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Structural Booms: Productivity Expectations and Asset Valuations

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In the first half of the 20th century, the West reeled from hyperinflations and deflations. To study the swings in economic activity of that period was to study the role of money and foreign exchange. Keynes became the towering figure while the nonmonetary theorists of "long swings" became ghosts in the mansion of modern macroeconomics.

The century's second half saw more muted behaviour of inflation rates. The impacts of shocks, real or monetary, through *monetary* channels were apparently milder or better contained by monetary policy. Yet huge swings in economic activity occurred nonetheless. In the 1960s, Europe's glorious years, several Continental countries saw unemployment nearly vanish – without rising inflation. In the 1980s, after a long slide begun earlier, nearly all OECD economies were in the great postwar slump – with little or no disinflation. Then, in the 1990s, employment soared again – with little inflation or even some disinflation – in several OECD economies. As macroeconomics teaches, if high "effective demand" – a strong flow of money chasing goods – were the main agent of the two waves of prosperity, inflation would have risen as a signal of the monetary excess; if low effective demand were the agent of the slumps, there would have been telltale signs of disinflation. The conclusion is that the path of unemployment is subjected to *non-monetary* shocks and developments operating through *non-monetary* channels.

We and several others have laboured for a decade modeling how such real forces

and mechanisms shape the equilibrium path of unemployment. Empirical work has focused on the secular rise of unemployment over the postwar decades, laying it to a progression of permanent structural shocks and adjustments. There has not yet been work on the phenomenon of *structural boom* and resulting *swing* in economic activity – an upswing and subsequent fallback of employment. Even the theory of it is undeveloped.

If the boom arising in several economies in the mid-1990s is structural, what is the mechanism? The pioneer investigators of long swings – Spiethoff, Cassel and Schumpeter – saw investment as the key force; behind investment were expectations of its profitability and the unanticipated events that raise or lower those expectations.[1] But the non-monetary links from these causes to aggregate employment were not forged.

The trio of non-monetary models of employment determination set out by Phelps (1994) are similarly forward-looking.[2] In each model there is a needed business asset – fixed capital or customers or job-ready employees. The valuation per unit of the asset impacts positively on the pace of investment: it boosts construction (which is labour intensive) or competition for customers (which shrinks markups) or preparation of workers to be functioning employees. In turn, increased investing impacts positively on labour demand, lowering unemployment and raising wages.

This paper develops the theory's potential to explain structural booms and runs some tests of this explanation against some data from the past century. The key step is to introduce the newly arrived prospect of profitable investment opened up by some new discovery, invention or whatever. As we will show, these models have the property that the sudden expectation of a *future surge* of *productivity* creates an expected simultaneous

[1] "The future of conjunctures depends essentially upon the future of material progress…Its excesses aside, [speculation] is an expression of the zeal of employers to profit by meeting the increased demand of the community for fixed capital." (Cassel, 1914, English trans. 1924, p. 622.)

surge of profits; this at once prompts a speculative lift in the asset valuation, which will look like an unjustified bubble to uninformed observers; the increased valuation sets in motion an upswing of employment; when the productivity surge is realised, employment subsides. In this account, the boom is *not* sparked by the "optimism" and *not* doomed by the "miscalculations" that some pioneer boom theorists invoked to start and end the boom. Our thesis is, first, that such expectations are *potentially* important: that an unusually large shift of this sort in the valuation of business assets would cause an unusually wide structural expansion or contraction; and, second, that wide swings in business valuations have *in fact* occurred and underlie some of the booms and slumps in the 20th century, especially those in the more capitalist economies.

We can make a first check of this thesis by inspecting historical time series but only upon finding some serviceable proxy for our theoretical notion of the managers' valuation of the business assets they need – more precisely, a proxy for a representative basket of these assets. We turn to the stock exchange for such proxies. Suppose that any major rise or fall in market capitalization or in the share price index on the stock exchange is a reflection, even if quite imperfect, of a major rise or fall in managers' valuation of such business assets. Then we should expect to observe that prosperity in a country follows sustained highs in stock market and depression follows sustained lows. (The same result will follow *if*, vice-versa, a rise in market capitalization induces firms' managers to raise the value they assign to investing in such assets; but that is not the direction of causation we have in mind.) A look at stock-market levels and employment growth since 1960 in the U.S. found a strongly positive low-frequency relationship.[3]

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[2] Phelps (1994). Some antecedent models are Phelps (1968), Phelps and Winter (1970), Salop (1979), Calvo and Phelps (1983), Fitoussi and Phelps (1988), and Hoon and Phelps (1992).

[3] Phelps (1999). The lagged level of the unemployment rate was the only other explanatory variable introduced. A doubling of share prices, no matter whether through a doubling of earnings or a doubling of

The time-series relationships in the six largest advanced economies in the West provide a wider sample. Figures 1 and 2 (next page) relates the unemployment rate (in decimal form), and the level of the national *real* share price index taken as a ratio to national labour productivity – the *normalised* share price level. Figure 1 shows data for the G7 countries (ex Japan) – ranked in the order of size – while Figure 2 has data for some good performers – Australia, Ireland, the Netherlands and New Zealand – and two bad performers – Belgium and Spain. The data are averages by half-decade where **I** indicates the first half of a decade and **II** the second half. In each half-decade, the data point records the average value of the unemployment rate in the last three years of that interval to the average value of the stock market variable in the first three years of the same interval. The figure shows that, since 1960, most if not all of these large economies exhibited a strongly positive relationship between the two.

The deterioration of employment in the 1970s and early 1980s in all cases corresponds to a fall in the normalised share price. Figure 1 shows that share prices fell least in Canada, the UK and the US relative to the unemployment increase; the job supply curve is flattest there. It also shows that the recent recoveries in Canada, the UK and the US are associated with stock-market recoveries. The sequence of slump followed by recovery traces out a counterclockwise loop. This is due to the faster adjustment of asset prices. The paradigm structural slump is characterised by a steep decline in share prices followed by a gradual rise in unemployment, as the unemployment rate (suitably scaled) seeks to "catch up" with the lowered share price level. Similarly, the paradigm structural boom displays a steep rise in share prices and a slow upswing of employment.

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the average price-earnings ratio, is estimated to reduce the unemployment rate at which no employment growth occurs by 4 percentage points – a very large effect.

Figure 1. Normalised share prices and unemployment in the G7 (ex Japan)

