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The Financial Crisis: Joblessness and Investmentlessness

Gylfi Zoega

Abstract

Financial crises follow a pattern that consists of changes in asset prices, real exchange rates, investment and employment. One noteworthy feature of this pattern is the “jobless recoveries” that often follow such crises. This was the experience of Finland and Sweden in the aftermath of their financial crises in the early 1990s and currently appears to be the case in the United States and many other countries. The behavior of unemployment during the crises mirrors that of investment, which is consistent with models of the natural rate of unemployment that make labor demand depend on investment in physical capital, new workers and customers. The implication is that the natural rate of unemployment falls during the investment boom that precedes a crisis and rises in its aftermath.

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The emerging recovery in the United States has not generated robust employment growth. The OECD states in its recently published *Employment Outlook* (2010) that unemployment levels are set to remain high amid fears that some elements of joblessness could become entrenched when cyclical unemployment becomes structural, leaving the unemployment rate in its member states above 8% at the end of 2011. In their analyses of the labor market consequences of the global financial crisis, economists have reverted to ideas and models generated in the 1980s which show how recessions can generate persistent elevations of unemployment through hysteresis channels.¹ Moreover, a concern about such persistence effects has guided policies in many countries. In this paper we will take a look at data from the Nordic financial crises in the 1990s. In particular, we will show how collapsing investment coincides with rising and persistent unemployment during a financial crisis and how employment does not start to recover until investment picks up again. The sluggish performance of today's labor markets would not come as a surprise to those familiar with these earlier episodes.

1. Output and unemployment

The relationship between output growth and changes in unemployment is weak in the current crisis. Table 1 below shows average unemployment in 2007 and 2009 for the OECD countries, investment (gross capital formation) as a share of GDP for the same years and average annual growth of real GDP in 2008 and 2009. We note the sizeable increase of unemployment in many countries, such as Ireland, Spain and the U.S. However, judged by the output figures the slump is much more widespread. Output fell significantly in Finland, where unemployment has not increased very much, and the same applies to Hungary, Italy and to some extent the U.K. Comparing the U.K. and the U.S., output has fallen further in the U.K., but unemployment has increased more in the U.S. Regressing the change of unemployment from 2007 to 2009 on cumulative output growth in 2008 and 2009, shown in the last column of the table, gives a coefficient of -0.31, which is statistically significant, with an R-squared of 0.24. Factors other than the output slump appear to explain most of the variation in the rise of unemployment across countries.² Note that the three countries that suffered the greatest increase of unemployment – Spain, Ireland and Iceland – also suffered a big fall in investment.

¹ See Elsy et al. (2010) and Nickell (2010), amongst others.

² Gordon (2010) also finds that the relationship between growth and changes in unemployment has become weaker in the United States since the late 1980s so that employment responds more (and productivity less) to changes in output. He attributes this observation to changes in the labor market that have made firms increasingly treat workers as disposable commodities.

Several factors have been mentioned as possible explanations for the differential unemployment response. Different policy responses are the most prominent explanation, such as the German jobs subsidy program for part-time workers (Kurzarbeiter Geld) and the distinction between countries that experienced a housing boom and financial turbulence domestically – such as Ireland, Spain, and the U.S. – and those that were indirectly affected through the fall in global trade – such as Germany and Japan. Much emphasis is put on designing policies that will reduce long-term unemployment.

In a recent paper Nickell (2010) argues that it is most important to ensure the attachment of workers to the labor force. These involve subsidizing worker retention, not offering incentives to retire early or enter long-term disability, making the unemployed participate in activation programs, and organizing national apprenticeship systems. Similarly, Bell and Blanchflower (2010) describe the large differences that exist between countries in terms of the response of unemployment to the current slowdown and attribute this to different policy responses, such as job subsidies and the use of automatic stabilizers such as tax credits to facilitate labor market adjustment. Andersen (2010) discusses the importance of cohort-specific persistence; how high unemployment for a given age group can affect labor market prospects for the remainder of working life. He concludes that policies to prevent long-term unemployment become important in recessions and mentions as examples wage subsidies targeting particular groups, work sharing arrangements and active labor market programs.

2. Nordic lessons

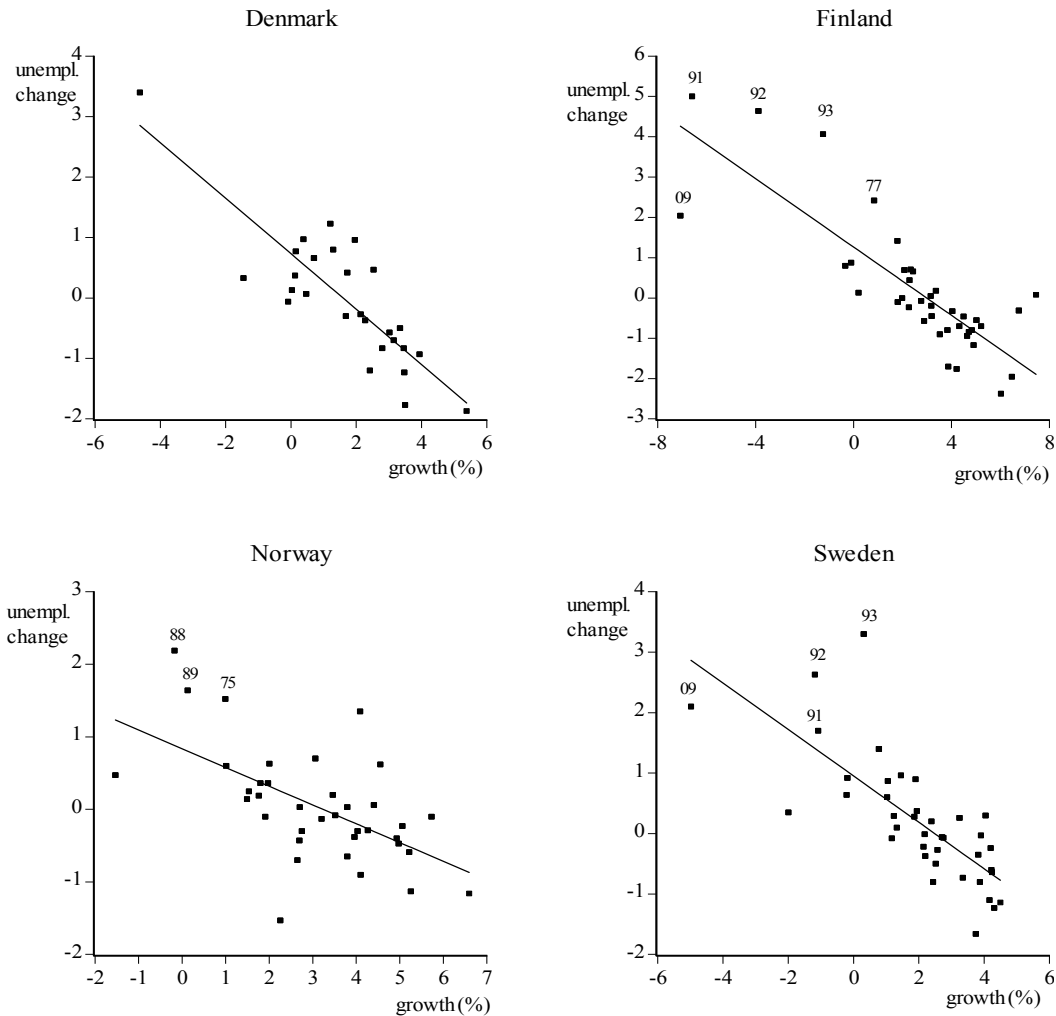
The absence of a strong Okun relationship during the current recession and a large and persistent increase in unemployment during the current financial crisis would not have come as a surprise to anyone familiar with the Nordic crises at the beginning of the 1990s. Figure 1 shows the Okun relationship between the change of unemployment and economic growth for Denmark, Finland, Norway and Sweden. Of these four countries, Denmark escaped the financial crises entirely, Norway suffered a mild version, Sweden a more severe crisis and Finland suffered the deepest financial crisis of the four countries. Note that the years 1991-1993 in Finland and Sweden are outliers in that unemployment rose much more than what should have been caused by the fall of output. Moreover, the positive outliers are not matched by any negative ones – unemployment did not drop significantly following the crises – and has still not reached its 1980s levels in either of the two countries.

