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Investment, Current Account, and the Long Swings of Unemployment

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Abstract

We estimate the relationship between investment and unemployment over the time period 1960-2015 in 20 OECD countries. While neoclassical growth theory typically assumes full employment – with no effect of investment on unemployment – we find that over our sample period covering more than five decades, a statistically significant negative relationship does exist: when investment fell, unemployment increased. When the time period is broken down into two sub-periods to take account of the Great Recession, we find that the estimated coefficient of investment is slightly smaller when the period 2001-2015 is added to the 1960-2000 period. We also find a positive effect of the current account surplus on unemployment that very likely works through investment. A non-monetary model shows how an increase in policy uncertainty that sharply contracts investment and raises unemployment can lead to an increase in current account surplus.

Keywords: Long swings of unemployment, investment, current account, Great Recession.
JEL Classification: E10, E22, E24.

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With the 1936 publication of John Maynard Keynes' *The General Theory of Employment, Interest and Money* and John Hicks' 1937 article entitled "Mr. Keynes and the `Classics': A suggested interpretation," which developed the ISLM model, effective demand was given a central role in determining aggregate employment. An increase in investment, in boosting effective demand, would expand employment and reduce unemployment. The negative relationship between investment and unemployment should prevail only in the *short run*. Over the *long run*, the neoclassical model of growth starting with Solow (1956) and Swan (1956) predicts that a higher rate of investment raises per capita output but has no effect on unemployment.[1] Spurred by the steady rise of unemployment in Europe from the early 1980s without disinflation, models were developed such as Layard, Nickell and Jackman (1991) and Phelps (1994) that identified forces that could shift the path of the natural rate of unemployment. In these models of the *medium run*, economic forces that lead to an investment boom typically also shifts down the whole path of the equilibrium rate of unemployment.

The theory summarised above predicts that a negative relationship between investment and unemployment should prevail only in the short run (say, over several quarters) to the medium run (say, over two to three decades).[2] The objective of this paper is to empirically assess whether this relationship holds over the long run (say, over half a century). We find that, empirically, the relationship indeed holds even over the long run. A statistically significant negative relationship exists between investment and unemployment over the time period 1960-2015 in a sample of 20 OECD countries. As the period includes the last decade of a financial crisis and the Great Recession, which some regard as a departure from normal economic fluctuations, we also conduct our empirical analysis by breaking down the whole period into two sub-periods: 2001-2015 and 1960-2000. We find that the estimated coefficient of investment is slightly smaller when the period 2001-2015 is added to the 1960-2000 period. Given our focus on investment, we also examine whether, empirically, it is through investment that the positive relationship between current account surpluses and unemployment, recently discovered by Bertola (2017), works. We find that this is, indeed, the case. We then spell out a theoretical model that is compatible with our empirical findings.

[1] In the standard formulation, full employment is assumed in neoclassical growth models.

[2] Modigliani (2000) first noted a medium-term relationship between investment and unemployment without formal testing (see also Blanchard, 2000). The relationship was formally estimated by Herbertsson and Zoega (2002) using data from 1960 to 1997 and found to be statistically significant and robust.

While the formal development of neoclassical growth theory has abstracted from unemployment, Professor Robert Solow in his Nobel lecture (1987) argued for the need to integrate unemployment into long-run growth models. He says, "[I]f one looks at substantial more-than-quarterly departures from equilibrium growth, as suggested, for instance, by the history of the large European economies since 1979, it is impossible to believe that the equilibrium growth path itself is unaffected by the short- to medium-run experience. In particular, the amount and direction of capital formation are bound to be affected by the business cycle, whether through gross investment in new equipment or through the accelerated scrapping of old equipment. … So a simultaneous analysis of trend and fluctuations really does involve an integration of the long run and the short run, of equilibrium and disequilibrium." Non-monetary medium-run models of structural slumps, such as those described in Phelps (1994), were developed with a view to understanding economic fluctuations over a couple of decades and provide to a degree an integration of unemployment theory and growth theory. Our empirical finding of a negative relationship between investment and unemployment over half a century suggests that this class of models, particularly when physical capital is incorporated, has explanatory power even over the long run.

We start in Section 1 by surveying the literature on mechanisms behind medium-term movements in unemployment and the investment-unemployment relationship before conducting our empirical analysis in Sections 2 and 3. In Section 4, we spell out a non-monetary model of the natural rate of unemployment that is compatible with the empirical patterns found in the data. Concluding remarks are in Section 5.

1. A brief overview of the literature

One of the objectives of this paper is to explore to what extent the medium-term negative relationship between investment and unemployment survived the Great Recession at the beginning of the 21th century. By covering a whole time period that is more than half a century long, we seek to empirically test whether the relationship exists also in the long run. We will first survey a host of models that predict a close relationship between investment and unemployment. Then, we survey the literature on how the Great Recession that followed the financial crisis of 2008 may have affected investment and unemployment as well as the relationship between the two.

1.1 Models of investment and unemployment in the medium run

When observing unemployment over long periods of time in developed economies, it becomes apparent that its long swings dominate shorter business cycle fluctuations. In many countries, the 1950s and 1960s were a period of low unemployment, the 1970s and 1980s were a period of rising unemployment, and the unemployment patterns in the 1990s were more diverse. The first decade of this century then saw unemployment initially falling in many countries and then rising rapidly in the Great Recession.

There is a large literature that explains differences across countries and over time in unemployment by differences in institutions and changes in institutions across countries. The paper by Nickell, et al. (2005) is a good example of this approach.[3] Here, unemployment is related to labour market institutions such as the level and duration of unemployment benefits, the size and centralisation of labour unions and taxes on labour, in addition to several macroeconomic shocks such as changes in oil prices and the real rate of interest.

There are also papers that model the relationship between various macroeconomic variables and unemployment. The employment decision has an investment dimension in many of these models. Thus, changes in the rate of productivity growth affect firms' investment in vacancies (Pissarides, 2001) as well as the training of workers (Phelps, 1994; Hoon and Phelps, 1997; and Salop, 1979); higher stock prices imply expectations of increased future profits and a higher value of trained workers making firms decide to increase training investment (Phelps and Zoega, 2001); and higher start-up costs reduce firm creation and employment (Pissarides, 2002), while higher oil prices may increase markups and hence lower the real demand wage causing increased unemployment (Carruth et al., 1998). In some papers, such as Nickell, et al. (2005), Phelps (1994), Fitoussi, et al. (2000) and Blanchard and Wolfers (2000), the two approaches are combined so that the effect of the macroeconomic shocks depends on the labour market institutions.