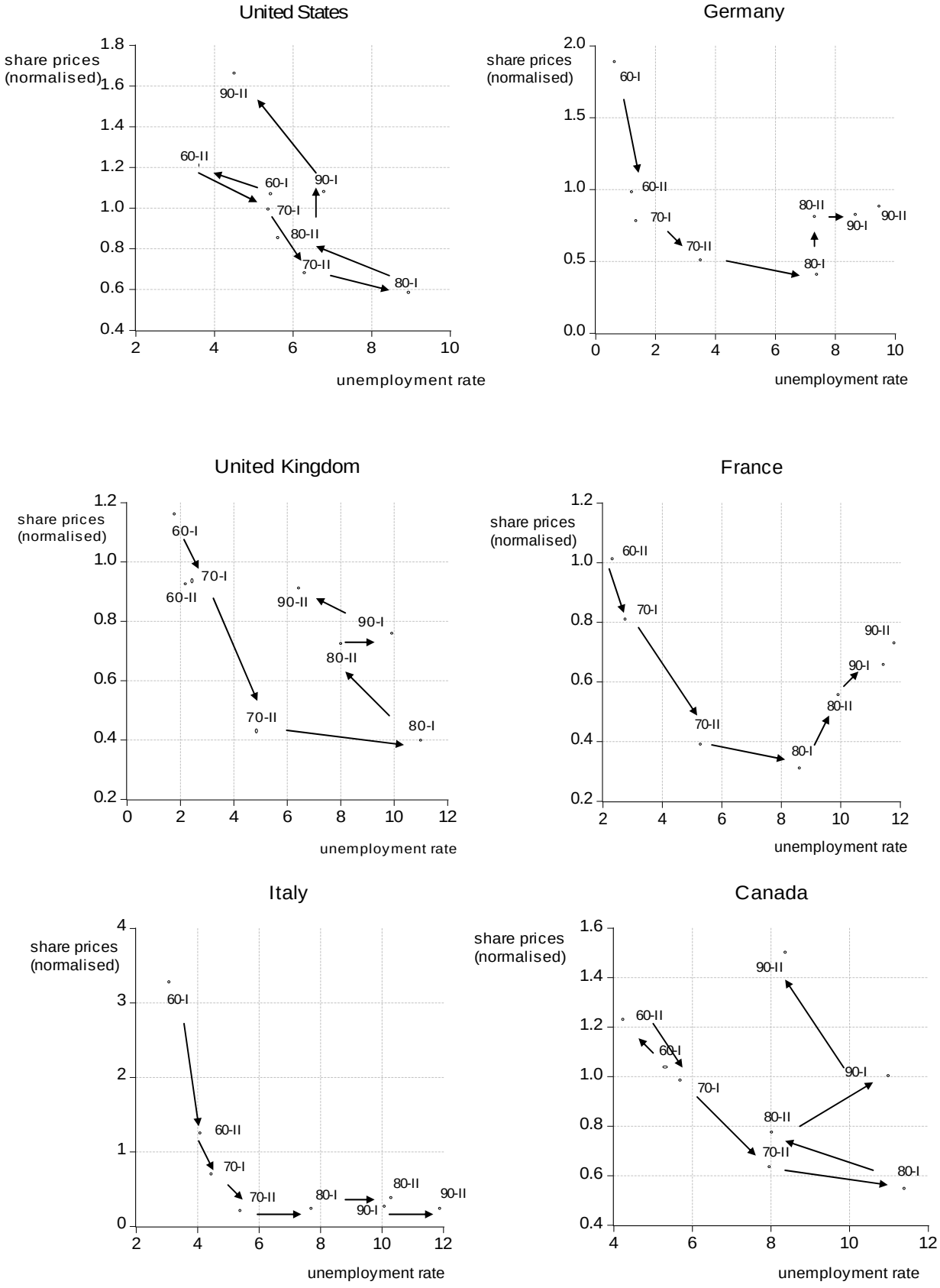
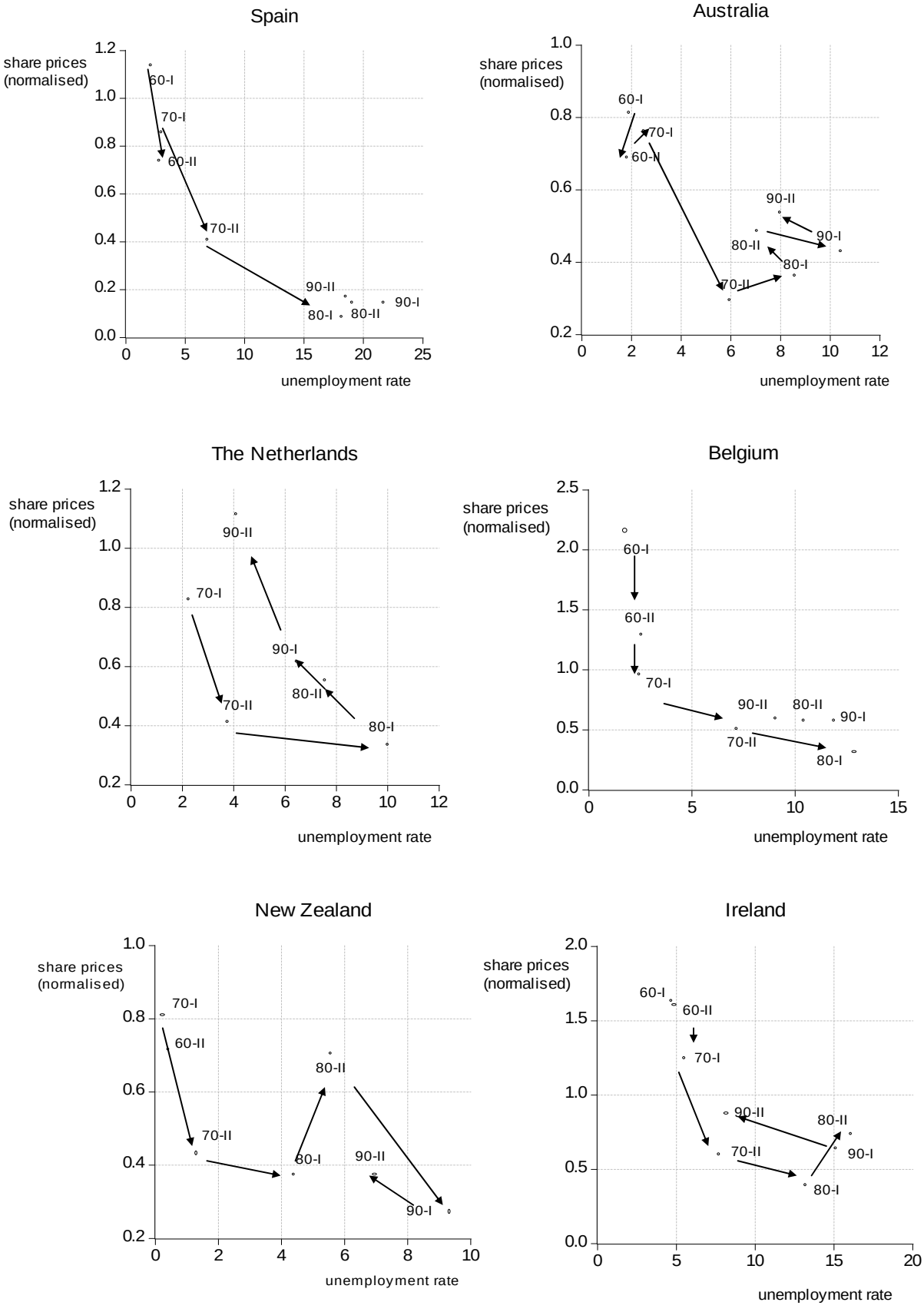


Figure 2. Normalised share prices and unemployment



The loop is narrower in the U.S., where it has been completed, than in the other countries.[4] Figure 2 shows that the deterioration in employment in Belgium and Spain in the 1960s and 1970s coincided with a fall in our normalised share price, and the recent recoveries in Australia, Ireland, the Netherlands and New Zealand go hand in hand with a booming stock market.

The 1990s, with its booms in some OECD economies amidst ongoing slumps in some others, offers some multidimensional evidence with which to check in a preliminary way whether our thesis might have applicability to the present period. If our theoretical mechanism is the operative one, a broad investment surge of structural origin such as we believe struck several economies in the mid-1990s has other effects besides reducing unemployment. First, almost by definition, the surge increases the pace of investing in fixed capital and in new customers along with new employees; and fixed investment data, at any rate, are available. Second, what pulls employment up is structural effects that raise the wage that employers can afford to pay at a given level of employment, which Marshall dubbed the demand wage, while labour productivity is not raised correspondingly or not as much at any rate; as a result, labour's share is pulled up alongside employment. Finally, when there is a step-up in the preparation of job-ready employees (hence having to produce less at given employment) and in the construction of new non-tradable plant (thus supplying less tradable output at given employment), there results, other things equal, an appreciation of the real exchange rate.[5]

What do the data show in these regards over the late 1990s? Two things. First, as

[4] The recent rise in share prices in France and Germany have not coincided with a rise in employment. However, the German data includes the eastern regions after unification which explains the continued fall in employment. This leaves France in the 1990s and late 1980s as the most notable exceptions to the predicted relationship between share prices and employment. A possible explanation may be found in the creation of jobs abroad as French firms set up production units in other countries.

[5] It ought to be noted that increased investment in customers would tend to have the opposite effect on the real exchange rate. This point comes up in the next section.

Figure 3 shows[6] there are signs of a broad investment boom in *all three* of these dimensions in the U.K., U.S. and the Netherlands. There are such signs in *two* dimensions in Canada and Sweden. This suggests that the remarkable expansion in these five economies over the past few years – the huge fall of unemployment and from a level that was in most cases not conspicuously high to begin with – is indeed largely a result of an investment boom of structural origin.