Table 1. Output and unemployment 2007-2009

	Unemployment (%)			Investment (% of GDP)			Real GDP growth (%)		
	2007	2009	Δ	2007	2009	Δ	2008	2009	08+09
Australia	4.37	5.58	1.20	28.43	28.65	0.22	2,14	1,35	3.52
Austria	4.43	4.81	0.37	21.85	20.75	-1.09	2,05	-3,46	-1.48
Belgium	7.48	7.86	0.38	21.73	21.36	-0.38	1,04	-3,02	-2.01
Canada	6.01	8.27	2.26	22.29	21.77	-0.52	0,52	-2,46	-1.96
Czech Rep.	5.34	6.66	1.32	25.18	22.44	-2.74	2,46	-4,12	-1.76
Denmark	3.77	6.02	2.25	22.26	18.63	-3.63	-0,87	-4,74	-5.57
Finland	6.88	8.23	1.36	21.34	19.77	-1.57	1,21	-8,03	-6.92
France	8.35	9.48	1.13	21.58	20.64	-0.94	0,22	-2,63	-2.42
Germany	8.37	7.48	-0.88	18.80	17.86	-0.94	1,26	-4,93	-3.73
Greece	8.30	9.50	1.20	21.36	16.80	-4.56	2,02	-1,96	0.01
Hungary	7.36	10.01	2.65	21.18	20.02	-1.15	0,64	-6,32	-5.72
Iceland	2.30	7.23	4.93	28.51	14.12	-14.39	0,96	-6,49	-5.59
Ireland	4.57	11.89	7.33	26.03	15.58	-10.45	-3,55	-7,58	-10.86
Italy	6.15	7.73	1.58	21.20	18.90	-2.30	-1,32	-5,04	-6.29
Japan	3.85	5.07	1.22	22.94	20.59	-2.35	-1,20	-5,24	-6.38
S. Korea	3.23	3.64	0.41	28.53	29.31	0.78	2,30	0,20	2.50
Mexico	3.72	5.46	1.75	21.42	21.81	0.39	1,49	-6,54	-5.15
Netherlands	3.18	3.42	0.23	19.98	18.88	-1.10	1,88	-3,92	-2.11
New Zeal.	3.68	6.13	2.45	23.16	21.78	-1.38	-0,17	-1,64	-1.81
Norway	2.52	3.15	0.63	22.18	21.40	-0.78	1,82	-1,64	0.14
Poland	9.65	8.20	-1.45	21.56	21.00	-0.56	5,13	1,75	6.97
Portugal	8.13	9.63	1.49	21.82	19.02	-2.79	-0,03	-2,58	-2.62
Slovakia	11.15	12.01	0.86	26.15	23.60	-2.56	6,17	-4,66	1.22
Spain	8.28	18.04	9.77	30.73	24.42	-6.31	0,86	-3,64	-2.81
Sweden	6.12	8.33	2.21	19.58	17.87	-1.70	-0,41	-5,14	-5.53
Switzerland	3.62	4.35	0.73	21.54	20.45	-1.10	1,90	-1,45	0.42
Turkey	8.83	12.55	3.72	21.42	16.84	-4.58	0,66	-4,74	-4.12
U.K.	5.29	7.57	2.28	18.31	13.88	-4.43	0,55	-4,92	-4.40
U.S.	4.62	9.25	4.63	19.40	15.88	-3.52	0,44	-2,44	-2.01

Source: OECD.

Figure 1. The Okun relationship in Nordic countries



The figure plots the Q4 to Q4 change in unemployment against the annual rate of output growth. A regression of changes in unemployment on output growth gives an Okun coefficient of -0.32 ($t=11$) and significant dummy variables for the first three years from the start of the financial crisis (1991-1993 in Finland and Sweden and 1987-1989 in Norway). A statistically significant fall of unemployment – beyond that predicted by output changes – only occurs in year eight after the start of the crisis.

The Finnish economist Seppo Honkapohja (1999) proposed an explanation for the persistent elevation of unemployment in Finland following its financial crisis. He attributed the elevation to high levels of business debt, which make firms increase markups of price over marginal cost. Higher markups then raise the natural rate of unemployment by lowering the demand wage when real wages are rigid. In contrast, a high level of household debt would force workers to accept wage cuts – their bargaining position weakened – which would tend to lower the natural unemployment rate. The natural rate of unemployment would go up if the first effect dominated the second, which Honkapohja found using data from Finland. However, while the Honkapohja hypothesis is potentially capable of explaining persistently high unemployment, it does not explain other stylized facts of financial crises, such as the fall in house prices, the fall in share prices, and output recovery before unemployment starts its downward descent.³

Table 2 shows some additional labor market data for the Nordic countries: unemployment rates from 1989 to 2000, as well as investment as a ratio to GDP, real exchange rates, stock prices, house prices, unit labor costs, real wages and the share of labor in national income.⁴ Unemployment tends to be low when the crisis hits and rises very rapidly once the crisis starts. It tends to increase for a number of years and remain high for many years afterwards. As the table shows, unemployment in Finland did not start to decline until 1995, four years after the beginning of the crisis, and has remained higher than pre-crisis levels. We can see a similar pattern in Norway and Sweden, although the changes in the Norwegian data are less dramatic because Norway's financial crisis was milder.