There is a more recent literature that explores the experience of the Great Recession of 2008-2009. Hoffman and Lemieux (2016) find that the larger employment swings in the United States than in Canada and Germany can be attributed to the larger employment swings in the construction sector linked to the housing bubble in the United States. Bertola (2017) describes the role of international capital mobility in generating labour market shocks that can account for differences in the evolution of unemployment within Europe. He proposes a

[3] See also Layard, et al. (2005) and its first edition published in 1991.

model where production is affected by the investment of foreigners in the domestic capital stock. Thus capital inflows increase labour demand through increased investment in physical capital and lower the rate of unemployment. The capital inflow countries – such as Ireland and Spain – experienced falling unemployment before the onset of the crisis for this reason. When the ratio of current account deficits to GDP is inserted into the empirical equation of Blanchard-Wolfers (2000), it turns out to be very statistically significant with a negative coefficient so that the current-account deficit countries – that is, the ones having capital inflows – have lower unemployment.[4]

A negative relationship between investment and unemployment arises in many of the papers mentioned above because hiring new workers often involves an investment decision. As discussed in Phelps (1994), firms can invest both in the training of new workers and in new customers in addition to physical capital. In all these cases, the real demand wage may be affected and hence also the natural rate of unemployment in the presence of real wage rigidity.

In Phelps (1992, 1994), the customer market model of Phelps and Winter (1970) is used to explain changes in the natural rate of unemployment. The expectation of higher productivity in the future makes firms want to increase their current market share by cutting markups since, although this leads to lower current profits, they can expect future profits to increase by more. Hence the price cutting is an investment in gaining future market share. Of course, in the representative agent model, no one gains market share in general equilibrium but markups end up smaller, prices fall, and the real demand wage increases resulting in a fall of the natural rate of unemployment. Conversely, the expectations of a fall in productivity would lead to an increase in markups and a fall in the real demand wage, and the natural rate of unemployment goes up. Changes in interest rates also have an effect on the investment in the market share such that an increase of interest rates will lead to a fall in the shadow price of new customers, higher markups, and a lower real demand wage; thus the natural rate of unemployment will rise.

In Hoon and Phelps (1992) and Phelps (1994), firms invest in the training of new workers and increase the number of workers being trained until the marginal cost of training a new worker equals his shadow price. The shadow price depends on the interest rate and future productivity such that higher interest rates and lower expected productivity would make firms

[4] When the current account is omitted, Bertola (2017) finds that labour market reforms cannot account for the variation in unemployment when recent years are added. Moreover, the same applies to the interaction of time-varying institutions and macroeconomic shocks so that many of the statistically significant coefficients in the Blanchard-Wolfers (2000) model drop out.

train fewer workers and raise the natural rate of unemployment. These models explain the level or stock of unemployment. There are also models that explain the flow of workers yielding equilibrium unemployment in the labour market. In these models the posting of new vacancies can have an investment component. In a matching model with search frictions, Pissarides (2001) shows how firms invest in the creation of new vacancies and the level of investment depends on the expected present discounted value of a newly hired worker. Thus the expectation of higher productivity would make firms invest in more vacancies generating a flow from unemployment to employment and similarly higher interest rates would reduce the shadow price of a worker leading firms to cut down on the number of job vacancies hence raising the equilibrium level of unemployment.

The empirical relationship that we are exploring in this paper is between investment in physical capital and unemployment. Although one can expect the shadow price of different assets – customers, trained workers, and physical capital – to be related we will emphasise a model where changes in investment in physical capital and unemployment are related. Investment in physical capital and unemployment are most directly related in the medium term in the two-sector model of Kanaginis and Phelps (1994) and Phelps (1994), which are based on Uzawa (1961). Here, there are two sectors, one producing a consumer good and the other producing a capital good. The consumer-goods sector uses capital intensively while the capital-goods sector uses only labour. It follows that a rise in the relative price of the capital good increases the real demand wage and employment when real wages are rigid. An increase in the real rate of interest or a fall in expected productivity will make demand for the consumer good fall, which translates into a fall in the demand for the output of the labour-intensive capital goods sector. This causes the real demand wage to fall and the natural rate of unemployment to increase.

1.2 The effects of the Great Recession

The Great Recession that followed the financial crisis of 2008 may have affected investment and unemployment as well as the relationship between the two. Increased uncertainty can affect the risk premium faced by different countries. In addition, there is the effect of increased uncertainty on investment and employment when hiring involves an investment decision that goes back to Dixit and Pindyck (1994) who explained how the value of the investment option increases with uncertainty, hence increasing the cost of investing. Baker, Bloom and Davis (2016) measure uncertainty by developing an index of economic policy uncertainty based on newspaper coverage frequency and find, using firm-level data, that

increased policy uncertainty is associated with greater stock price volatility and reduced investment and employment in sectors that rely heavily on policy such as defence, health care, construction and finance. Hence increased policy uncertainty tends to precede declines in investment and employment in the United States and also in a sample of 12 large economies. Gulen and Ion (2015) use the index of Baker, Bloom and Davis (2016) to estimate the effect of policy uncertainty on corporate investment. They find evidence for a negative relationship between policy uncertainty and investment such that a doubling in the level of policy uncertainty is associated with an average decrease in quarterly investment rates of close to 9% relative to the average investment rate in the sample. Gilchrist et al. (2014) provide a complementary explanation for the effect of uncertainty on investment to that of Dixit and Pindyck. They show using both macro and micro evidence how fluctuations in idiosyncratic uncertainty affect investment through changes in credit spreads. They compare empirically the two effects – the value of waiting and the changing credit spreads – on investment and find that both types of shocks exert a strong effect on investment by generating countercyclical credit spreads and procyclical leverage, which fits the data well. Banerjee, et al. (2015) attribute the weak investment in the world economy in the aftermath of the Great Recession to uncertainty about the future state of the economy and expected profits rather than financing conditions. Bordo and Haubrich (2016) also attribute the slow recovery from the crisis to policy uncertainty. Caldara, et al. (2016) explore the macroeconomic development around the Great Recession and find that both financial shocks and uncertainty shocks are important macroeconomic disturbances, especially when the uncertainty shocks coincide with a tightening of financial conditions.

There is the question whether uncertainty could be expected to affect investment and unemployment differently. In an interesting recent paper, Kim and Kung (2016) show how the ease with which an asset can be sold, what they call redeployability, affects the response of investment to increased uncertainty. Thus firms are more cautious when it comes to investing in assets that are less redeployable in the face of uncertainty because of their lower liquidation values. This intuition has direct relevance for our study because the firing of workers involves costs in the form of lost training and human capital as well as redundancy pay in many cases while productive capital can be discarded or sold in the second-hand market. The redeployability of the two assets may hence not be the same and uncertainty affects investment in capital and new workers differently, depending on which model of the labour market we have chosen. This applies particularly to the turnover-training model of Hoon and Phelps (1992). It follows that either investment or unemployment may have

responded more to the increased uncertainty during the Financial Crisis hence affecting the strength of the relationship between the two.

In a recent paper, Hall (2017) put forward an alternative explanation for how recessions can affect unemployment through investment. In his model the stock market and all types of investment fall in a recession, including investment by firms in job creation. In essence, the discount rate implicit in determining the stock market value goes up and the discount rate applied to other claims on future business income also rises during a recession. In particular, this generates a lower present value of future profits an employer attributes to a new hire. In the Pissarides-Diamond model, this reduces the rate of job creation, the labour market slackens, and unemployment goes up. Thus high discount rates, low investment level, and high unemployment go together.