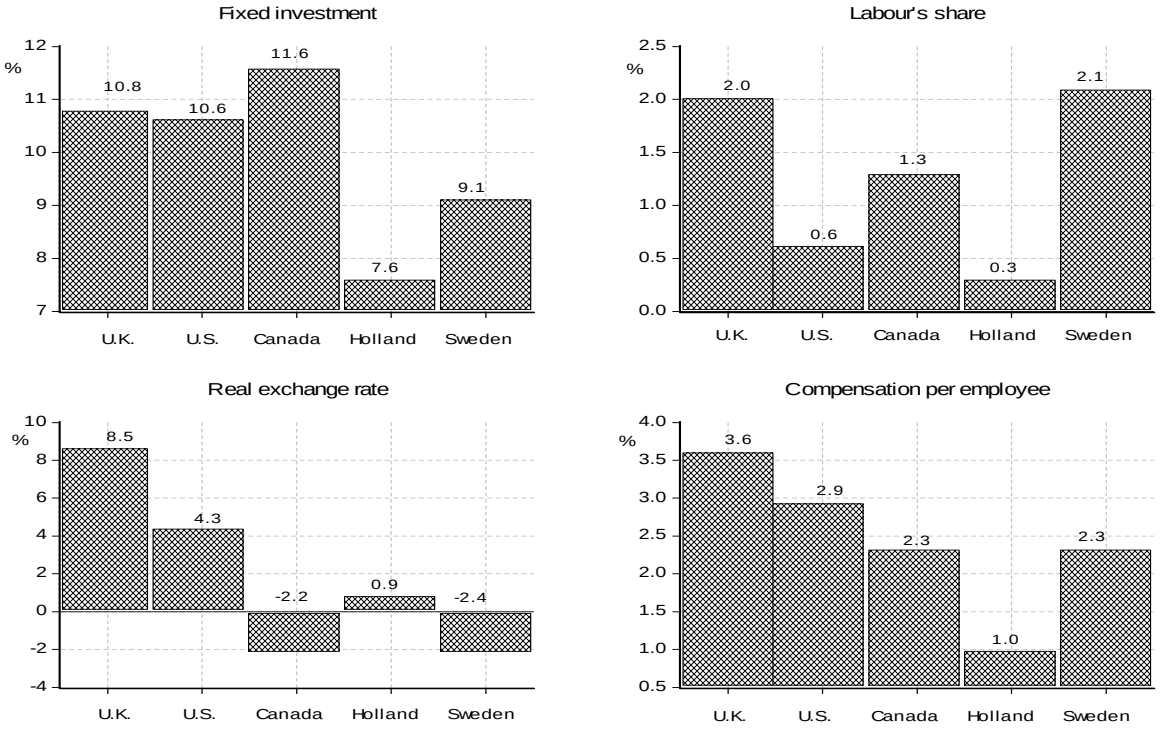
Second, the figure's data support our theory that a structural investment boom is accompanied by a rise in labour's share and, typically, by a rise in the real exchange rate. The weak growth of fixed investment found in most of the Continental economies goes hand in hand with a stable or even reduced labor share and a weakened real exchange rate. Among these economies, the relatively strong expansions found in one or two, such as Spain, seem unlikely on this evidence to be the result of a broad investment boom. More likely, they are due to labor-market or other structural reforms and, in some cases perhaps, to excessive increase in effective demand.

This paper will now address the main questions posed by our thesis. Is the valuation of (a basket of) business assets really a powerful determinant of unemployment, once other observable influences are allowed for? In what epochs, if any, have swings in the valuation been wide enough to cause major structural booms or slumps? And, if asset

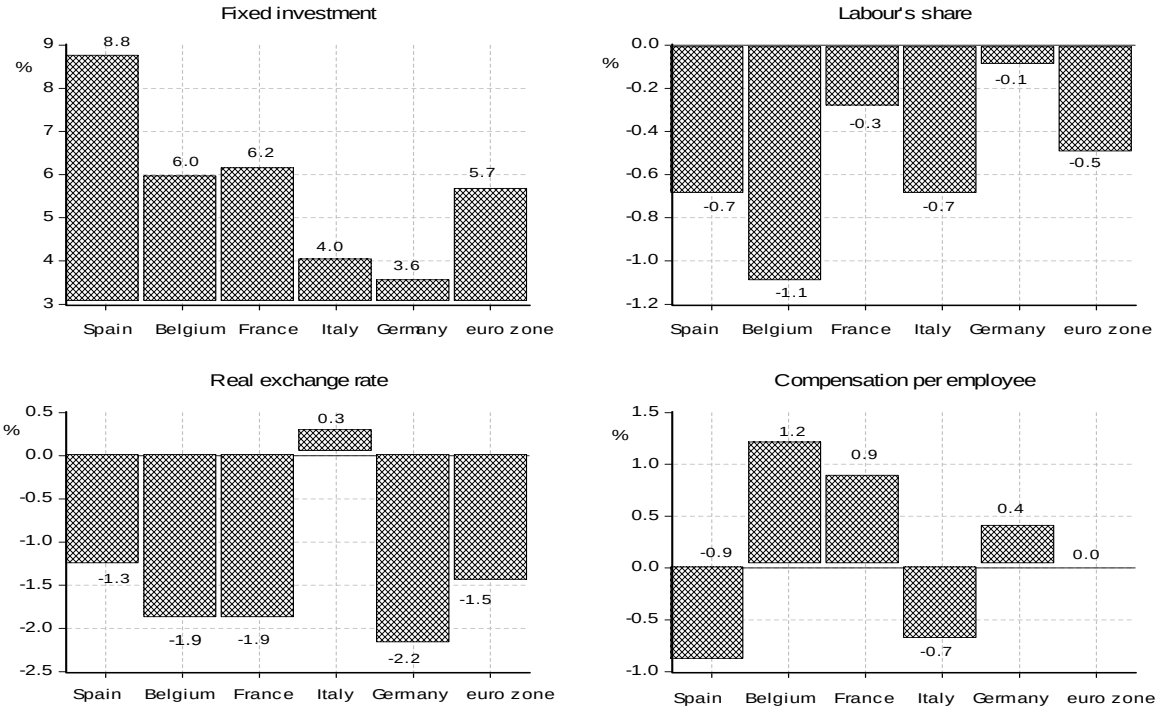
[6] *Source: OECD Economic Outlook* June 2000, Appendix and Phelps (1994). NOTES: The mean growth rate is the mean of the annual growth rates after 1996 or, if different, the boom's start date shown in parentheses. Fixed investment is real gross private non-residential fixed capital formation. Compensation per employee is real total labour cost per person employed in the business sector. Labour's share is compensation per employee to output per employee in the business sector; only the growth rates from 1996 are available. The exchange rate is an index of trade-weighted nominal rates deflated by consumer price indices.

Figure 3. Mean rates of growth of fixed investment, labour's share, the real exchange rate and compensation per employee since 1996

A strong broad investment boom in evidence



Few signs of such a boom driving the expansion (if any)



valuations have been so influential, since the last world war at any rate, what is the upshot for economic policy?

Part 1 below takes up conceptual issues, paying particular attention to why, theoretically, the observable explanatory variables that drive unemployment through their effect on asset valuation, such as the real interest rate and the recent trend growth rate of productivity, are not superseded by the asset valuation variable. Part 2 of the paper will examine the data. The first exercise is to examine the stocks-jobs relationship over a long span for each of a small set of countries for which such time series exist. A question here is whether there are significant differences among countries in the responsiveness of their unemployment rate to stock market variables; and, if so, whether responsiveness tends to be lowest in the more socialist economies, higher in the neo-corporatist countries (such as Germany with its so-called Rhenish capitalism) and highest under Anglo-American capitalism. The second exercise is to examine the cross-country evidence: Do economies with a comparatively meager market capitalisation suffer comparatively low employment and do economies whose labour markets have most strongly improved in the past few years tended to be those whose capital markets boomed most strongly as well? We will also investigate the sources of stock-market changes. Part 3 takes up some of the policy ramifications of our findings.

Asset Valuations in Unemployment Theory

Our models postulate for the sake of clarity that all the actors in the economy will exhibit correct expectations about the economy's path, *absent* any significant and unforeseeable structural shift – in short, intertemporal equilibrium theory. In the event this *conditional* intertemporal equilibrium is punctuated by such a shock, the economy leaps onto the new conditional equilibrium path. For simplicity we suppose that such shocks are very

infrequent and that the economy's participants do not bother to try to allow in their expectations for the low probabilities of *potential* shifts. Subject to that qualification, then, expectations are taken to be "correct." Managers correctly work out the future path of profit per unit of the business asset and hence place the right valuation per unit on it. Workers, that is, the adult population, employed or unemployed, correctly estimate the implications of the equilibrium path for their own pay rate and the income from their wealth. Shareowners, say, financial intermediaries where the workers are depositors, will be supposed to gear correctly their estimates of the value of firms' shares to the asset valuations made by the business managers: the assessments of firm's assets by the managers are conveyed to analysts and on to the market.

Each of the models we draw on has one business asset, as noted above.[7] In the turnover-training model, the firm invests in its new hires by imparting the firm-specific "training" they need to perform. In the customer-market model, the firm sacrifices some mark-up to attract or keep customers from foreign or domestic firms. In the classic two-sector model, one sector produces a tradable consumer good and the other a non-tradable fixed capital good, say office or factory space.

