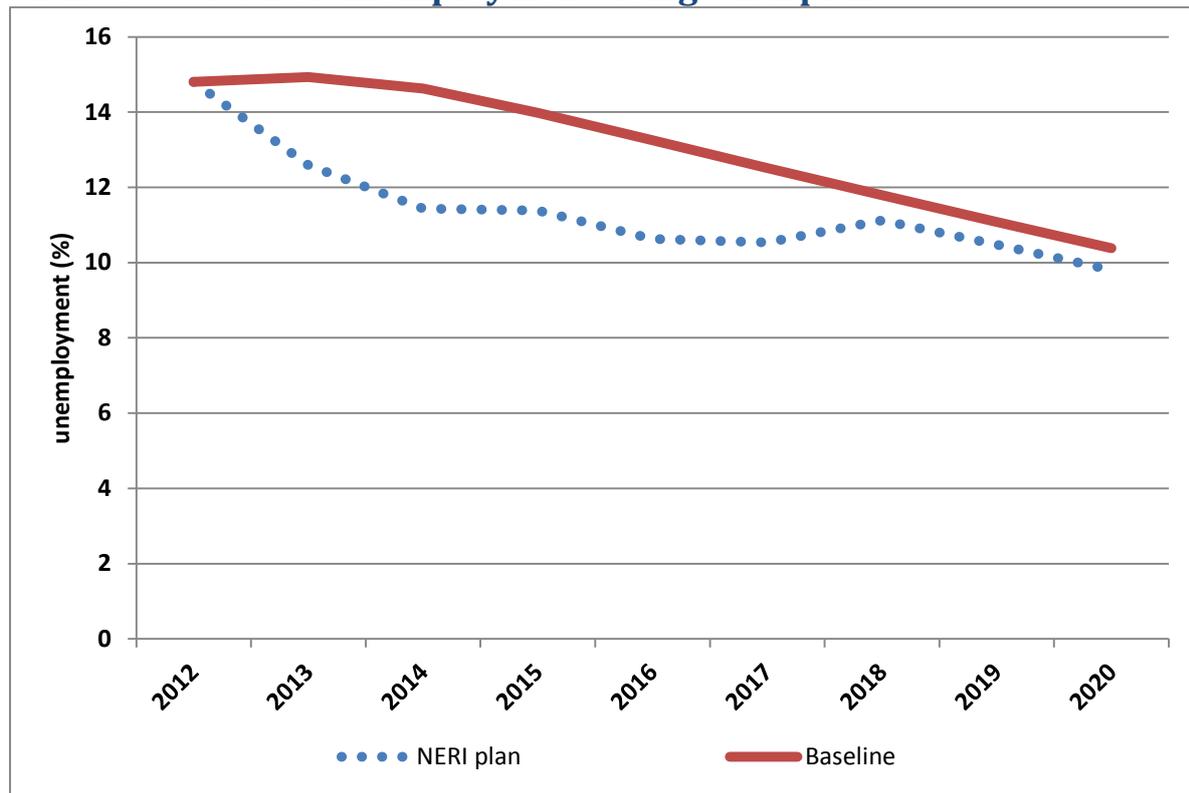
Source: HERMIN

Size and timing of a programme

When designing the size and timing of an investment stimulus care must be taken, first, not to increase construction employment beyond that which is sustainable in the long term; and second, that the stimulus be phased out to prevent a crash when the stimulus is withdrawn. Due to the collapse in construction employment the first problem is unlikely to occur. Data from Eurostat shows that between 2008 and 2011 the average share of construction employment as a proportion of working age population ranged from 5.6 per cent to 4.7 per cent in the EU15, while in 2011 in Ireland it was 3.5 per cent. To return construction employment to EU15 norms would require construction employment to rise to between 140,000 and 166,000, or the creation of 35,000 to 60,000 jobs. Therefore an investment stimulus of at least €6bn in 2013 would be required before there is any danger of construction employment overshooting.

In spring 2012, NERI (2012) proposed a phased investment stimulus over five years of €3bn in 2013, €4bn in 2014, €3bn in 2015, €3bn in 2016, and €2bn in 2017. Chart 8 shows the path of unemployment with and without an investment stimulus. As can be seen, by phasing out a stimulus an abrupt return to higher unemployment can be prevented.

Chart 8 Path of unemployment using NERI plan



Source: HERMIN

Conclusion

Critics of an investment stimulus frequently cite the openness of the Irish economy as a reason why the benefits of stimulus would leak abroad. In contrast proponents point to the deficits in Ireland's infrastructure that have been highlighted by Forfás (2012) and in an IMF staff position note (Allard and Everaert, 2010), and to the need to reduce unemployment. The effects of an investment stimulus are examined using the HERMIN model, which is used by the European Commission to measure the impact of EU Cohesion Funds. The HERMIN model explicitly incorporates the openness of the Irish economy. It has been found that the multiplier effects of an investment stimulus are large, with an impact multiplier of approximately 1.6 and a cumulative multiplier in the range of 5.2 and 6.2. These large multipliers are due to the high level of unemployment in the Irish economy, which reduces crowding out effects. Though the increase in demand leads to an increase in imports in the first year, the effect is short lived, and the beneficial supply side effects of improved infrastructure lead to higher net exports.

The research finds that an investment stimulus of €1bn for one year would create approximately 16,750 short term jobs and between 675 and 850 long term sustainable jobs. Due to greater tax revenues due to higher GDP, the net cost of a €1bn investment is €575 million. This is found to be self-financing, as the long term increase in tax revenue more than offsets the interest payments on the initial capital outlay. In designing an investment stimulus care must be taken to phase out its withdrawal, in order to prevent reverse Keynesian effects.

Overall the case for an increase in public investment is compelling.

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Table A.1 Summary of Results: Change in variables with respect to baseline

Scenario	Impact Effects				Cumulative Multiplier	Average increase in employment	Cumulative export increase
	GDP multiplier	Job creation	Construction jobs	Net initial outly			
Central	1.638	16,998	6,006	€572.8m	5.877	1,735	€1,008m
High export growth	1.619	16,742	5,896	€575.8m	6.165	1,776	€1,136m
Low export growth	1.638	16,998	6,006	€572.8m	5.207	1,625	€753m
20% Machinery content	1.689	17,731	6,601	€555.0	5.911	1,769	€1,029m
40% Machinery content	1.585	16,245	5,397	€591.1	5.841	1,700	€986m

Note: The investment stimulus involves a once off increase in public investment of €1bn in 2013 (in 2013 Euros). Long-run effects are to 2030