We now turn to establish the stylised facts found in the data, in particular to estimate the relationship between investment and unemployment and to explore whether it changed during the Great Recession and its aftermath, paying particular attention to the relationship with the current account balance. In the penultimate section of the paper, we will then spell out a theoretical model of equilibrium unemployment that fits the stylised facts.

2. Shocks identified

We start by measuring the long swings of unemployment and investment using principal component analysis. In an earlier paper by one of us (Smith and Zoega, 2007), we showed how the first principal component (PC) of an unemployment matrix with 21 countries and 42 years of observations could explain 69% of the variation in the matrix and capture the global changes in unemployment over time.

We have unemployment data for 20 countries from 1960-2015 and investment data (gross capital formation as a share of GDP) for a sample of countries from 1970-2015. We take the standardised 56*20 matrix of unemployment rates (*U*) and the 46*20 matrix of investment (*I*) and construct their variance-covariance matrices, *U'U* and *I'I*, and diagonalise the matrices in the following way

$$A'U'UA = \Phi_1 \qquad\qquad B'I'IB = \Phi_2$$

where *A* and *B* are the matrices of orthogonal eigenvectors and Φ is the (20*20) diagonal matrix of eigenvalues.

We can then define $Z_1=UA$ and $Z_2=IB$ to be the 56*20 and 46*20 vectors of principal components (PCs) where each column of matrix Z_1 (Z_2) is a 56*1 (46*1) vector of

observations for one principal component. Each eigenvalue gives the proportion of the total variance of each matrix, *U* and *I*, explained by the relevant PC. Table 1 gives the four largest eigenvalues, the percentage of the variance and the cumulative percentage of the variance of matrix *U* and matrix *I* explained by the first four principal components and the eigenvectors corresponding to each.

Table 1. Principal components and eigenvectors for OECD unemployment and investment

Unemployment					**Investment**				
Number	Value	Proportion	Value	Proportion	Number	Value	Proportion	Value	Proportion
1	13.02	0.65	13.02	0.65	1	10.75	0.54	10.75	0.54
2	2.84	0.14	15.87	0.79	2	2.47	0.12	13.22	0.66
3	1.45	0.07	17.31	0.87	3	1.80	0.09	15.03	0.75
4	0.79	0.04	18.10	0.91	4	1.38	0.07	16.41	0.82
Variable	PC 1	PC 2	PC 3	PC 4	Variable	PC 1	PC 2	PC 3	PC 4
Australia	0.25	-0.13	-0.25	0.08	Australia	0.16	0.34	-0.07	-0.16
Austria	0.22	0.26	0.18	0.12	Austria	0.26	-0.15	-0.17	0.18
Belgium	0.26	-0.11	-0.14	0.09	Belgium	0.23	0.16	-0.10	0.41
Canada	0.23	-0.24	-0.14	0.22	Canada	0.16	0.47	-0.04	-0.06
Denmark	0.23	-0.24	0.03	0.17	Denmark	0.24	0.09	0.11	0.13
Finland	0.22	0.22	-0.23	0.13	Finland	0.27	0.11	-0.03	-0.20
France	0.27	0.10	-0.03	-0.05	France	0.27	0.19	-0.09	0.15
Gernabt	0.23	0.21	-0.11	0.30	Germany	0.24	-0.30	-0.23	0.01
Greece	0.17	0.27	0.36	-0.44	Greece	0.27	-0.18	0.07	0.01
Ireland	0.20	-0.32	0.11	-0.33	Ireland	0.14	0.11	0.55	0.20
Italy	0.24	-0.02	-0.16	-0.40	Italy	0.27	-0.02	0.15	-0.07
Japan	0.18	0.36	0.17	0.24	Japan	0.25	-0.29	-0.17	-0.04
Netherlands	0.21	-0.34	0.02	-0.02	Netherlands	0.23	-0.25	-0.17	0.23
Norway	0.23	0.11	-0.26	0.01	Norway	0.23	0.20	-0.18	-0.28
New Zealand	0.25	0.07	-0.16	-0.19	New Zealand	0.18	0.12	0.29	-0.36
Portugal	0.19	0.02	0.54	0.00	Portugal	0.17	-0.34	0.24	-0.03
Spain	0.27	-0.03	0.07	-0.24	Spain	0.16	0.14	0.29	0.49
Sweden	0.20	0.34	0.01	0.10	Sweden	0.26	0.15	-0.21	-0.09
U.K.	0.25	-0.21	0.02	-0.01	U.K.	0.27	-0.10	-0.06	-0.20
U.S.	0.13	-0.29	0.45	0.40	U.S.	0.15	-0.22	0.42	-0.31

The factor loadings for the first PC of unemployment are similar for all countries except the United States for which they are smaller. The PC has a very low value until the first world oil shock affected unemployment in 1974-75, then another elevation in the early 1980s, the recession of the early 1990s, the period of low unemployment in the early 2000s, and then the effect of the Great Recession starting in 2008. A similar pattern emerges for the first PC of the investment matrix. Plotting the inverse (negative) of the first PC of unemployment against

the first PC of investment gives the relationship shown in Figure 1. There is a clear relationship between the two series.