Three well-known concepts are involved: One is the *incentive wage*, i.e., the wage level required (at given unemployment rate) for minimizing costs. With each decrease of the unemployment rate, u, the incentive wage is increased, so the "wage curve" is rising with $1 - u$. Another concept is the *demand wage*, i.e., the wage level firms can afford to pay (at given unemployment rate) and make a *zero pure profit* (inclusive of any net capital gain) on any current hiring and other investing. As the unemployment rate decreases the demand wage decreases, since quitting, shirking,

[7] See Phelps (1994) and the references there. Subsequent development includes Hoon and Phelps (1996, 1997), Phelps and Zoega (1997, 1998) and Phelps (1999, 2000).

absenteeism etc. worsen with the tighter labor market; so the "zero-profit curve" is falling with 1–*u*.[8] Finally, the pace of net investment in the stock of employees, tangible capital or customers, is a function of the valuation, or *shadow price*, placed on a marginal unit of the asset – q^N, q^K and q^X, respectively – as a *ratio* to some kind of *cost*. The hiring-training model (under rising marginal hiring costs) makes hiring per employee – the "hire rate" – an increasing function of q^N as a ratio to existing employees' productivity (and no other variable matters). The customer model makes the growth rate of a firm's customers an increasing function of q^X as a ratio to the output supplied per customer. The two-sector fixed capital model makes net investment as a ratio to the capital stock an increasing function of q^K as a ratio to the general efficiency parameter in the consumer-good production function.

In our small open-economies, the key parameters include the expected world real interest rate, r^*, and the current *level* of cumulative labor augmentation, Λ (as well as the growth rate of labor augmentation, λ). In the category of so-called state variables, which move gradually, are the income or services from private wealth, y^W, and the stock of the business asset, *N*, *X*, or *K*. The labour supplied, *L*, is fixed.

How can these models generate structural booms and slumps in the sense of wholly or largely *temporary* expansion or contraction of employment?[9] Theoretically, an immediate jump of the productivity *level*, one that is permanent and unanticipated, might lead to a temporary bulge of customers or of fixed capital and thus of employment as

[8] The incentive wage increases with employment since, with unemployment lower, thus quitting and shirking more frequent, there is more to be gained (a greater decrease in quitting and shirking) from a given small pay increase. The demand wage decreases because, with employee performance worsened, employers cannot afford the same high wage as before.

[9] The term structural "slumps" in Phelps (1994) was used to designate *all* contractions, including the wholly permanent. That is broader than the concept of slump and boom that we are using here, which conveys some partial or complete return to the normal in the long run.

well. But our impression of the historical records does not suggest that booms often result that way; certainly the employment expansions in the recent investment-boom economies of Tables 1 and 2 did not follow (or coincide with) a productivity surge – only a modest acceleration of productivity, and not even that in some cases. Such an immediate jump, if *temporary*, is problematic as cause for a boom, since firms will not want to assign employees to training when their productivity is temporarily up and the productivity of anyone hired would be up only fleetingly. And a jump, permanent and unanticipated, in the 'known' *trend growth rate* of productivity also does not serve the purpose. We have argued with increasing emphasis (Phelps, 1994; Hoon and Phelps, 1998?, Phelps and Zoega, 1998) that the OECD-wide slump was in substantial part the result of the 1974 productivity slowdown, not just the long rise in the welfare state and the later rise in the world real interest rate. However, the consequent rise in the natural unemployment rate is, in theory, permanent, and the fall in the natural rate that results from an *increase* in the trend growth rate of productivity would be permanent too – and not necessarily with any overshooting. Our purpose, to repeat, is to understand *cyclical* expansions and contractions.

The way out is Cassel's idea: to ground structural booms, with their strong upswing and downswing of employment, on the unanticipated arrival of the *prospect* of new opportunities for profitable use of capital beginning at some point in the *medium-term future* – perhaps several years ahead. A parallel proposition is that structural slumps result when entrepreneurs come to expect a lull in new investment opportunities over the *medium-term future*. It would be natural to proceed by modeling the sudden expectation of the future profitability of a 'new sector.' However, for simplicity, we represent these expectations in terms of a shift or a pause in a

productivity parameter. So, with our three models, we want first to make the theoretical argument that sudden expectations of a *future* upward shift of productivity may, depending on its nature, generate a structural, thus non-inflationary, upswing of employment, hence a temporary fall of the natural rate (in some terminology); and that sudden expectations of a pause in the rise of productivity over the *future* before it resumes its accustomed trend growth rate generates an employment downswing, thus a temporary fall of the natural rate. (The latter is a *temporary* drop in the productivity *growth rate* and the former *resembles* somewhat a *temporary* rise in that rate.)

What is the mechanism of the resulting boom? One has to piece together some implications of the equilibrium (i.e., correct-expectations) scenario consequent upon the new expectations of a future shock. Entrepreneurs calculate that the jump of productivity will produce an improved rental on the business asset and this raises immediately the valuation per unit they place on a marginal unit of the business asset in the present without immediately raising the cost of investing another unit of the asset—a rise in the marginal valuation-to-cost ratio. One effect of this rise is a wave of anticipatory investing – in new job-ready employees, new customers and new structures. In each of the models, this impetus to increased investing in the business asset – also, in the turnover-training model, the asset revaluation itself – at once raises the ‘demand wage’ (the wage firms can afford to pay, i.e., the wage for zero profits upon figuring capital gains in profits); and since the wage curve is not pushed up to an offsetting degree (as nonwage income is not increased and not even the value of household wealth is raised proportionally with the marginal asset valuation) there results a temporary rise of employment in the new equilibrium scenario. On the date of the expected productivity increase, supposing it is exactly realised, the cost of investing in another unit of the asset is sharply increased (as labour’s other uses is

raised) so the marginal valuation-to-cost ratio drops back; hence investing in the asset and the wage both drop and, details aside, employment declines – as the air goes out of the boom. Somewhat symmetrically, the new expectation of a productivity lull precipitates an immediate drop in the valuation attached to a unit of the business asset, in view of the newly forecast sag in the rental expected from the asset, and that leads to an abrupt cutback, if not suspension, of firms' investment activities for the duration of the lull, and hence, in general, reduced employment over that period.

We consider now some further aspects of the argument, beginning with the relatively familiar two-sector model, then the customer-market model and last the turnover-training model.

A boom in the two-sector model. In this model, we want to locate the expected future productivity shift in the consumer-good-producing sector, which uses the capital good, such as office space, produced by the other sector. We further suppose that the shift is a step-increase in the "augmentation" of labour in the consumer-good production function, to be denoted by the parameter Λ_C. In response to the new expectation, businesses figure that, absent an equiproportionate increase in the stock of the nontradable capital good, there would result a jump in the flow of profit per unit starting at the moment of the productivity surge. But the market abhors an anticipated windfall, as nature abhors a vacuum. So this sudden expectation causes at once an unanticipated *jump* in the consumption sector's per-unit valuation of the nontradable capital good, q^K, and in turn an equal jump in the market-clearing real price of the capital good. The rise in that price in turn pull up the real demand price for labour in the construction industry, which is relatively labour intensive, and thus in the economy as a whole. The real wage is thus pulled up and, given the incentive-wage curve, aggregate employment too. (The real wage will rise proportionately less than the real

price, owing to personnel problems arising with reduced unemployment.) This additional labour input plus some labour priced out of the consumer-good sector, which has to wait for the productivity surge, all go to work producing increased output in the capital good sector, while consumers make up the gap with increased imports or decreased exports.[10] In the ensuing first phase, when the scheduled productivity surge is drawing near, the capital stock will be rising (we abstract from any trend growth) and the real price must be rising *further*, since owners of structures must be compensated for the decreased yield of their holdings with prospective capital gains. This further climb will pull up further the real wage and employment.