It is revealing to show the pattern of other labor market variables in the Nordic crises. *Labor's share of output* goes up during the bubble economy that precedes a financial crisis and then falls rapidly to much lower levels, where it remains for many years. In Finland, the share of labor of national income was 76% in 1991 but was still lower in 2008 at 64%. In spite of rising consumer prices following the depreciation of the currency we find that *money wage growth* is very limited. The absence of second-round effects in the labor market prevents a price-wage spiral from arising, which ensures a slow but certain (price)

³ See Reinhart and Rogoff (2009) on the drawn-out fall of house and share prices that coincides with the deteriorating labor market. There is a lengthy fall in house prices (average of 6 years) and share prices (average 3.4 years) while output reaches a trough much sooner (1.9 years on average). The real price of houses declines by 35.5% on average from peak to trough with a duration of 6 years. The real price of shares falls by 55.9% on average from peak to trough with a duration of 3.4 years. Gross domestic output declines by 9.3% on average from peak to trough with a duration of 1.9 years. Unemployment increases by 7% with a duration of 4.8 years. Public debt rises by 86%, mostly due to fiscal deficits during the crisis, but also due to the cost of bailing out the banking system.

⁴ Note that Norway's crisis started in 1987 while those in Finland and Sweden started in 1991.

disinflation.⁵ Rising labor productivity and wage moderation generate falling *unit labor costs* that improve competitiveness in addition to the effect of a depreciation of the real exchange rate. Both help turn a current account deficit into a surplus. In Finland, unit labor costs fell by more than 15% from 1991 to 1997.

Changes in asset prices, in particular *real share prices*, precede changes in employment and investment in the medium term. When asset prices collapse we see the unemployment rate move up to a higher plateau and *investment* drop to a lower plateau. Unemployment only starts to fall once investment starts to recover. Unemployment in Finland started its downward path in 1995 and investment as a share of GDP also started its recovery in that year while stock prices and house prices started to recover in 1993 and 1994 respectively. The fall of real exchange rates during the crisis is often met with relief since the high real exchange rates during the bubble economy have made export- and import-competing industries uncompetitive. However, lower real exchange rates may affect the supply side of the economy adversely and raise the natural rate of unemployment.⁶ Thus unemployment continued to rise when the real exchange rate in Finland fell between 1990 and 1994.

3. Investment and unemployment

An important lesson to be drawn from the Nordic crises is that rising unemployment coincides with falling investment and the recovery of employment coincides with the recovery of investment. This evidence is consistent with the general finding of a medium-term relationship between real share prices, investment and employment.⁷ During financial crises there is also a pattern in the movements of real exchange rates and unemployment: unemployment rises as long as real exchange rates fall.

⁵ Clearly, a monetisation of the public deficit could turn out to be inflationary. This did not occur in the Nordic countries in the 1990s.

⁶ See Hoon et al. (2005).

⁷ See Fitoussi et al. (2000) and Phelps and Zoega (2002) on the relationship between real share prices (normalized by labor productivity) and unemployment and Smith and Zoega (2007, 2008) on the relationship between investment and unemployment.

Table 2. Labour markets in the Nordic countries

		89	90	91	92	93	94	95	96	97	98	99	00
Denmark	Unemployment (%)	8.23	8.41	9.21	9.10	10.81	8.13	7.13	6.99	6.16	5.51	5.58	4.64
	Investment (%)	20.50	19.50	18.63	17.63	16.91	17.20	18.38	18.58	19.60	20.44	19.79	20.18
	Real exch. Rates	93.01	96.81	93.07	93.63	94.36	94.10	97.49	96.07	93.58	95.75	95.82	92.52
	Stock prices	100.00	107.76	104.54	87.91	89.76	103.11	97.27	111.61	155.46	177.61	167.65	220.27
	House prices	–	–	–	100.00	98.05	107.34	113.03	122.77	133.78	142.94	149.13	154.28
	Real wages	100.00	101.07	102.05	103.13	102.70	103.64	106.24	109.74	111.94	116.17	118.51	120.42
	Unit labour cost	103.00	102.00	102.00	101.00	100.00	96.00	96.00	96.00	95.00	97.00	97.00	94.00
	Labour share (%)	70.66	69.81	69.11	68.64	68.48	66.29	66.58	67.37	66.92	68.96	69.05	67.11
Finland	Unemployment (%)	3.11	3.19	6.67	11.73	16.42	16.63	15.45	14.63	12.68	11.40	10.24	9.81
	Investment (%)	29.77	28.69	24.44	20.10	16.70	15.83	16.57	17.08	18.32	19.00	18.98	19.36
	Real exch. Rates	138.60	142.51	135.85	117.27	98.00	101.74	109.26	102.87	99.19	100.84	100.66	96.44
	Stock prices	100.00	68.61	47.67	37.43	58.47	86.42	88.59	93.85	145.54	203.20	345.79	639.37
	House prices	100.00	89.06	73.65	59.50	53.21	55.75	53.22	55.80	64.79	70.41	75.80	77.74
	Real wages	100.00	102.65	98.90	91.42	84.61	85.34	89.51	92.55	95.97	100.82	104.38	107.08
	Unit labour cost	107.00	109.00	112.00	108.00	100.00	97.00	98.00	97.00	95.00	95.00	95.00	92.00
	Labour share (%)	71.46	72.85	76.45	74.73	69.68	67.68	65.75	66.30	64.67	63.14	63.12	61.73
Norway	Unemployment (%)	5.00	5.32	5.55	6.01	6.06	5.47	4.97	4.88	4.07	3.23	3.25	3.48
	Investment (%)	25.16	20.92	19.88	18.97	19.58	19.84	19.79	20.20	21.96	25.00	21.94	18.42
	Real exch. Rates	88.16	87.18	82.59	74.82	76.53	80.65	86.44	91.66	93.17	83.09	79.11	71.82
	Stock prices	100.00	116.69	92.46	74.56	93.39	116.08	122.82	146.64	207.38	186.72	175.24	218.68
	House prices	–	–	–	100.00	98.61	110.03	115.24	124.33	135.34	147.12	159.86	213.68
	Real wages	100.00	99.23	99.90	101.11	100.91	104.02	107.22	112.73	118.63	127.35	132.36	135.28
	Unit labour cost	111.00	108.00	105.00	103.00	100.00	98.00	97.00	97.00	97.00	102.00	104.00	103.00
	Labour share (%)	65.07	63.31	62.68	63.45	61.95	62.25	61.59	59.86	59.64	64.50	62.81	54.50
Sweden	Unemployment (%)	1.62	1.81	3.26	5.83	9.48	9.78	9.22	9.98	10.19	8.47	7.17	5.86
	Investment (%)	23.70	23.40	20.87	18.28	15.44	15.26	15.72	15.94	15.47	16.25	17.05	17.62
	Real exch. Rates	124.27	129.24	135.17	135.19	110.99	109.44	108.61	116.91	111.03	108.06	106.05	104.60
	Stock prices	100.00	86.02	72.07	60.13	75.16	93.76	101.85	123.41	178.79	206.87	238.79	352.27
	House prices	100.00	101.51	99.25	88.10	74.78	76.52	75.04	75.09	79.96	87.75	95.40	104.78
	Real wages	100.00	101.84	97.95	94.53	88.69	91.15	92.81	98.14	101.09	105.46	108.65	117.90
	Unit labour cost	–	–	–	–	100.00	99.00	96.00	100.00	100.00	100.00	99.00	102.00
	Labour share (%)	70.75	72.59	73.08	72.34	69.63	68.34	65.48	67.68	67.16	67.16	65.80	67.88