Figure 1. The first PCs of unemployment and investment

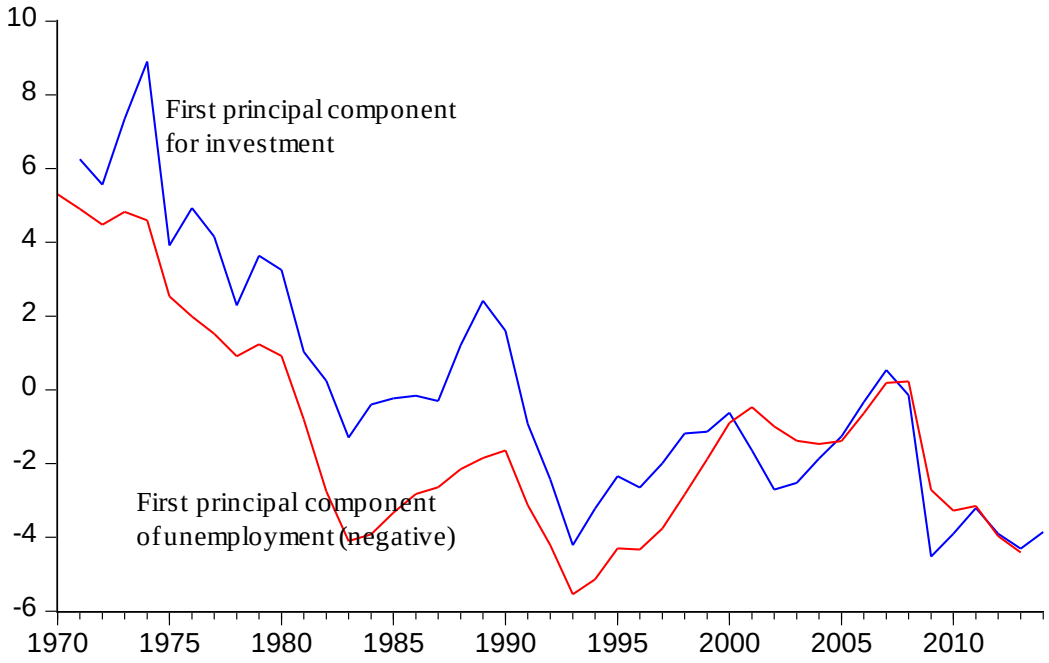


Figure 1 shows how the rise in world unemployment (fall in the inverse of the first PC of unemployment) in the 1970s and early 1980s coincides with a fall in investment as a share of GDP. Moreover, the rise of investment in the late 1980s coincides with a rise in employment and the recession in the early 1990s has both investment and employment falling, then rising in the late 1990s. The Great Recession starting with the financial crisis of 2007-2008 has both investment and employment falling suddenly.

3. Panel estimation

We next test for the stationarity of our panel data using the Im, Pesaran and Shin (2003) and the combining p-values Fisher-type (Choi, 2001) panel unit root tests. Both of those tests allow for an unbalanced panel. Because the countries in our sample may have similarities, our results could be affected by cross-sectional correlation in unemployment or investment rates. We control for cross-sectional correlation by removing cross-sectional means. The results

reported in Table A1 indicate that we can reject the null hypothesis of a unit root at the 1% significance level for investment and at the 5% level for unemployment.

In Table 2 we estimate a panel equation for the OECD countries reported in Table 1. In order to remove the business cycle in columns (1), (2), (5) and (6) we use five-year averages of our data while in the remaining columns we use decadal averages. First, in order to get comparable results with Herbertsson and Zoega (2002) we first restrict our sample to the 1960-2000 period. Columns (1)-(4) depict the results of an unbalanced panel estimation for the 1960-2000 period (starting in 1970 for some countries). We also control for real oil prices in columns (2) and (4).[5] All equations include country fixed effects in order to capture country-specific characteristics. The coefficient on investment is negative and statistically significant in all cases while using decadal averages increases its value at a level that is very close to the estimates of Herbertsson and Zoega (2002). In column (4) a rise in investment as a percentage of GDP by 3% will decrease unemployment by about 2.5%. Note that the relationship is stronger (the coefficient larger) when using decadal data.

In columns (5)-(8) we expand our sample to the 1960-2015 period in order to test whether the inclusion of the Great Recession affected the relationship. The coefficient on investment remains negative and statistically significant but its value decreases both in the estimations using decadal averages (from -0.854 to -0.518) as well as in those using five-year averages (from -0.653 to -0.421). A likely explanation for the lower investment coefficient in the 1960-2015 period is that the financial crisis affected the relationship between investment and unemployment. If we restrict our sample only to the EU countries, we observe a similar decrease in the value of the investment coefficient when we include the period of the Great Recession [see columns (1) to (8) in Table A2 in Appendix].

[5] All results are very similar when we take averages over five-year periods.

Table 2. Relationship between unemployment and investment in the OECD, 1960-2015

	1960-2000				1960-2015			
	5 year averages (1)	5 year averages (2)	Decadal averages (3)	Decadal averages (4)	5 year averages (5)	5 year averages (6)	Decadal averages (7)	Decadal averages (8)
Investment (% gdp)	-0.617***	-0.653***	-0.828***	-0.854***	-0.470***	-0.421***	-0.563***	-0.518***
	(-3.64)	(-3.78)	(-3.08)	(-3.02)	(-4.11)	(-3.56)	(-4.10)	(-3.04)
Real price of oil		0.319**		0.292		0.169***		0.096
		(2.47)		(0.99)		(2.56)		(0.75)
N	124	124	64	64	184	184	104	104
R^2	0.502	0.538	0.595	0.610	0.463	0.525	0.551	0.554

Notes: All regressions include country fixed effects. *t* statistics based on robust standard errors clustered at country level in parentheses. * p<.10, ** p<.05, *** p<.01.

In order to test directly for the impact of the financial crisis, in Table 3 we include the dummy *DFC* that takes the value 1 for the period 2008-15. *DFC* is positive and statistically significant in both columns implying the expected positive effect of the financial crisis on the level of unemployment. Furthermore, when multiplying *DFC* with investment as a share of GDP, we see in column (3) that the financial crisis decreases the coefficient on the investment ratio and this effect is statistically insignificant at the 5% level but significant at the 10% level.

Table 3. The impact of the financial crisis on the relationship between unemployment and investment, 1960-2015

	OECD			EU		
	Annual	Annual	Annual	Annual	Annual	Annual
	(1)	(2)	(3)	(4)	(5)	(6)
Investment (% gdp)	-0.148***	-0.159***	-0.167***	-0.158***	-0.172***	-0.179***
	(-4.03)	(-3.97)	(-4.07)	(-4.35)	(-4.56)	(-4.50)
Investment (% gdp) x DFC		0.090**	0.065		0.099**	0.074**
		(2.30)	(1.70)		(2.91)	(2.66)
DFC	0.239***	0.999**	0.659*	0.271***	1.087***	0.708**
	(3.48)	(2.84)	(1.83)	(3.35)	(3.21)	(2.44)
Real price of Oil			0.136*			0.168*
			(2.08)			(2.06)
N	933	933	906	933	104	104
R^2	0.372	0.377	0.385	0.357	0.551	0.554

Notes: All regressions include country fixed effects. *t* statistics based on robust standard errors clustered at country level in parentheses. * p<.10, ** p<.05, *** p<.01.

In the last three columns of Table 3 we restrict our sample to the EU countries, where the crisis was more prolonged compared to the rest of the OECD countries and coupled with the euro debt crisis. Comparing columns (3) and (6), we observe that restricting our attention to the EU countries increases the level of statistical significance of the crisis dummy from the 10% to the 5% significance level, implying that the crisis may have had a more significant positive impact on unemployment in the EU than in the rest of the OECD countries. Moreover, in column (6) where *DFC* is multiplied with investment as a share of GDP, we see

that the financial crisis has a statistically significant negative effect on the coefficient of the investment ratio. However, the overall effect of investment on unemployment still remains negative and statistically significant.

We have found that the effect of the Great Recession was greater on unemployment than investment. Unemployment increases by more than the fall in investment would lead us to predict based on the years prior to the crisis. In terms of the models of the effect of uncertainty on investment, this would imply that the decision to hire a new worker is less reversible than the decision to invest in new capital equipment. Thus investment in workers would be less redeployable using the terminology of Kim and Kung (2016) as discussed in Section 1.2.