At the moment of the productivity surge, say, by Δ per cent, the capital stock, it can be shown, must have increased by proportionately *less* than the post-surge productivity parameter, Λ_C, leaving the *normalized* capital stock, K/Λ_C, *below* where it started; and as a result, the rental per unit of capital, which had been falling, jumps to a

[10] It might be thought that, in fact, what matters for the wage curve is the wage relative to the *market value* of the assets owned by workers and that the impact of the jump in the real price of the asset is to increase the real wage and the real value of workers' wealth in the same proportion, so that no increase of employment results – only a gradual rise of the real asset price and real wage as the date of the expected productivity jump draws near. But such a result does not hold with appreciable generality. First of all, there are real-world complications from which the models abstract. One obstacle to the neutrality of the asset price for employment is the existence of public debt. Another is that the nationals may hold appreciable assets overseas, even if they are not net creditors. And presumably the government will not increase the social wealth (provided by the welfare state) immediately by as much proportionately as the market immediately raises the real value of private wealth. Second, there are theoretical issues. If part of workers' wealth consists of co-op and condominium housing and even if this housing will enjoy the productivity increase postulated, in the interim the rental earned per square foot of this housing will not be increased; it will be decreased, since the increase in the wage pulls labour away from the production of housing services. So the increase in the wage is an opportunity to earn additional housing space at temporarily better terms. Thus shirking will fall in response to the higher wage and thus cause employment to respond as well. Further, if it is supposed as in Phelps (1994) that wealthowners invest all or at any rate some of the savings in annuities, even if annuities of the equity type, so they receive annually the earnings on the wealth invested plus actuarial dividends, the actuarial dividend *will* increase in proportion to the price of the asset but the *earnings* will not, since these will be paid out of the earnings on real property and equity shares, which do not increase until the jump of productivity occurs. Thus, although the wage curve will be shifted up by the increase in the real price of the business asset, it will not shift up enough to block an increase of employment. Readers may say that this view errs in not crediting workers with the awareness that they could smooth further their consumption and their shirking by selling some of their annuities periodically until the arrival of the productivity shift. However, such maneuvers would incur the costs of acquiring and

level above its initial level – which is precisely the prospect motivating the investment boom. Thus the post-surge K/Λ_C will start out *smaller* than the medium-term rest point where it started. In the ensuing second and last phase, the key is that q^K/Λ_C will be constant. (It will be lower than the steady-state level at which it started, so q^K must not have increased by as much as the productivity parameter in the first phase.) As a result, the asset price will no longer propel employment. If we hold workers' wealth unchanged for purposes of medium-run analysis, no further adjustment of employment occurs in this medium run. In the long run, though, further wealth accumulation in response to the increased productivity will exert a contractionary force on employment through the shirking rate.[11]

A boom in the customer-market model. In this model, the sudden expectation of future productivity jump generates an immediate expansion of employment (and output) in two ways. First, the resulting jump in firms' valuation of an additional customer induces firms to reduce their markups, thus foregoing profits in the near term, for the sake of adding overseas customers or regaining domestic customers in view of their increased valuation; and a cut in the markup is tantamount to the offer of an increased wage (in terms of the product domestically produced), which leads to reduced shirking and increased employment as well as increased output. This feature of our story fits nicely the recent investment boom, especially the US where many firms, such as Amazon.com, have been bent on expanding their stock of customers at such a speed that they have not been covering their costs (as normally measured, at any rate).

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processing the information needed to make these transactions. And if the size of the upcoming productivity shift is a matter of considerable uncertainty, some or all workers may shy away from such a move.

[11] Actually the above description is only an approximation of the medium-term rest point, the point at which capital would be again constant if workers' assets are held constant. Since workers' wealth is now too low in relation to the newly increased levels of productivity and real wage rates, the salutory effect on employee behavior will boost both employment and wages. But ultimately workers' ownership of capital will reattain its normal ratio to domestic capital.

Second, at unchanged domestic real interest rates, domestic customer demand will also jump in anticipation of the future increase in productivity, which boosts their financial wealth (to the extent they hold domestic shares) as well as their prospective future wages. As a consequence, the real exchange rate must abruptly appreciate to clear the market, given the consumption goods supplied by the domestic firms. (Domestic prices and wages in terms of comparable goods obtainable abroad must jump up so that the prospect of their gradual fall boosts the domestic real interest rate by enough to cause consumption to fall back to its original level.) This real exchange rate appreciation induces firms to moderate their markup, since each one per cent increase in price is now a bigger invitation to foreign suppliers to enter, and this translates into an increase in the wage in terms of domestic product that firms judge they can afford to pay. So employment is increased on both counts and likewise the wage in terms of domestic product as the economy moves up its wage curve. These effects are eroded, however, as the economy adjusts.

For a medium-run analysis we take in account the evolution of the national firms' "capital" – their stock of customers as a *share*, denoted x, of the domestic "customer force" – while artificially holding constant the stock of business assets, s, that workers (i.e., households) own indirectly as the stockholders of the domestic firms – the income from which influences their shirking and thus employer costs. (Simplifying, we suppose that, before the future shock, $x_o = 1$, and households owned just these assets, i.e., $s_o = x_o$.) In the pre-surge phase, according to such an analysis, the stock of customers will *decline* if the real appreciation implied by the consumer demand jump exceeds the real depreciation implied by the valuation jump, so that a real appreciation occurs on balance. In that case, there results a gradual loss of market share to foreign suppliers, which causes employment to subside, and a gradual end to the real

appreciation; the arrival of the productivity surge causes an unchanged output to be produced with abruptly reduced employment. (This leaves the customer stock *below* where it started, but long-run analysis takes into account that workers' assets have actually been reduced correspondingly, so their consumption will not yet have increased in proportion to productivity and their shirking will be down, which will induce firms to gain back the customers lost to overseas competitors.) On the other hand, the firms' market share will *expand* if instead the real depreciation implied by the valuation jump exceeds the real appreciation implied by the consumption demand jump, so that a real depreciation occurs. There is a statistical association between the strengthening of the real exchange rate and the other signs of a general investment boom in the late 1990s, as Figure 3 shows. So it may be that the parameter patterns required for this latter scenario are seldom found empirically.

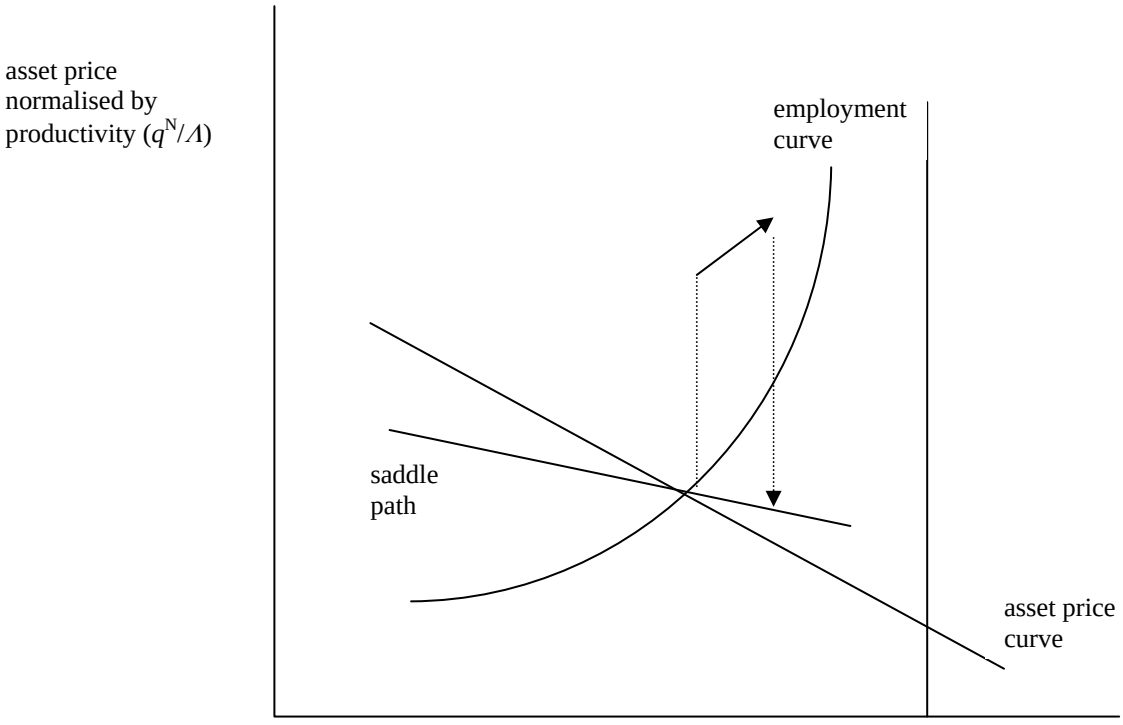
A boom in the turnover-training model. This model's property of rising marginal hiring costs in standard formulations injects a friction that slows down the employment response to present shocks but advances in time the response to the expectation of future shocks. The sudden expectation of the future jump of productivity prompts firms immediately to commence additional hiring, since, up to a point, smoothing of the firm's hiring helps to reduce the total discounted cost of the necessary training of new recruits.

We would note that an unanticipated and immediate increase in the expected *trend-rate* of technical progress (as measured by the rate of labor augmentation) is a shock having quite different effects. It operates like a drop of the expected real interest rate: it boosts the present discounted value of every employee, existing or additional, and in so doing permanently shifts the 'rest point' to which the economy gradually converges.