Source: Labour share, OECD; stock prices (real), OECD; house prices (real), Denmark: Statistics Denmark, Finland: Statistics Finland, Norway: Statistics Norway, Sweden: Statistics Sweden; real wages, OECD (compensation of employees) and IFS (CPI). Unit labour cost (real), OECD, level in 1993 normalised at 100

Figure 2 below shows the relationship between investment (share of GDP) and real exchange rates, on the one hand, and the rate of unemployment, on the other hand, for Denmark, Norway, Finland and Sweden. The shift to a lower level of investment and real exchange rates and higher unemployment are obvious in the figures for Finland and Sweden. Figure 3 is a difference-in-difference graph, using Denmark as a benchmark country since Denmark managed to escape the early 1990s Nordic financial crises.

By taking into account the relationship between unemployment and investment in the Nordic episode one can better account for differences in labor market performance in the current episode. Table 3 below shows a regression of changes in average unemployment from 2007 to 2009 in the 29 countries listed in Table 1 on the growth of real GDP and the change in the share of investment (gross capital formation) as a share of GDP using the data presented in the table.

Table 3. Okun relationship revisited

	(1)	(2)	(3)
Constant	1.18 (3.35)	0.70 (2.06)	0.53 (1.72)
GDP growth	-0.31 (3.76)		-0.13 (1.62)
Investment (change)		-0.49 (3.21)	-0.43 (2.56)
Observations	29	29	29
R-squared	0.23	0.48	0.51

White Heteroskedasticity-Consistent Standard Errors & Covariance.

Differences in the rate of growth of real GDP in 2008 and 2009 across countries explain only 23% of the variation in the increase of the unemployment rate from 2007 to 2009 while differences in the investment-GDP ratio explain 48% of the variation. The investment variable prevails when both regressors are included. Changes in investment do a better job at explaining differences in the increase of unemployment between the counties.

Figure 2. Investment, real exchange rates and unemployment

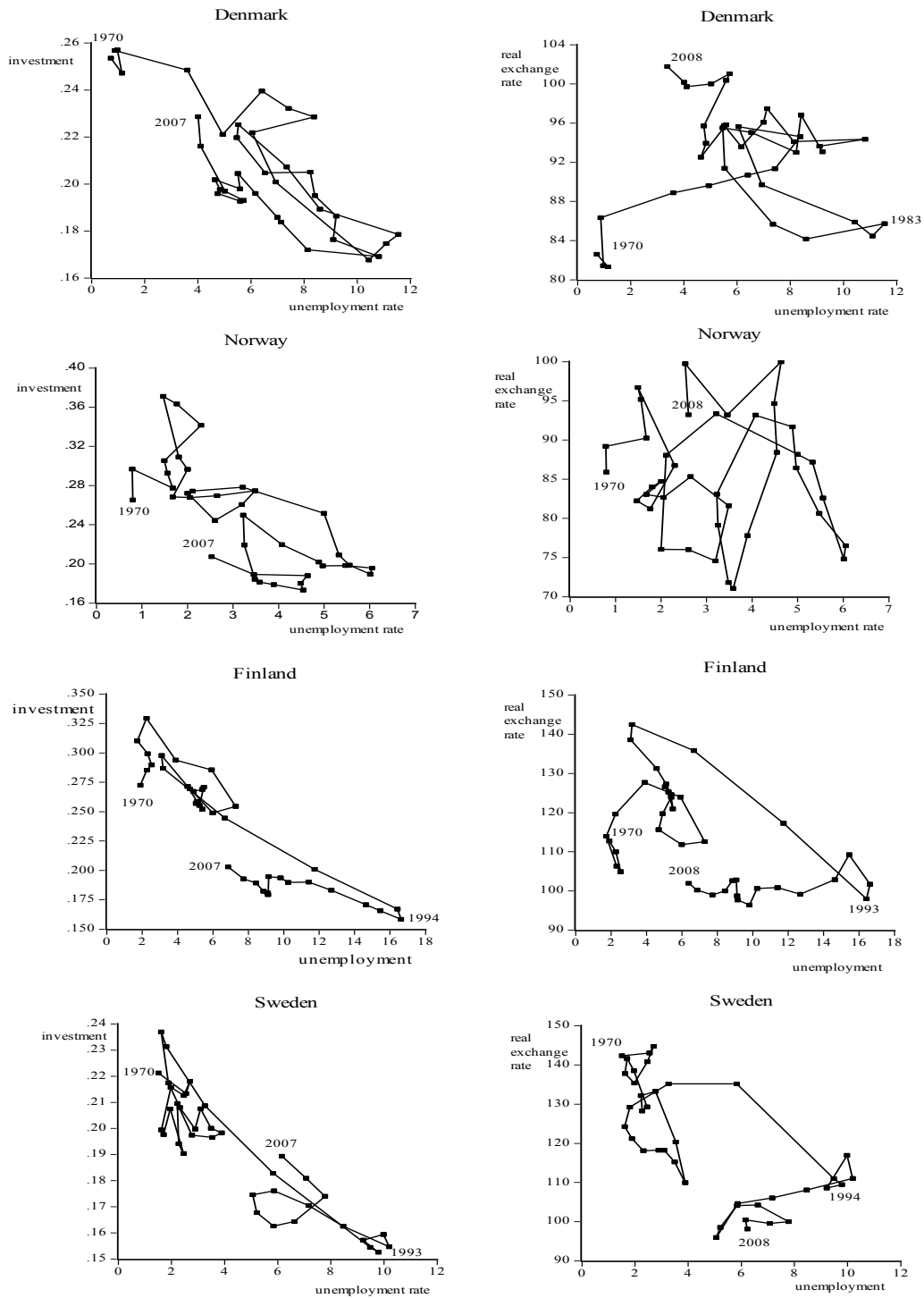
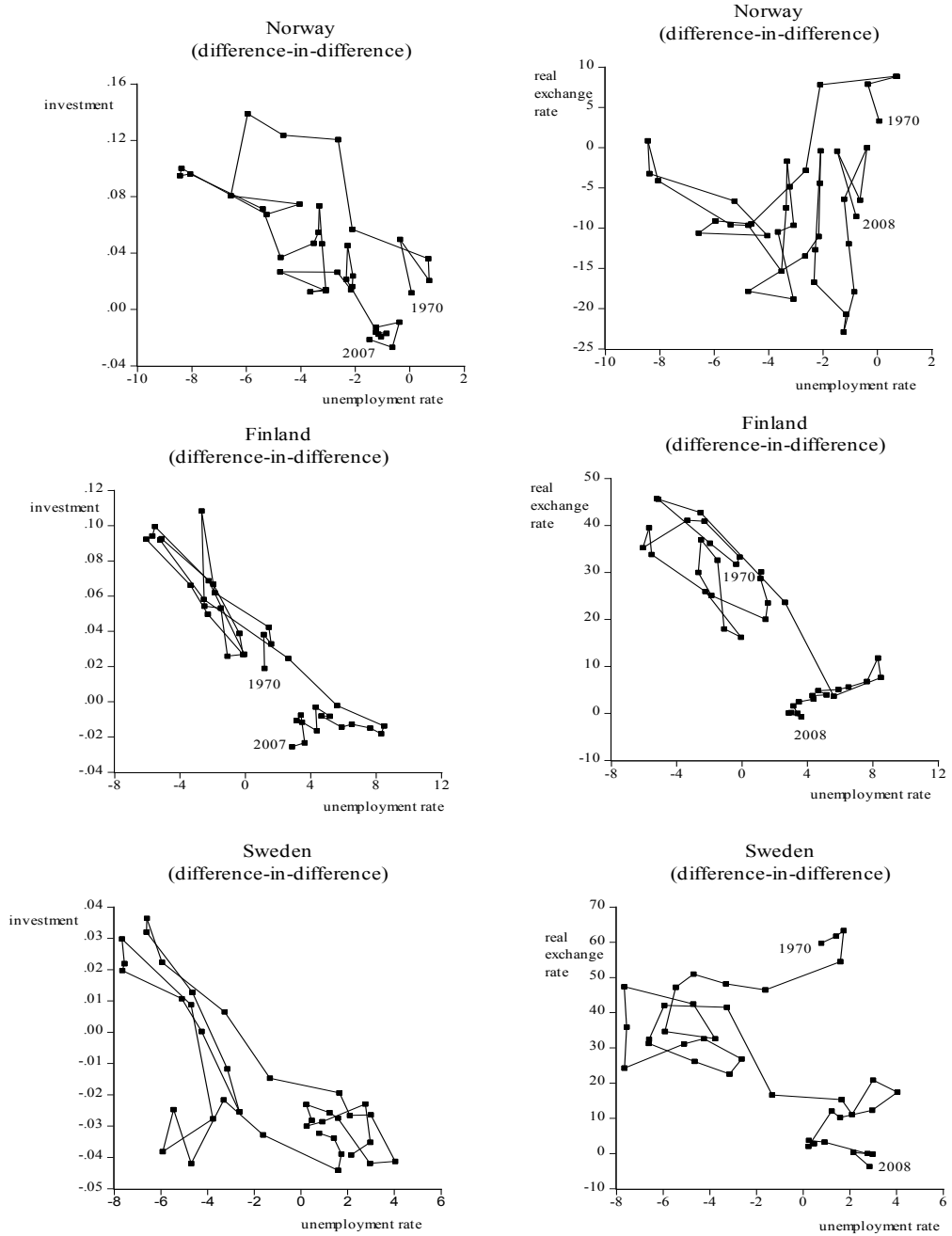