In Table 4 we add the current account surplus for the crisis years following Bertola (2017). In column (1) we include investment and the current account as regressors and find that investment retains its significance and the estimated coefficient value is very similar to that in column (5) of Table 2. In contrast, the current account variable is not statistically significant from zero although with the expected sign – a more positive current account makes the rate of unemployment go up. In columns (3) and (4) we repeat the regressions using decadal averages, which reduces the number of observations. In this case the coefficient of the current account variable becomes even less significant while the absolute size of the investment variable increases as in Table 2.[6] In columns (5) and (6) we include the financial crisis dummy and interact it with both the investment variable and the current account variable. The dummy variable has a positive effect on unemployment and reduces the value of the negative coefficient of investment as well as the positive effect of the current account surplus on unemployment.

[6] Results remain very similar if we reduce our sample to the EU countries as can be seen in columns (9) - (12) of Table A2.

Table 4. Relationship between unemployment, investment and the current account, 1960-2015

	Annual (1)	Annual (2)	Decadal averages (3)	Decadal averages (4)	Annual (5)	Annual (6)
Investment (% gdp)	-0.170*** (-4.54)	-0.160*** (-3.93)	-0.562*** (-3.79)	-0.517*** (-2.87)	-0.151*** (-3.89)	-0.156*** (-3.90)
Current account (% gdp)	0.018 (1.39)	0.021 (1.50)	0.000 (0.03)	0.000 (0.02)	0.020 (1.39)	0.024 (1.59)
Real price Oil		0.186*** (4.02)		0.096 (0.75)		0.168** (2.32)
Investment (% gdp)* DFC					0.084** (2.19)	0.058 (1.57)
Current account (% gdp)* DFC					-0.018 (-1.55)	-0.021* (-1.91)
DFC					0.940** (2.69)	0.555 (1.56)
N	933	906	104	104	933	906
R^2	0.365	0.390	0.551	0.554	0.384	0.395

Notes: All regressions include country fixed effects. *t* statistics based on robust standard errors clustered at country level in parentheses * p<.10, ** p<.05, *** p<.01.

We can conclude that it may be through investment that the positive relationship between current account surpluses and unemployment, discovered by Bertola (2017), works. This is in accordance with Bertola's (2017) model. As a consequence, by including investment alongside the current account variable, the significance of the latter is much reduced compared to the results of Bertola (2017). A very likely reason for this is that a negative current account balance, which implies a capital inflow, generates an investment boom which then decreases unemployment through that channel.

Table 5. Labour Market Institutions and the relationship between unemployment, investment and the current account, 1960-2015

	1960-2000						1960-2015					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Investment	-0.655***	-0.727***	-0.518**	-0.674***	-0.712***	-0.510**	-0.461***	-0.413***	-0.330***	-0.449***	-0.393***	-0.294**
(% gdp)	(-3.49)	(-3.98)	(-2.87)	(-3.38)	(-3.76)	(-2.82)	(-3.76)	(-3.31)	(-3.19)	(-3.49)	(-2.99)	(-2.79)
Current account				-0.019	0.019	0.013				0.008	0.012	0.021*
(% gdp)				(-0.68)	(0.69)	(0.56)				(0.63)	(0.96)	(1.88)
Real price oil		0.407***	0.561***		0.437***	0.585***		0.184**	0.215***	0.184**	0.192***	0.229***
		(3.94)	(3.35)		(3.87)	(3.20)		(2.82)	(3.33)	(2.82)	(2.91)	(3.54)
Union density		0.045***	-0.017		0.044***	-0.018		0.026***	-0.001		0.025***	-0.001
		(4.98)	(-0.79)		(4.74)	(-0.81)		(4.50)	(-0.05)		(3.92)	(-0.09)
Tax wedge		0.003	0.037		-0.000	0.038		0.006**	0.042**		0.003	0.044**
		(0.90)	(1.14)		(-0.05)	(1.15)		(2.51)	(2.22)		(1.15)	(2.39)
UI replacement		0.032***	0.024**		0.033***	0.024*		0.019***	0.015*		0.018***	0.015*
rate		(4.28)	(2.16)		(4.35)	(2.08)		(3.87)	(1.98)		(3.60)	(2.00)
Empl. protection		0.012***	-0.296**		0.016**	-0.289**		0.021***	0.026		0.024***	0.052
		(11.99)	(-2.39)		(2.62)	(-2.27)		(58.41)	(0.23)		(9.13)	(0.48)
Coordination		-0.824***	-0.133		-0.802***	-0.131		-0.483***	-0.297*		-0.457***	-0.337*
		(-7.16)	(-0.48)		(-6.28)	(-0.47)		(-7.09)	(-1.74)		(-5.72)	(-1.88)
Union Coverage		1.486***	1.344***		1.440***	1.345***		0.822***	0.762***		0.771***	0.721***
		(4.43)	(3.35)		(4.02)	(3.34)		(3.73)	(4.30)		(3.21)	(4.09)
Active labour		-0.030***	-0.003		-0.030***	-0.003		-0.022***	-0.007		-0.022***	-0.008*
market policy		(-7.33)	(-0.43)		(-7.70)	(-0.53)		(-7.56)	(-1.47)		(-7.53)	(-1.74)
N	117	117	117	117	117	117	174	174	174	174	174	174
R^2	0.520	0.471	0.538	0.575	0.577	0.659	0.471	0.489	0.561	0.472	0.491	0.567

Notes: All regressions include country fixed effects. *t* statistics based on robust standard errors clustered at country level in parentheses * p<.10, ** p<.05, *** p<.01. Time invariant institution data of Blanchard and Wolfers (BW, 2000) in columns (2), (5), (8) and (11). Time variant data for *Union Density*, *Tax wedge*, *UI replacement rate* and *Employment Protection* from Bertola (2017) in columns (3), (6), (9) and (12). While in BW and Bertola (2017) the signs of *Coordination* and *Active labour market policy* have been adjusted so that they have a positive impact on unemployment, we keep the signs of all institution variables positive.

Finally, we want to test if our results will be affected by controlling for institutions in line with the large literature that emphasises the prominent role of their heterogeneity across countries on the nature and the level of unemployment [see Nickell, et al. (2005), Phelps (1994), Fitoussi, et al. (2000) and Blanchard and Wolfers (BW, 2000)]. In all columns of Table 5 we use five-year averages and Greece is excluded due to the unavailability of data for institutions. Nevertheless, comparing column (1) of Table 5 with column (1) of Table 2 we conclude that excluding institutions does not affect the impact of the investment ratio on unemployment for the 1960-2000 period. Column (2) of Table 5 controls for institutions using time invariant variables from the data set of BW that builds on the Institutions Data Set of Nickell (2006) for OECD countries in the 1960-2004 period. We see that controlling for the heterogeneity of institutions across countries does not affect significantly the impact of the investment ratio on unemployment.