Econometric issues. The implication of the foregoing discussion is that asset valuations belong in the employment growth equation or unemployment equation (where lagged unemployment is on the right-hand side). That implication may seem trivial, obvious beforehand. Student of dynamic systems know that, as Miles Kimball puts it, the state variables (K, $1 - u$, …) tell us all we need to know about the past and the costate variables (our q's) tell us all we need to know about the future. So *of course* the q's belong in our employment equations. Yet some may feel that such a conclusion is superficial since, in systems that are stationary, even if brushed by the occasional temporary shock, the q's are derivable functions of the state variables and the parameters. No wonder a generation of macroeconomists have not judged it promising to add asset prices to their equations.

The issue can be easily resolved. Clearly it would be a mistake to say that the increased valuation sparked by a *sudden and unprompted shift in expectations* is in any sense the *cause* of the expansion of employment; the valuation is only the

Figure 4. Response of employee valuation to an expected future increase in employee productivity



endogenous variable that transmits the effect on employment. But if there are no prior clues to the shift of expectations in the *standard* macroeconomic and other data among our explanatory variables, it is well justified to supplement those variables with a valuation variable or a surrogate for valuations that can be regarded as a *proxy* for the expectations shift not revealed in the standard observable data. Prevailing statistical practice is quite right in excluding forward-looking expectational variables in circumstances where there is ample reason to think that the explanatory variables already in use do a satisfactory job of capturing such expectations.

Improved expectations about the future *trend* growth rate of productivity are apt to be inspired by recent experience of an *actual* and observed acceleration of productivity in the recent past; the new expected growth rate of productivity will be captured by the actual rate of productivity growth observed in the recent past. The kind of technological shock termed a *future surge* in the time path of productivity at some *future date* seems particularly in need of data on asset valuations to capture it.

So the “value added” by having managers’ valuations of business assets in the employment equation is that they would capture the confidence or despair that managers feel about forthcoming developments and what they will mean for the profitability of their business assets. It is only if the asset valuations are always in a fixed relation to the state variables and observable parameters that nothing is gained from having them in the equation.

With the above as background several other issues can be quickly resolved. One is whether the asset valuations are sufficient, depriving all the conventional variables from any explanatory role in the employment growth equation. The general answer is that since employment growth involves the quit rate, which in turn involves the

unemployment rate, non-wage income and benefits, and the after-tax wage, it is immediately clear that those variables and, in the case of the wage, the variables determining the wage have a rightful place in the equation.

It might nevertheless be thought that it makes no sense to retain, in particular, the cost of capital, $r^* - \lambda$, in the employment growth equation, since presumably since q^N reflects the cost of capital as well as profits. The truth is that while q^N surely does reflect the cost of capital, r^* matters for the after-tax wage rate not only indirectly through q^N but also directly through its impact on the net-interest-and-depreciation terms appearing in the equation for the demand wage, which has an impact on quitting. (Interestingly this implies that q^N enters the employment equation once independently of r^* and again in interaction with r^*.)

Ideally, an econometric implementation of this system would estimate how the shadow prices of trained employees, tangible capital goods and customers impact on the pace of employment growth. Even more ideally, the implementation would also control for the stocks of employees, customers and capital goods! Lacking data on most of these shadow prices as well as some of these stocks, our practical instinct is to seek *proxies* for the general level of these principal asset valuations, or shadow prices, in the various stock market indicators of the retail investors' valuation of shares and firms. This brings up several issues about our '*q* theory' of employment behavior.

Our theory of investments and Tobin's Q *theory*. How well compared with the ideal implementation can one expect to do with the firms' aggregate value in the capital market – so-called market capitalization – as a ratio to some index of the quantities of their business assets? Certainly such an aggregation is unreliable. The rise in the valuation of *some* business assets, such as the functioning employee, are surely more potent

generators of employment growth than the same percentage increase in the valuation of *other* assets. An example that has already been implicit is a rise in the real price of a nontradable capital good such as structures. Such a price increase could, theoretically, be *contractionary* for employment, since the production of that capital good might be less labor-intensive than the production of other goods on the whole, with the result that the demand wage actually falls as a result. (Gross investment in construction goods would be increased, but not bring an aggregate expansion of employment.)

Certainly the approach suggested by the models discussed here share with Tobin's Q theory of investment the attractive feature that assets are accumulated when their valuation exceeds their reproduction cost (or would exceed it if the accumulation did not occur). But Tobin's treatment somehow compresses what might have been thought to be a multidimensional problem, with many heterogeneous capital goods, into a unidiminensional problem of comparing the total value of the business assets with their total reproduction cost: If there is an excess of one over the other, replicate more plants like the original one. The problem here requires managers to decide *which* assets to invest more in. Here there is no substitute for the vector with the valuation (per unit) of each kind of business asset. Nevertheless we will want to see how well we can do with the stock market's measures of the value of firms.

It warrants commenting in view of recent challenges that the presupposition behind our modeling of employment's link to asset valuations and, for that matter, behind the Q theory of investment started by Keynes and Tobin is that there is first a rise in the valuation of some or all assets, then investments in them occur until their valuations have settled down to some sort of steady-state replacement-cost level. Surprisingly, this view has for some time been opposed by some equilibrium theorists, who say that *Q* is, theoretically, always equal to one, so it cannot serve as a determinant of anything.

Recently a radically different view has been proposed by Robert Hall, who interprets market capitalization as the stock of assets valued at replacement cost.[12] In some cases the difference between him and us is only semantic, as he would say that Figure 4 corresponds to an instantaneous increase of assets at the moment the employment stock is revalued at the higher marginal cost of hiring corresponding to the increased rate of hiring. But there is also a substantive difference. "The dramatic rise in the stock market in the 1990s could be interpreted," Hall writes, "as showing that corporations have built up large amounts of new capital…"[13] The assertion here seems to be that, in fact, market capitalization lacks predictive value in explaining subsequent asset investment. But clearly the story told in Figure 4 does confer on market capitalization some predictive power regarding future hiring.

The last issue relating to Q theory is the question of what is reflected by market capitalization. The model sketched here is not complete until it is recognized that one of the greatest assets of a firm, especially a start-up, is its as-yet unrealized ideas. Under ideal conditions, which are not necessarily consonant with profit maximization, a firm hitting upon a new idea will at once announce the discovery (presumably without giving details away to potential competitors) and place its own estimate on the contribution it will make to the firm's market value once it is implemented through the hiring of new employees, the acquisition of customers for the product and the purchase or lease of the necessary equipment for its production. If the stock market takes the announcement at face value, most of the rise in market capitalization will occur on the announcement; over the years, the unrealized value of the idea will be declining while the value of the assets accumulated to realize the idea will be rising. The anticipated future productivity shock

[12] Hall (1999b).
[13] Hall (1999a). p. 2.

described in Figure 4 does not have to be interpreted as the firms' sudden perception of some impending discovery in their industry or the economy that creates a profitable opportunity for them. The future shock can be interpreted instead as the effect on their future productivity of firms' *own discovery* of some virgin ideas.

Incorrect expectations. The remaining topic, which is surely one of the most interesting, is the role, if any, of wrong expectations. Does it matter whether managers' expectations are incorrect? It does not appear so, as long as the mistaken expectations are attributable to the radical uncertainty they face about the future and the profitability of that or that uncertain prospect. It does matter, however, if managers misunderstand the true model and use their model to predict future profits. Results may be poor or even misleading if managers persist in some error in calculation, such as figure present discounted values, or, worse yet, if they shift from time to time from one costly short cut to another.

The last question is whether the stock market will have any estimated impact on employment growth if the retail investors who buy shares in corporations and whose own valuations must make a difference for share prices form valuations of firms that diverge from the valuations by the managers. Here Tobin's Q theory answers that the managers, as faithful agents of shareowners, must invest more in the assets they use in their operations; to fail to do so is to deny the shareowners a capital gain represented by the difference between their valuation of the assets acquired and the reproduction cost of those assets. In practice, as Tobin recognized, managers may not all be so selfless. They may see it as to risky to invest more, no matter what their shareholders believe. Further, there is the problem that the managers may not have any idea what mix of new business assets to acquire, since there is a variety of ways in which to expand the core business and, moreover, the firm has the option of investing instead in other firms. If the stock

market turns out to make little difference, a likely explanation is that the managers paid little attention to it, for better or worse. And if the stock market turns out to be a rather powerful mover and shaker of business asset investment, including hiring in particular, the explanation may be that the world's stock markets reflect rather well the outlook held by the managers, who act largely on their own valuations.