Figure 3. Difference in differences.



All variables measured in differences from Denmark.

4. Accounting for the investment-unemployment relationship

The investment – employment relation found in the data is consistent with a number of macroeconomic models. In Keynes's General Theory, investment determines demand, which determines unemployment. The evolution of unemployment was determined by the dynamics of investment, driven by the state of confidence in expected returns on production. Unfortunately, these insights were mostly forgotten by mainstream theory⁸ but are now being rediscovered. In contrast, New Keynesian models assume that labor market institutions determine the natural rate of unemployment and ignore investment as a factor behind the problem of persistently high unemployment. The problem of persistently high unemployment in some OECD member countries is then traced to labor market institutions. Such is the flavor of the papers on the current crisis cited above.

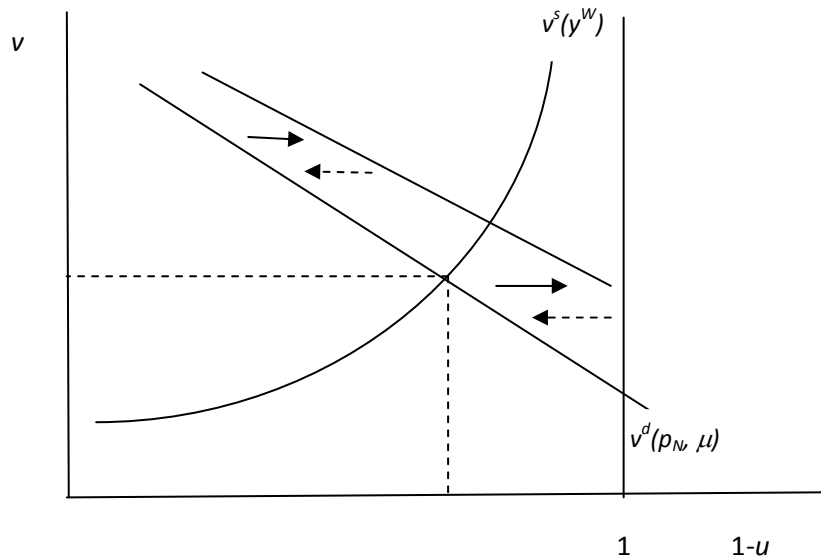
Some recent models of the natural rate of unemployment bring back to life the idea that expectations affect investment and have a long-run effect on the labor market. In the book *Structural Slumps*, Edmund Phelps (1994) lays out three basic models where investment affects the natural rate of unemployment. Firms can invest in new capital; they invest in the training of new workers; and in the customer market model they invest in new customers by offering lower markups. When the value of a trained employee increases compared to the cost of training a worker, we expect firms to increase their rate of hiring which lowers unemployment in the presence of real wage rigidity. Also, when the value of a customer goes up – because firms can expect each customer to buy more goods in the future – firms may respond by cutting markups in order to invest in a larger market share in the future. Lower markups are tantamount to a higher real demand wage which lowers the rate of equilibrium unemployment. Finally, in a two-sector model where one sector produces a tradable consumer good and the other a non-tradable investment good (where the former is capital intensive and the latter labor intensive), an increase in the relative price of the non-tradable investment good will raise the real demand wage and employment. This functions according to the Stolper-Samuelson theory of international trade. The recent construction booms in Ireland, Spain and the United States provide good examples of this effect.

From the three structural models it follows that expectations of future profits raise labor's current rewards. Expectations of higher profits per worker, per customer or per unit of installed capital equipment cause firms to train more workers and offer higher wages; lower markups of price over marginal costs raise real wages; and increased demand for new capital equipment raises labor demand and real wages. A higher real demand wage v^d then makes the structural or natural

⁸ Blanchard (2000) expressed his surprise at discovering a medium-term relationship between investment and unemployment by labelling it the "Modigliani Puzzle".

rate of unemployment fall, which shows up as a rightward shift of the price-setting curve in the figure below where the price-setting curve intersects a wage-setting curve v^s in equilibrium.