BW revised the institution data set by introducing time variability for some institution variables while Bertola (2017) extended the BW dataset up to 2015 and used time-varying series for *labour tax wedge*, *employment protection legislation*, *union density* and *unemployment insurance replacement rates*. In column 3 of Table 5 we use the above institutions from the Bertola (2017) data set together with the time invariant variables of BW for *coordination*, *union coverage* and *active labour market policy*. Introducing time variability of some institutions decreases the coefficient of the investment ratio while *union density*, *coordination* and *active labour market policies* become statistically insignificant while the impact of *employment protection* on unemployment becomes negative. The latter result may reflect the reforms of labour protection legislation through time. In columns (4)-(6), we control for the current account and find that, similar to our results in Table 4, the coefficient of the current account ratio remains insignificant. In the RHS of Table 5 we perform the same regressions after extending our sample to include the crisis years as in Table 2. Columns (7) - (12) confirm our previous result for a decrease in the value of the investment ratio coefficient, which remains negative and statistically significant. The coefficient of the current account ratio in columns (10)-(12) is mostly statistically insignificant although it becomes statistically significant at the 10-percent level when we control for time-variable institutions in column (12). Regarding the impact of institutions on unemployment rate, including the period of Great Recession leads to a statistically significant impact of the *tax wedge* on *unemployment* while *employment protection* becomes insignificant.

Overall, we find that union coverage and the unemployment benefit replacement ratio have a positive and significant coefficient in the regressions of Table 5. Another such variable is the real price of oil, which captures the elevation of unemployment in the mid-1970s and early 1980s. However, we note that investment retains a positive and statistically significant coefficient in all 12 columns and note also that the numerical value of the coefficient of investment is similar across columns. Looking at the R-squares we see that not much is gained from adding the institutional variables since investment alone explains around half the variation in unemployment.

We will now spell out a model that is compatible with the stylised relationship between investment, unemployment, and the current account.

4. A small open economy two-sector model of investment, unemployment and current account

While the mechanism linking investment to unemployment in the medium run is present in a range of models with different types of assets such as trained employees and customers, our investment data only include physical capital. Thus, the two-sector model is relevant for understanding our empirical results. We model increased uncertainty as an increase in the risk premium. Our model is related to that in Kanaginis and Phelps (1994) and Phelps (1994). Moreover, as we are interested also in exploring the relationship between the variation in current account and unemployment movements, we develop here an open economy version of the two-sector model. We assume that there is a non-traded sector producing a pure consumption good that is also relatively capital intensive. The tradable sector produces a good that can be used both for consumption and investment such as in the standard Solow (1956) model. This sector is relatively labour intensive. Consumers have homothetic preferences and devote a fixed share of their expenditure to each good. We introduce endogenous job rationing in general equilibrium by drawing upon an efficiency-wage theory of unemployment; in particular, we adopt the effort-elicitation or shirking model of Shapiro and Stiglitz (1984), extended to allow for worker savings in Brecher, Chen, and Choudhri (2010). To obtain an investment demand function, we introduce installation costs to generate a Tobin's q theory of investment. There is perfect international capital mobility, with world interest rate exogenously given by r^*. To capture the effects of policy uncertainty, we introduce a risk premium μ that requires that the domestic real interest rate be equal to r^*+μ. We let the tradable good be the numeraire.

Figure 2 below shows an upward-sloping wage-setting curve (WS) in the real wage (v) – employment (1-u) space that can be derived from efficiency wage theory, as in Shapiro and Stiglitz (1984), and a downward-sloping labour demand curve. In our model, following Brecher, et al. (2010), the wage-setting curve can be represented by

$$\frac{v}{E} = \frac{\rho+a+b}{g} + 1, \tag{1}$$

where v is the real wage, E is real consumption expenditure, a is the job accession rate, b is the exogenously given job separation rate and g is the probability of being caught if shirking.[7] In turn, assuming that employment adjusts rapidly to equate the outflow from the unemployment pool to the inflow into the unemployment pool, we can write, using $a = \frac{b(1-u)}{u}$, the wage-setting curve:

$$v = [1 + \frac{\rho+b}{g} + \frac{b(1-u)}{gu}]E. \tag{2}$$

To obtain the labour demand curve or the demand-wage curve, we specify the production functions and profit-maximising behaviour of firms selling under perfect competition. Using the subscript "N" to denote non-tradables and "T" to denote tradables, we have

$$v = p_N[f(k_N) - k_N f'(k_N)] = g(k_T) - k_T g'(k_T), \tag{3}$$

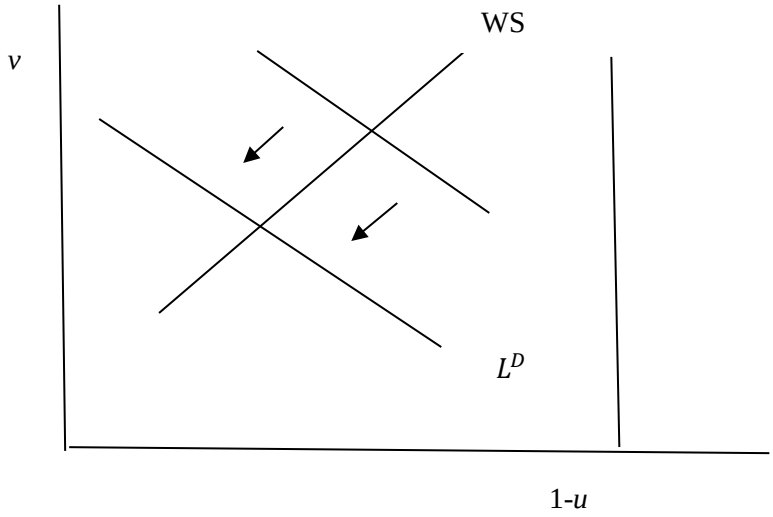
$$R = p_N f'(k_N) = g'(k_T), \tag{4}$$

where R is the user cost of capital, the output of the non-tradable is given by $Z_N = L_N f(k_N)$, $f(k_N)$ being the output per worker expressed as a concave function of capital per worker in the non-tradable sector, and the output of the tradable good is given by $Z_T = L_T g(k_T)$, $g(k_T)$ being the output per worker expressed as a concave function of capital per worker in the tradable sector. A key result of the two-sector model is that the real demand wage is a monotone decreasing function of the relative price of the non-tradable, p_N which is the relatively capital-intensive good. Moreover, given the relative price of the non-tradable, p_N, the user cost of capital, R, is also pinned down. The market-clearing condition for the non-tradable sector, in turn, determines the relative price of the non-tradable. Note that, given the assumption that the non-tradable good sector is relatively capital intensive, a decrease in total domestic capital stock leads to a relatively more expensive non-tradable good and thus increases the user cost of capital. An increase in the risk premium due to an

[7] The equation is taken from Proposition 2 of Brecher, et al. (2010), where we have specialised to the case where exerting effort results in a loss of utility equal to one.

increase in policy uncertainty results in a fall in investment, thus a gradual decline in capital stock, which leads to a higher relative price of the non-tradable good, p_N. This, in turn, increases the user cost of capital and lowers the real demand wage; that is, it shifts the labour demand curve to the left as shown in Figure 2.