Empirical Findings

Our main objective here is to test whether large swings in real share prices play a significant and quantitatively important role in explaining the large swings in some countries' mean unemployment rate and whether differences in share price swings help explain differences across countries in the swings of unemployment.

We start by stating some of the stylised facts about unemployment dynamics that our empirical methodology will have to address:

- There can be big differences in average unemployment across decades, just as there are across countries. In our view, these are the result of infrequent large shifts – or in some cases an accumulation of frequent small shifts – in the mean unemployment rate. In recent decades, such upward shifts occurred in the mid-1970s and early 1980s in most of the OECD countries and downward shifts have been observed in a few countries in recent years, as discussed in the introductory section.[14]
- There is correlation over time between unemployment, on the one hand, and changes in the recent growth rate of productivity (negative), real interest rates (positive) and real oil prices (positive). Thus the upward shifts in mean

unemployment in the 1970s and 1980s can be statistically accounted for by the two oil price shocks of the period, the elevation of real interest rates in 1981-82 and the mid-1970s productivity slowdown.

- There is cross-country correlation between average unemployment and various institutional variables (the unemployment-benefits replacement ratio, the duration of such benefits, union density and -coverage, and indices of union- and employer coordination).[15]

The first "fact" makes any empirical testing difficult since the effective number of observations is reduced to a handful for each country. For this reason, we will use a panel to increase the degrees of freedom and measure unemployment and all regressors – such as productivity growth, interest rates and oil prices – for five-year non-overlapping averages.

We will first take a look at querterly data going back to 1960 in order to test for causality, i.e. whether changes in share prices precede changes in unemployment once we have removed the contemporaneous effect of output on unemployment. We then take a look at the stocks-jobs relationship over a long span for each of a small set of countries for which such time series exist. If our theory is to find any empirical support, there has to be a visible correspondence between a measure of share prices (appropriately normalised) and the unemployment rate. We then turn to the issues raised by the recent period using the panel:

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[14] See Bianchi and Zoega (1998)
[15] See Layard, Nickell and Jackman (1991) and Nickell (1999).

- We examine whether economies currently having low levels of market capitalisation suffer comparatively high unemployment and whether the boom in the labour market seen in some countries coincided with a relatively strong boom in the capital market as well. We also test whether the relationship between unemployment and share prices is robust to the inclusion of other macroeconomic variables, in particular – following our own work, Pissarides (1990) and Carruth et al. (1998) – real oil prices, the world real rate of interest and productivity growth rates.
- Looking at the more recent period, we test whether there are significant differences among countries in the responsiveness of the unemployment rate to the stock market variable(s) and, if so, whether the responsiveness tends to be highest under Anglo-American capitalism. This may lead the way to finding the set of institutions most conducive to harnessing managers' optimism.

Cointegration and Granger causality

Figures 1-2 pointed towards a long-run relationship between share prices and employment. To further test for a long-run relationship we performed unit-root tests on the quarterly unemployment rates and the normalised (by labour productivity) share prices for the G7 countries (ex Japan) and the good- and bad performers in Figure 2. The results of the unit-root tests follow:

Table 1. Unit-root Tests – ADF statistics

	share price	unemployment		share price	unemployment
U.S.	1.86 (158)	-2.84 (158)	Spain	-0.87 (149)	-0.79 (158)
Germany	-2.06 (154)	-2.49 (158)	Australia	-1.70 (157)	-2.01 (158)
U.K.	-1.30 (155)	-1.80 (158)	Netherl.	-0.63 (121)	-0.35 (122)
France	-1.50 (134)	-1.77 (139)	Belgium	-1.23 (146)	-0.82 (158)
Italy	-2.27 (154)	-2.46 (158)	New Zeal.	-2.31 (129)	-0.91 (158)
Canada	-0.52(157)	-2.18 (158)	Ireland	-0.64 (155)	-0.62 (158)

Note: The unit-root tests use quarterly data 1960-1999 and include both trend and intercept. Critical value –3.44 for 5% confidence level. The share-price indices are normalised by GDP per employed worker. * denotes rejection of null-hypothesis at 5% critical level.

The critical value is –3.44 for a 5% confidence level so we are unable to reject the existence of a unit root for all the series. We then tested for cointegration between the two variables, that is a long-run relationship. Column (1) in the table below has the test statistics for the null hypothesis of *no* cointegration between the two series. In column (2) we also include as exogenous variables the world real rate of interest and the real price of oil.

Table 2. Test for cointegration of q/Λ and u

	likelihood ratio			likelihood ratio	
	share prices only (1)	other variables (2)		share prices only (1)	other variables (2)
U.S.	27.95*	27.11*	Spain	20.33	27.76*
Germany	30.26*	34.99*	Belgium	21.69	34.40*
U.K.	16.69	30.14*	Australia	14.46	27.80*
France	15.75	28.04*	Netherl.	15.52	17.89
Italy	42.75*	46.16*	New Zeal	9.80	21.10
Canada	25.54*	31.05*	Ireland	15.62	30.87*

Note: Test allows for a linear deterministic trend in the data. The critical value is 25.3 for a 5% confidence level. * indicates rejection of null hypothesis at 5% level.

Turning first to column (1), we reject the hypothesis of *no* cointegration at the 5% critical level for the U.S., Canada, Germany and Italy. When the two global variables are also taken into account in column (2) we find cointegration in the vast majority of cases. We have thus found a long-run relationship between our normalized share prices and the unemployment rate for many of the countries. The question of causality remains.

Table 3 has the results of Granger-causality tests of the first difference of our normalised share price and the first difference of unemployment using quarterly data, once we have removed the effect of contemporaneous changes in real GDP on the unemployment rate. In other words, the question is if changes in share prices precede changes in the unemployment rate once we have removed the contemporaneous relationship between output and employment from the unemployment series. To do this, we first regressed the change in the unemployment rate on rate of growth of real GDP and then took the residual from this regression – which denotes the change in the rate of unemployment not accounted for by current changes in output – and tested if this was preceded by changes in share prices. We thus tested whether changes in share prices have predictive power when it comes from changes in the employment rate that are not directly related to the business cycle. The results follow:

Table 3. Granger tests (H_0: changes in share prices do not Granger cause changes in the employment rate)

	Obs.	F-Statistic	Probability	Lags		Obs.	F-Statistic	Probability	Lags
U.S.	156	2.92*	0.04	3	Spain	143	1.87	0.08	7
Germany	152	1.88	0.14	3	Australia	156	3.21*	0.04	2
U.K	151	1.97	0.09	5	Netherl.	120	3.59*	0.03	2
France	133	0.95	0.39	2	Belgium	141	3.30*	0.00	6
Italy	153	2.91	0.06	2	New Zeal.	128	2.90	0.06	2
Canada	155	4.19*	0.01	3	Ireland	153	2.91	0.06	2

Note: We first regressed changes in the employment rate on the rate of growth of real GDP to account for the Okun relationship: $\Delta(1-u) = \alpha_0+\alpha_1\Delta\log(Y)$ where Y denotes real GDP. We then took the residual from this regression and used it in the Granger tests using quarterly data 1960.1 to 1999.4. These tested whether changes in the rate of employment were preceded by changes in normalised share prices. Most significant lag included. * indicates rejection of null hypothesis at 5% level.

We reject the hypothesis that changes in share prices do *not* Granger-cause changes in the employment rate at either the 5% or the 10% critical level for all but two of the countries. In all cases, a rise (fall) in unemployment is preceded by a fall (rise) in share prices.

We can summarise the results of this section by saying that there is some evidence to suggest that there is a long-run relationship between share prices (normalised) and the rate of employment and that changes in the former precede changes in the latter. Our theory is hence not rejected by the evidence although more tests need to be done before we have a convincing case. We now take a look at the relationship between the series

over the very long run and then look at the time-series and cross-sectional relationshipts in a shorter sample towards the end of the paper.

Long-term country records . Figure 5 below shows share price indices in constant prices – normalised by labour productivity – and the rate of employment for three large OECD economies. The left-hand panels show the series for the period 1900-1999 while the right-hand side panels focus on the recent period 1960-1999.

Although the relationship is far from tight, we do see a correspondance between some of the major turning points in the two series that become clearer for the recent period 1960-1999. However, low share prices and high employment went together during the second world war in the U.K. and the U.S. which obscures the relationship somewhat. Also, the fall in employment in these two countries during the Great Depression was much greater than the corresponding fall in our normalised share price.

To test for a long-run relationship we perform the standard tests for cointegration. The table below has unit root tests for each of the six series as well as cointegration tests for each of the three countries.