Figure 4. Labor market equilibrium



In the period that precedes a financial crisis we typically find credit expansion, low interest rates, rising asset prices and optimism about future profitability. During this period we can expect firms to invest in physical capital, workers and an expanded market share. During the financial crisis itself the cost of capital goes up and its availability falls. The labor demand curve shifts back toward its original position and may overshoot it, which generates unemployment until firms resume their investment in workers, customers and capital. Real wages fall, unemployment rises and labor will get a smaller share of national income.

It is in this framework that we can best understand the Honkapohja and Koskela (1999) analysis. These authors argued that high business leverage forced firms to raise markups of price over marginal cost, which caused the natural rate of unemployment to go up due to real wage rigidity.⁹ Intuitively, firms that are concerned about their market share become more focused on the present – and less focused on the future – the higher their level of business debt; high levels of debt increase bankruptcy risk. A firm that is fighting for its survival is likely to

⁹ Using data from the American supermarket industry, Chevalier and Scharfstein (1996) find empirical support for the hypothesis that business debt raises markups.

raise prices in order to increase current profits and cash flows even if this may cause it to lose some customers to other firms in the future because its present indebtedness causes it to discount the future heavily. Honkapohja and Koskela also find that higher real interest rates raise markups, which can also be explained by firms discounting the future at a higher rate.

Jonung, Söderstöm and Stymne (1996) describe the role of balance sheet adjustments in reducing investment. They also describe the structural distortions in the pre-crash economy where sectors that rely on low real interest rates and high real exchange rates expand at the expense of other sectors. The construction sector, the retail sector and the financial sectors are the primary examples, all expanding at the expense of the manufacturing sector. When real interest rates rise and the real exchange rates fall these sectors must contract, generating unemployment while workers are gradually absorbed by the now expanding manufacturing sector. But these authors miss one important point, which is that the factor intensities of the sectors differ; with the non-tradable sectors generally more labor intensive and manufacturing more capital intensive. As Phelps (1994) shows, when the relative price of the labor intensive sector's output falls, it follows that the real demand wage falls and the natural rate of unemployment goes up, once the sectoral adjustment is complete.

It follows that a financial crisis may increase the natural rate of unemployment even if all labor market institutions are unchanged.¹⁰ Countries that suffer big falls in investment can expect to have high rates of unemployment for a number of years. It does not really matter whether the expectations of future profits that generated the preceding investment boom are rational or not. The expectations of a promising future will bring rewards to labor in the form of low unemployment, high wages and a large share of national income. We now move on to explore the relationship between investment and unemployment further within the Phelps (1994) framework.

5. Financial boom and bust in a two-sector model

The two-sector model can be summarized by a set of two differential equations showing the movements of capital K and its shadow price q over time.¹¹ The growth of capital is equal to the difference between non-tradable capital output Y_N and depreciation δK ,

$$\dot{K}_t = Y_N(q, \dots) - \delta K_t \quad (1)$$

¹⁰ Nickell (1999) studied labor market institutions in Finland and compared them to those of other OECD countries. He found that the natural rate of unemployment should be around 6% but in fact unemployment in Finland did not reach this level until 2007.

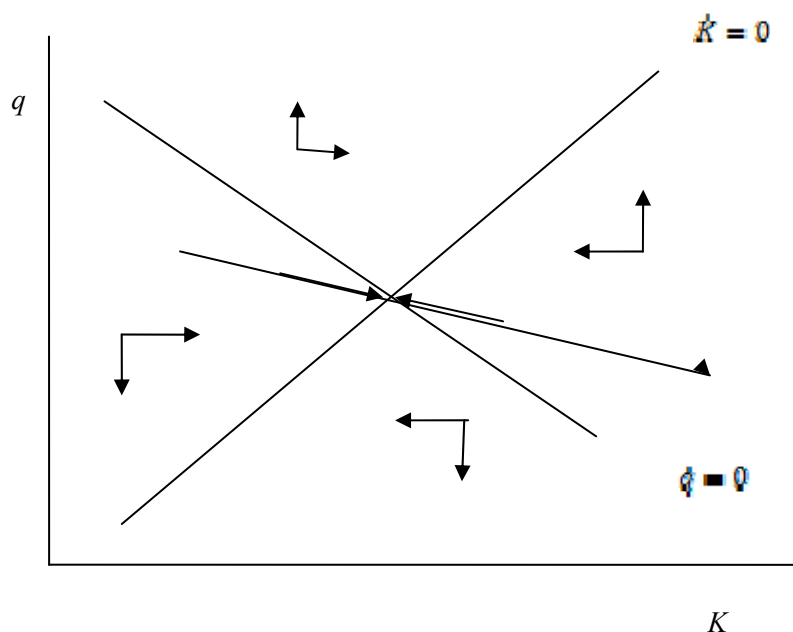
¹¹ This section draws on Hoon and Phelps (2002, 2007).

where the output of the capital-goods sector depends positively on the shadow price q of capital in the tradable goods sector amongst other variables. The shadow price of capital is determined by the following equation

$$(r^* + \delta)q = A_T f'(K, ..) + \dot{q} \quad (2)$$

where A_T denotes the level of technology in the tradable sector and $A_T f(\cdot)$ the production function in the tradable goods sector. The steady-state value of q depends negatively on the world real rate of interest r^* . The general equilibrium is shown in Figure 5 below.

Figure 5. General equilibrium in the two-sector model



The *K-schedule* schedule slopes upwards because a higher level of q raises the output of capital which requires the stock of capital to increase for steady state. The *q-schedule* schedule slopes downwards because an increase in the stock of capital lowers the marginal product of capital which lowers the shadow price of capital.

Changes in the world real rate of interest r^* make the *q-schedule* shift by changing the rate at which future marginal productivity is discounted. One can model the boom that precedes a financial crisis by a fall of r^* – representing access to cheap capital – and the reversal that leads to the financial crisis by a rise of r^* – limited access and high cost of capital.

The expansion that precedes a financial crisis is generated by easy access to capital at low interest rates. This can be shown to temporarily raise potential output by making the natural rate of unemployment fall. A “Great moderation” will then become possible by a combination of high growth, low unemployment and moderate inflation. In the phase diagram below this is shown by an upward shift of the *q-schedule*, which makes the shadow price of capital jump to a new saddle path. The higher value of *q* represents the higher value of capital in the tradable goods sector, which increases the demand for the output of the non-traded capital goods industry. Because the capital goods industry is labor intensive this results in higher real demand wages – the labor demand curve in Figure 4 shifts up – and a fall in the natural rate of unemployment. Subsequently, we move along the new saddle path towards a new equilibrium.