Figure 2. Labour market equilibrium



Next, to understand how an increase in policy uncertainty that leads to an increase in risk premium contracts investment, we suppose that the total cost of investing in investment of I is equal to $I + C(I)$, where $C'(I) > 0$ and $C''(I) > 0$. Solving the optimisation of price-taking firms under perfect competition gives rise to

$$C'(I) = q - 1 \tag{5}$$

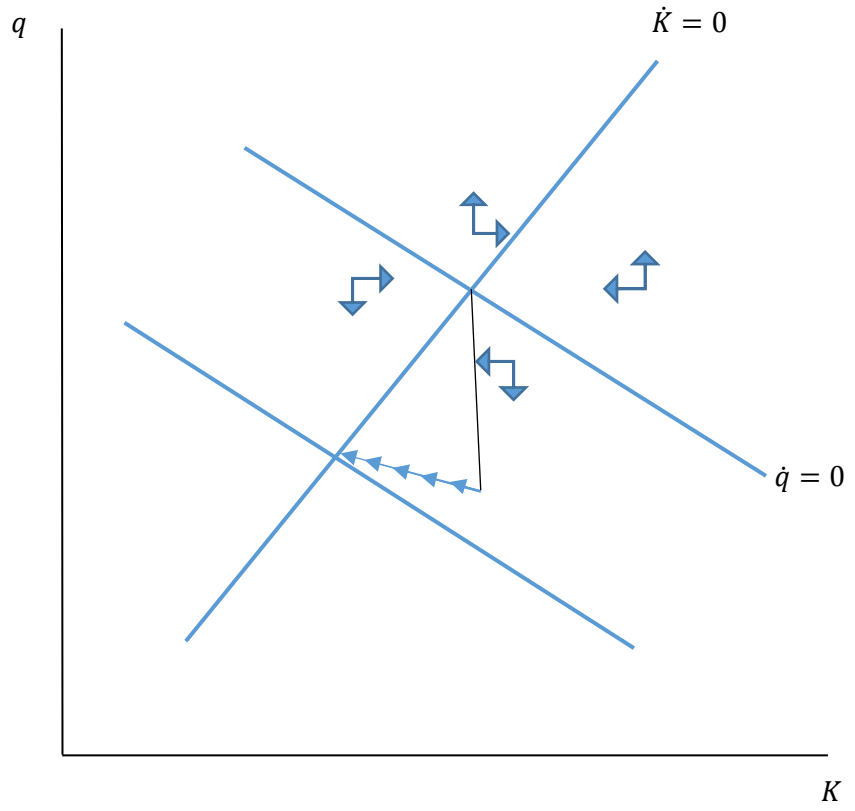
and $I = \Phi(q - 1)$ with $\Phi'(q - 1)>0$. Here, q is the shadow price of capital. The following two equations show the dynamic behaviour of the capital stock resulting from the q theory of investment:

$$\dot{K} = \Phi(q - 1) - \delta \mathrm{K}, \tag{6}$$

$$g'(k_T) = q\left(r^* + \mu + \delta - \frac{\dot{q}}{q}\right) = R. \tag{7}$$

In Figure 3, we show that an increase in policy uncertainty that leads to a rise in risk premium leads to drop in q, which in turn means a decline in investment demand.

Figure 3. Increased uncertainty and the risk premium



Thus an increase in the risk premium leads to a drop in q, lower investment, a reduction in the stock of capital and an increase in the user cost of capital, hence a fall in the real demand wage and an increase in the natural rate of unemployment in Figure 2. Increased uncertainty generates a higher level of the natural rate of unemployment going through a lower price of the labour intensive good, which is the tradable good in our model.[8] The same story could be told if the world real rate of interest r^* increased. Then the relative price of the tradable good would fall worldwide resulting in an increase in unemployment in the world. This was the theme of the Phelps (1994) book and the subsequent papers by Phelps and Zoega (2001) and Fitoussi, et al. (2001).

What is the effect on current account? In Figure 4, we depict an economy that is initially neither a net creditor nor debtor with current account balance. We show that an increase in the risk premium, which in Figure 2 leads to an increase in equilibrium unemployment, shifts the production possibility curve in towards the origin. In Figure 3, this increase in risk

[8] It is theoretically possible that a rise in the risk premium leads to such a drastic drop in q that the user cost of capital R falls. In this situation, however, the fall in investment and any accompanying current account surplus involve a decline in unemployment. This theoretical case does not find empirical support in Bertola (2017) nor in our own empirical work reported above. We could say that the theoretical case where a rise in μ leads to a fall in q that, overall, still leaves R higher and hence unemployment higher finds empirical support.

premium leads to a decrease in investment. While the decline in production of the tradable good and increase in consumption of the tradable good (as consumers shift away from consuming the non-tradable good as p_N increases) tend to lead to a current account deficit, a sufficiently large drop of investment demand can produce a current account surplus as illustrated in Figure 4.[9] This provides a theoretical explanation for why a decrease in investment is found empirically to accompany a rise in unemployment and a current account surplus.