The onset of a financial crisis is then caused by a rise in r^* which represents a higher cost of capital and sometimes a reversal of capital flows or a sudden stop.¹² This shifts the *q-schedule* back down – normally further down than its initial position – and makes the shadow price of capital *q* fall in the consumer-good sector. The fall in the shadow price lowers the demand for capital, which lowers the real exchange rate and also lowers the demand wage and raises unemployment.¹³

Changes in the foreign real rate of interest affect the natural rate of unemployment over the boom-bust cycle by affecting the demand for output of the labor-intensive non-traded sector. The structure of demand matters. During the preceding boom, the demand for non-tradable output goes up and also the demand wage and unemployment falls. There is a non-inflationary boom. When access to foreign capital is curtailed, the non-traded sector contracts and the natural rate of unemployment increases.¹⁴

The slump is even more severe when balance sheets are damaged. With damaged balance sheets, caused by the fall in asset prices and the effect of currency depreciation on the domestic-currency value of debt incurred in foreign

¹² See Calvo (1998).

¹³ There is a subsequent fall in the use of capital in the tradable sector that lowers the real exchange rate further. Hence, the real demand wage and unemployment further increase as we approach a new steady state.

¹⁴ Two accompanying papers by Phelps (2010) and Hoon (2010) in this volume describe the employment effects of a housing boom; in particular how a housing boom can lead to a transient fall in the natural rate of unemployment followed by an increase due to the previous overinvestment in housing.

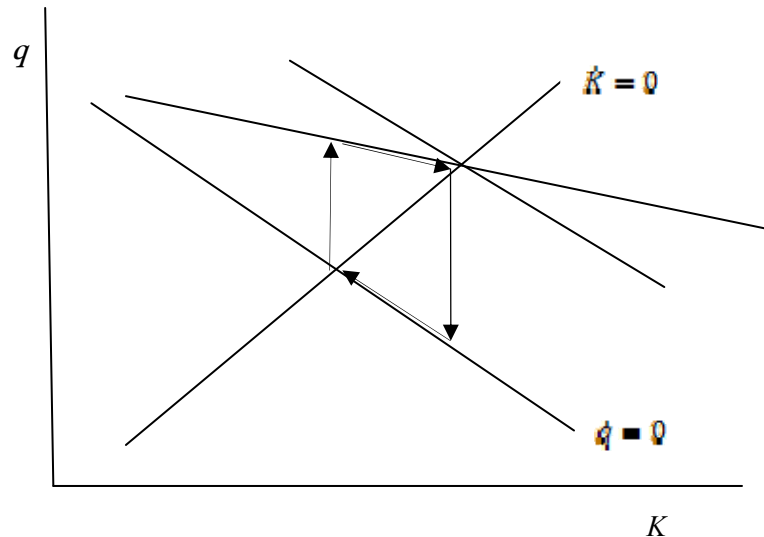
currencies, firms in the tradable sector take into account the effect of investment decisions on balance sheets. The cost of investment now consists of the real price of capital goods, measured in tradable goods, and the marginal balance sheet effect.¹⁵ The more distressed the balance sheets, the lower the investment demand. This lowers the real price of capital and the real demand wage further, further raising the natural rate of unemployment. Pessimism about future productivity levels exacerbates the slump. Previous expectations of high levels of productivity may now suddenly be seen as unrealistic. This further depresses real exchange rates, real wages and employment by reducing the demand for new capital equipment.¹⁶ Yet another effect is added by tradable sector firms raising markups over marginal cost when bankruptcies lower the number of firms competing in different markets – the effect discussed in the previous section. Markups may also be raised when highly leveraged businesses discount their future profits at a higher rate realizing that they may not survive for long and for that reason put considerations about future market share aside.

The two-sector model can account for the co-movement of macroeconomic variables. During the boom period we have high asset prices, the relative price of non-tradable goods such as capital (think new houses!) is high, the real wage is high as well as the share of labor in output, unemployment is low, investment is high and output is high. *Potential* output is also high, due to a low level of the natural rate of unemployment. The onset of a financial crisis sees the reversal of these trends; asset prices fall, the relative price of non-tradable goods falls, investment falls, real wages fall and unemployment goes up. A recovery of employment will only occur when investment picks up again, which may not happen for a number of years until access to capital has been restored, debt repaid and balance sheets restored.

¹⁵ See Greenwald and Stiglitz (1993) on the effect of bankruptcy risk on labor demand and the natural rate of unemployment.

¹⁶ When we reach the time when productivity is actually lower than previously expected, the fall in productivity in the traded goods sector lowers the marginal product of labor in the tradable sector and pushes workers into the non-tradable capital goods sector. This causes the real exchange rate to drop further, hence the demand wage and unemployment increases further. The supply of capital is now increased and we move to a steady state where the capital stock is larger and the value of capital is lower than before. The net effect is to make the demand for the labor-intensive non-tradable good fall and its supply increase, both of which tend to lower the real exchange rate and the real wage and raise the natural rate of unemployment.

Figure 6. Financial boom and bust



6. Empirical unemployment equations

The strength of the relationship between unemployment and investment shown in Table 3 and Figures 2 and 3 does not preclude other influences. Equilibrium unemployment has also been shown to depend on the rate of productivity growth and a number of labor market variables. Several labor market variables (see Appendix for sources and definitions) have been shown to have a robust medium-term relationship with unemployment. The variables include the coordination of bargaining; union density; benefit replacement rates; the duration of benefits; and, finally, employment protection. These variables have shown a fairly robust association with unemployment in many studies.¹⁷ There is evidence that suggests that unions raise unemployment while the coordination of employers and unions in wage negotiations lowers it.¹⁸ Moreover, the level and duration of unemployment benefits has a positive correlation with the rate of unemployment.¹⁹ The evidence on employment protection is ambiguous, except

¹⁷ See, amongst others, Layard, Nickell and Jackman (1991), Baker et al. (2004) and Nickell, Nunziata and Ochel (2005).

¹⁸ See Nickell and Layard (1999).

unemployment benefits has a positive correlation with the rate of unemployment.¹⁹ The evidence on employment protection is ambiguous, except that there seems to be a clear positive relationship between employment protection and long-term unemployment^{20,21}

The following equation was estimated to test further for the relationships implied by the two-sector model where u is the rate of unemployment, I denotes investment as a ratio of GDP, g denotes the growth of productivity.²² All variables are measured as five-year averages giving ten observations for each country from 1960-2009. X is a vector of variables measuring labor market institutions: the unemployment benefit replacement ratio, the duration of benefits, a measure of union density and a measure of the coordination of bargaining. The instruments chosen for investment – measured as gross capital formation as a proportion of GDP – are share prices (normalized by labor productivity), the world real rate of interest (average real rate for the G7 countries) and real oil prices.

$$u_{it} = c_i + \alpha I_{it} + \gamma g_{it} + AX + \varepsilon_{it} \quad (3)$$

The results follow in Table 4 below. The coefficient estimates for the investment variable are qualitatively robust to the inclusion of other variables but its size is sensitive to the inclusion of the labor market variables. In contrast, the coefficients of the labor market variables are less robust and the coordination variable has an unexplained positive sign, implying that increased coordination raises unemployment.

¹⁹ See Layard et al. (1991) and Nickell and Layard (1999).

²⁰ See, amongst others, Lazear (1990), Bentolila and Bertola (1990), Elmeskov et al. (1998) and Nickell and Layard (1999) on the effect of employment protection.

²¹ In a recent paper, Lafontaine and Sivadasan (2009) show that labor regulation lowers the frequency of employment adjustment at the firm level which creates misallocation costs that offset some of the benefits to incumbent workers of longer tenure and protection against job loss during downturns.

²² The importance of the rate of productivity growth for unemployment has been emphasised by, amongst others, Manning (1992), Hoon and Phelps (1997), Pissarides (2001) and Ball and Moffitt (2001).

Table 4. Unemployment equations for the Nordic countries, 1960-2008

	(1)	(2)
Constant	22.66** (9.57)	-6.77 (1.37)
Investment	-0.75** (6.97)	-0.19** (2.19)
Productivity growth	-0.47* (1.89)	0.35 (0.72)
Labor market variables		
Replacement ratio		4.27** (2.45)
Duration of benefits		-1.40 (0.99)
Union density		0.15** (2.68)
Coordination		1.35** (2.61)
R-squared	0.69	0.83
Observations	38	38

** denotes significant at 5% level and * denotes significance at 10% level.

Two-stage-least squares estimation. White cross-section standard errors and covariance. Instruments: real share prices, world real rate of interest and the real price of oil. Productivity growth and labor market institutions are assumed to be exogenous.

Table 5 has the results for an expanded sample of 16 OECD countries²³ of a regression where the unemployment rate (in percent of the labor force) is, as before, regressed on investment – with real share prices, the world real rate of interest and real oil prices used as an instrument – and a group of labor market variables. Employment protection is added to this group because of its prevalence in some of the non-Nordic OECD countries.

The size of the coefficients of investment coefficient is quite large. In column (9) an increase of investment as a ratio to GDP by one percentage point will lower unemployment by around one percentage point. Productivity growth lowers unemployment so that a one percentage increase in the rate of productivity growth makes unemployment fall by about half to one percentage points. Turning to the labor-market variables, union density raises unemployment, as does stricter employment protection. The coefficients on coordination and union density are insignificant. Surprisingly, the duration of benefits has a significant and negative coefficient.

²³ Australia, Austria, Belgium, Canada, Finland, France, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, U.K. and U.S.

Table 5. Unemployment equations for a larger set of countries, 1960-2008

	(1)	(2)*	(4)*	(6)	(7)	(8)	(9)
Constant	42.24** (9.06)	35.43** (6.86)	34.61** (7.37)	30.22** (8.15)	31.21** (9.30)	32.07** (7.39)	26.34** (8.80)
Investment	-1.58** (7.63)	-1.24** (4.91)	-1.25** (5.36)	-1.21** (5.60)	-1.20** (6.13)	-1.15** (5.70)	-1.06** (6.77)
Prod. growth		-0.48** (2.08)	-0.46** (2.01)	-0.61** (2.57)	-0.76** (4.11)	-0.91** (4.29)	-0.86** (5.94)
Coordination			0.54 (0.70)	0.03 (0.03)	-0.003 (0.00)	-0.11 (0.12)	-0.13 (0.15)
Unions density				0.12** (3.44)	0.12** (3.69)	0.11** (4.05)	0.12** (4.36)
Replacement ratio					-2.64 (1.41)	-1.10 (0.48)	-1.01 (0.58)
Duration of benefits						-2.56 (1.33)	-3.13** (2.07)
Employment protection							3.46** (4.16)
R-squared	0.58	0.67	0.66	0.74	0.74	0.74	0.81
Observations	160	156	156	160	156	156	156

** denotes significant at 5% level and * denotes significance at 10% level.

Method: Panel Two-Stage regression. White cross-section standard errors and covariance. Instruments: real share prices, world real rate of interest, and the real price of oil. Productivity growth and labor market institutions are assumed to be exogenous.

7. Conclusions

An economic expansion driven by easy access to foreign credit and the expectation of future productivity improvements brings high asset prices, real exchange rates and low unemployment. The expansionary phase is favorable to labor – labor’s share of national income rises, the purchasing power of wages in terms of tradable output grows, unemployment falls and there are scant signs of inflationary pressures. Such a macroeconomic performance is likely to reinforce the general sense of optimism that fuels the expansion. The bursting of the bubble sets the same variables in reverse motion – labor’s share of national income falls, real wages fall, unemployment rises and inflationary pressures emerge at higher rates of unemployment than before. The recovery, once it starts in the tradable sector, is likely to be seen as disappointing because it is “jobless” and weak. Unemployment will only decline substantially once investment picks up; that is, once the non-tradable sector recovers.

APPENDIX – The data and their sources

Variable	Definition	Units	Source
Unemployment	Standardized unemployment rates.	Percentages.	OECD.
Investment	Gross capital formation as a share of GDP.	Percentages.	IMF: International Financial Statistics.
Share prices	Real share prices, deflated by CPI.	Index: 1989=100.	
	Share prices normalized by labor productivity measured as real GDP per employed worker.	Index: base = 1 in 1960.	IMF: International Financial Statistics.
House prices	Real house prices, deflated by CPI.	Index: 1989=100.	Statistics Denmark, Statistics Finland, Statistics Norway, Statistics Sweden
Productivity growth	The rate of growth of labor productivity, measured as real GDP per man hour.	Percentages.	OECD.
World real rate of interest	Weighted average of real interest rates in G7 countries, nominal interest rates measured by the yield on long-term government debt. Relative GDP, taken from the Summers-Heston data set, is used as weights.	Percentages.	IMF: International Financial Statistics.

The data and their sources, continued.

Oil prices	Average crude price, dollars per barrel, constant prices.	Index: base=1 in 1960.	IMF: International Financial Statistics.
Real exchange rates	Trade weighted real exchange rates, based on CPI.	Index: base=100 in 2000.	IMF: International Financial Statistics.
Real wages	Compensation of employees.	Index: base =100 in 1989.	OECD.
Unit labor cost	Unit labor costs index deflated by the CPI.	Index: base =100 in 1993.	OECD.
Labor share	OECD definition	Percentages.	OECD.
Coordination	An index of the coordination of unions and employers in wage negotiations.	Index: 1-3.	Dataset of Nickell, Nunziata and Ochel (2005).
Union density	The share of the labor force that belongs to a labor union.	Percentages.	Dataset of Nickell, Nunziata and Ochel (2005).
Replacement ratio	The ratio of unemployment benefits and average wages.	Decimals.	Dataset of Nickell, Nunziata and Ochel (2005).
Duration of benefits	An index measuring the duration of unemployment benefits	Index.	Dataset of Nickell, Nunziata and Ochel (2005).
Employment protection	An index of employment protection.	Index: 0-2	Dataset of Nickell, Nunziata and Ochel (2005).

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