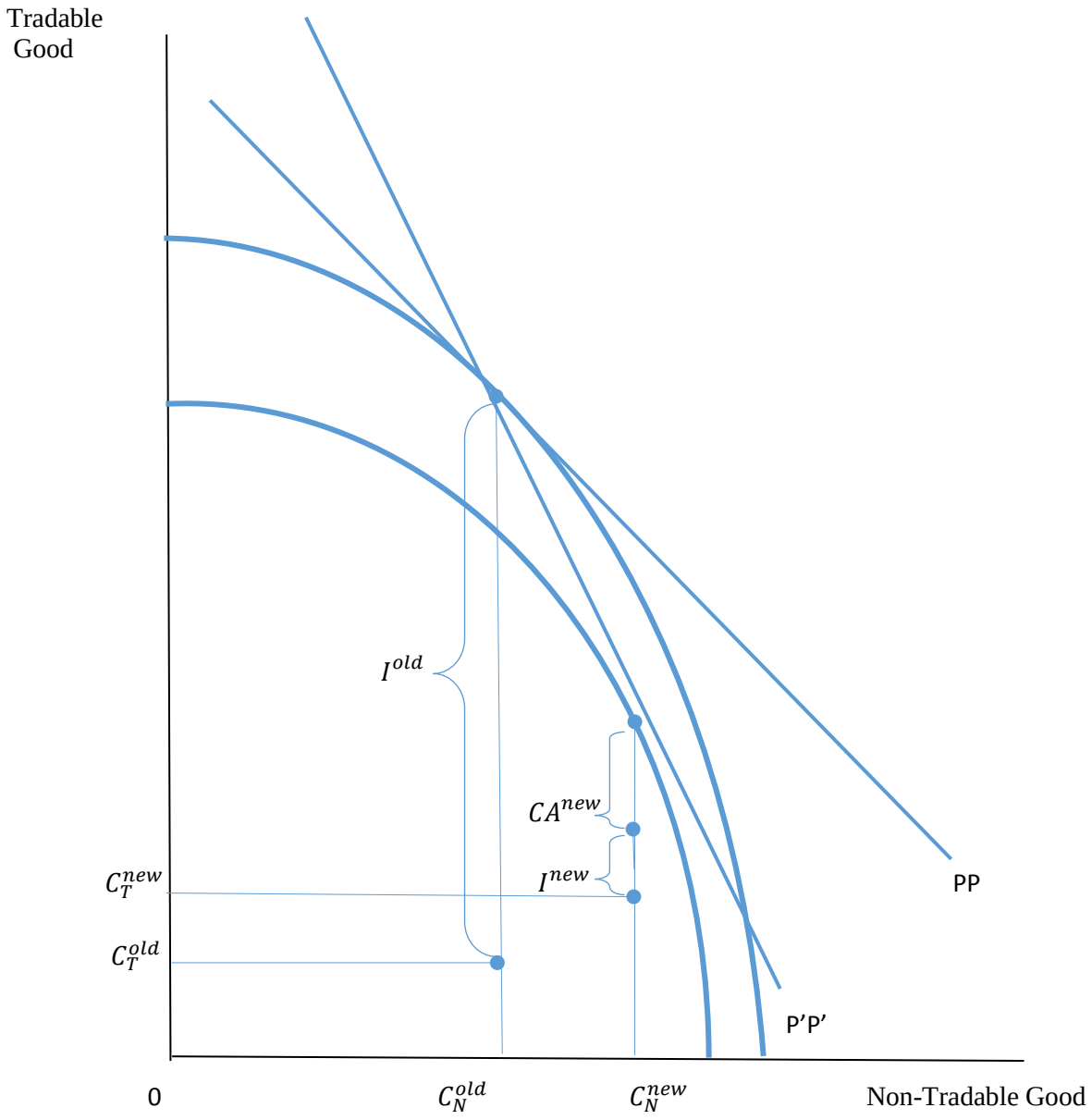
5. Concluding remarks

We find that over a period as long as half a century, a statistically significant negative relationship exists between investment and unemployment. The negative relationship between investment and unemployment can be regarded as a stylised fact even when the years of the financial crisis and the Great Recession are included in the sample as well as traditional institutional variables of the labour market. Our empirical analysis shows that the Great Recession has a direct positive effect on unemployment and reduces the coefficient of investment although the investment coefficient retains its statistical significance at conventional levels. Including the current account surplus in the regression does not change these results. This variable has a positive but insignificant coefficient when investment is also included in the regression. We then develop a small open economy two-sector model that provides a theoretical explanation for this relationship and its link with the current account.

We conclude that the inverse relationship between investment and unemployment remains robust even in the long run and that the statistical relationship going from a rise in current account surplus to higher unemployment is likely to work through investment so that a capital outflow – that is a positive current account surplus – generates lower investment and higher unemployment.

[9] Note that the consumption of the non-tradable good goes up in the figure as it is drawn while the ratio of the consumption of the tradable to the non-tradable good has to increase due to the fall in the relative price of the tradable good. Thus the level of consumption of both goods can increase. However, if the production possibility frontier were to shift sufficiently further inwards the consumption of the non-tradable good would fall.

Figure 4. Effect of an increase in policy uncertainty that leads to increased risk premium



Note: PP is the old price line with slope given by P_N^{old} , P'P' is the new price line with slope given by P_N^{new}, CA^{new} is the new current account surplus, C_T^{old} and C_T^{new} are old and new consumption of tradable good, respectively, C_N^{old} and C_N^{new} are old and new consumption of non-tradable good, respectively, I^{old} and I^{new} are old and new investment demand for tradable good, respectively.

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Appendix

Data appendix

Data for the *unemployment rate*, *investment (% gdp)* and *current account (% gdp)* are from the OECD (https://data.oecd.org). *Real price oil* is the ratio of the price of crude oil in the U.S. to the consumer-price index for that country from U.S. Energy Information Administration. Data on institutions were kindly provided by Giuseppe Bertola. *Coordination* and *Active Labour Market Policie*s are the series of the Blanchard and Wolfers (2000, henceforth BW) data set extended to 2014. Time variant data for the *tax wedge* and *UI replacement rate* are imputed using BW and OECD data. Time variant *union density* comes from the OECD from 1960 to 2014 for most countries. *Employment protection* is the BW employment protection time varying variable from 1960 to 1995 and recent predictors are from the OECD Version 1 (1985-2013) indicators of regular and temporary employment protection. For full details, see Bertola (2017).

Table A1. Unit root tests

	Im-Pesaran-Shin test	Fisher-type unit root test			
	W-t-bar	Inverse chi-sq.	Inverse normal	Inverse logit	Modified inv. chi-sq.
		Unemployment			
Statistic	1.7879	149.2806	-8.4152	-9.0713	12.2179
p-value	0.0369	0.0000	0.0000	0.0000	0.0000
Lags	1.60	2	2	2	2
No of periods	55.80	55.80	55.80	55.80	55.80
		Investment			
Statistic	-23.1455	344.7425	-15.6250	-21.3395	34.0712
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
Lags	0.80	2	2	2	2
No of periods	48.85	48.85	48.85	48.85	48.85
		Investment (%gdp)			
Statistic	-12.7453	253.8645	-12.3322	-15.6879	23.9108
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
Lags	3.20	2	2	2	2
No of periods	46.85	46.85	46.85	46.85	46.85

Notes: For the IPS test, the number of lags are chosen so that the AIC for the regression is minimised. The number of panels is 20 for all cases.

Table A2. Relationship between unemployment and investment in the EU, 1960-2015

	1960-2000				1960-2015							
	5 year averages (1)	5 year averages (2)	Decadal averages (3)	Decadal averages (4)	5 year averages (5)	5 year averages (6)	Decadal averages (7)	Decadal averages (8)	5 year averages (9)	5 year averages (10)	Decadal averages (11)	Decadal averages (12)
Investment (% gdp)	-0.617***	-0.653***	-0.766***	-0.777**	-0.487***	-0.429***	-0.614***	-0.543***	-0.503***	-0.437***	-0.637***	-0.566***
	(-5.30)	(-5.76)	(-3.23)	(-2.98)	(-4.86)	(-4.19)	(-5.06)	(-3.45)	(-4.67)	(-3.78)	(-4.92)	(-3.40)
Current account (% gdp)									-0.008	-0.004	-0.010	-0.009
									(-0.51)	(-0.24)	(-0.75)	(-0.72)
Real price Oil		0.319***		0.295		0.188***		0.143		0.185**		0.142
		(2.81)		(0.89)		(2.42)		(1.06)		(2.34)		(1.03)
N	124	124	49	49	139	139	79	79	139	139	79	79
R^2	0.502	0.538	0.590	0.609	0.476	0.496	0.592	0.599	0.477	0.496	0.594	0.601

Notes: All regressions include country fixed effects. *t* statistics based on robust standard errors clustered at country level in parentheses. * p<.10, ** p<.05, *** p<.01.