Table 4. Tests for a long-run relationship 1900-1999[16]

		United States	France	United Kingdom
Unit-root tests	real share prices	-2.17 (97)	-2.16 (88)	-2.40 (96)
	unemployment (%)	-3.11 (100)	-1.35 (90)	-2.59 (100)
Test of cointegration	Dickey-Fuller statistic	20.21*	6.31	14.96*

Note: Stars indicate rejection of null hypothesis at the 5% level. Numbers of observations in parentheses. Null hypothesis: There is unit root in the unemployment rate (share prices) and there is no cointegration between the two series. The years 1940-1945 are treated as missing observations in the case of France.

[16] Critical values in unit root -3.46 and 15.41 for Dickey-Fuller.

We are unable to reject the existence of a unit root for all the series at the 5% significance level apart from the U.S. employment rate where we reject at the 10% level of significance.[17] We find a cointegrating in the case of the U.S. and the U.K. but not for France.

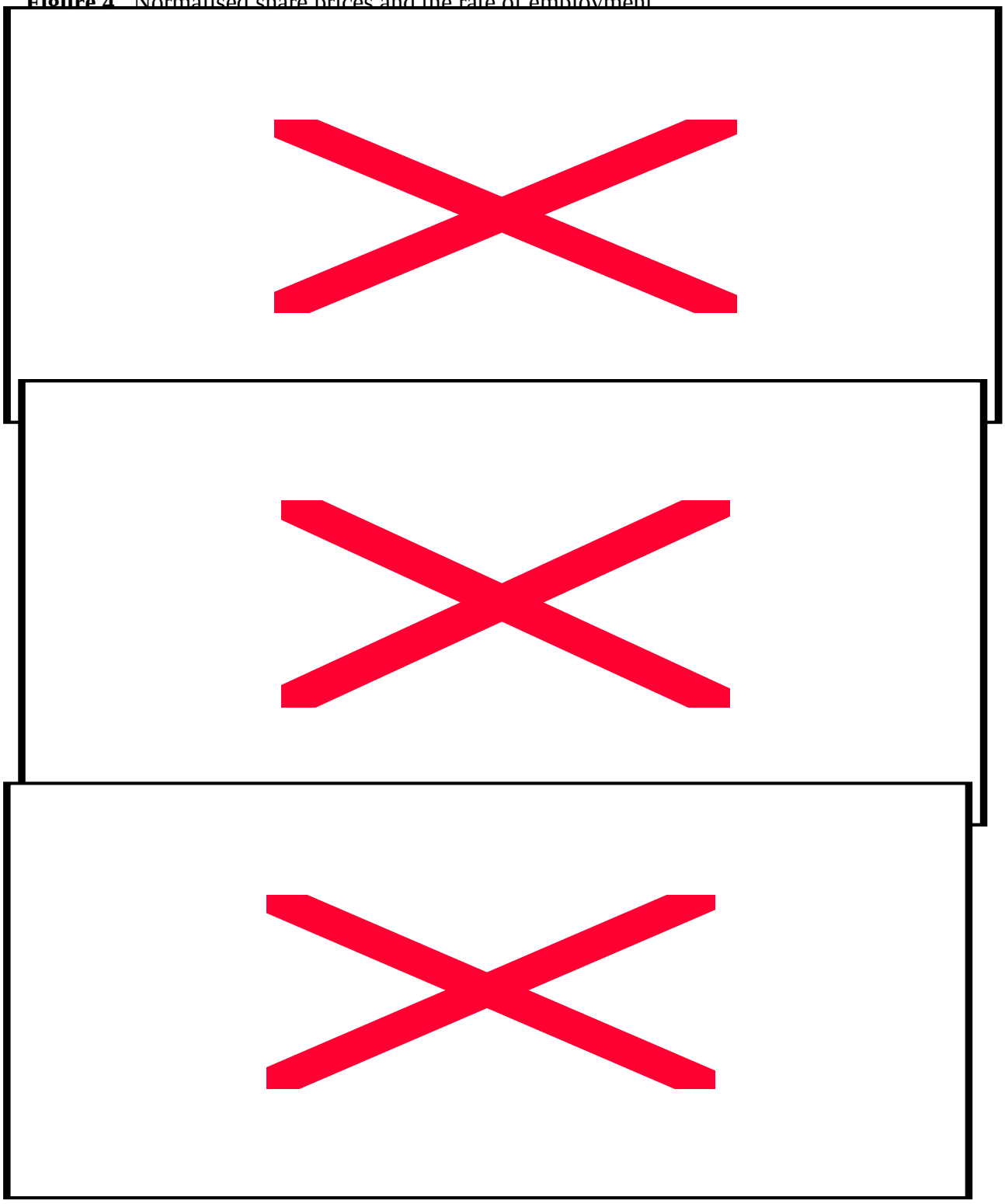
Estimation of baseline unemployment equation

We can study the relationship between unemployment and share prices over a much larger set of countries for the period after 1960. In the Introduction we began with the period 1960-1999 in the G-7 (ex Japan), summarising the data with five-year averages. Our theory implies an upward-sloping relationship and this does appear in the figures.

We now attempt to quantify the relationship between share prices and unemployment by estimating the baseline equation above for a panel of 18 OECD countries.[18] We take averages for (non-overlapping) five-year periods, which gives us eight observations for each country (note that unemployment is measured by the average of the last three years in the halfdecade while the causal variables are measured by the average of the first three years). The equation has current unemployment as a dependent variable and lagged (one five-year- period) unemployment on the right-hand side alongside various other macroeconomic variables. We note that the (normalised) share-price variable has value 1 in the first quarter of 1970 while unemployment is written in percent of labour force.

[17] We get a rejection at the 5% level if we look at data from 1929-1999.
[18] These are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, the UK and the US.

Figure 4. Normalised share prices and the rate of employment[19]



[19] Sources: United States: Share prices are measures by the SP500 as reported by Robert Shiller. GDP and employment data is from Maddison (1995). France: The source of the share price data is INSEE while the employment and GDP data comes from, Maddison, INSEE and Pierre Villa(1988). United Kingdom: Maddison (1995), Feinstein and *Economic Trends*, various issues.

We will use the panel to estimate a reduced-form unemployment equation. In formulating the equation we are guided by our theory, which allows us to decompose movements in unemployment into three separate components:

Observed unemployment	=	influence of past unemployment	+	influence of the natural rate	+	influence of cyclical unemployment

First, observed unemployment may be high because of past unemployment having been high owing to the presence of rising marginal hiring costs or rising marginal installation costs – both of which operate to slow down the adjustment to steady state. The persistence of unemployment can vary across countries owing to the presence of employment-protection legislation which raises the effective cost of firing as well as the cost of hiring (see Bertola and Bentolila, 1990). A generous treatment of the unemployed may also lengthen the duration of unemployment, hence contribute to a loss of skills and motivation

Second, there is the underlying path of the natural-rate of unemployment. This is the equilibrium, or correct-expectations, path toward which the actual unemployment rate is hypothesised to converge. Our maintained hypothesis suggests that shifts in this path go hand in hand with shifts in share prices and market capitalisation, among other macroeconomic forces. There are other potentially important country-specific macroeconomic shocks that impact on the level of the natural rate in addition to global macroeconomic shocks. Our models imply that the medium-run steady-state unemployment rate in an open economy depends on, among other things, exogenous input prices, thus the world real interest rate and the world real price of oil: an increase in either of the two causes wages to fall due to zero-profit conditions (which must be

satisfied if positive investing in new employees, new customers and new plant and equipment are taking place), so unemployment is forced up to the point where workers will accept the needed reduction of real wages. Carruth, Hooker and Oswald (1998) find that real oil prices and real interest rates alone, unaccompanied by wealth and asset stocks, do a surprisingly good job at explaining medium-term changes in US unemployment.[20] We too have found in our earlier work that these two macroeconomic variables are highly correlated with unemployment in a larger set of countries (Phelps, 1994, chapter 17). The work of Pissarides (1990) and Hoon and Phelps (1997) shows how productivity growth can affect labour demand if labour is a quasi-fixed asset. In this case the hiring decision (or vacancy decision) becomes an intertemporal investment decision and expected productivity growth takes center stage.

We also need to keep in mind the purely cross-sectional regularities. There may be differences in the level of sensitivity to real shocks affecting the natural rate – that is the slope of the price-setting and the wage-setting curves. These differences may reflect institutional differences. To test for the importance of the institutional differences we will attempt to explain the country-specific coefficients from our panel regression in separate regressions using cross-sections of countries. In so doing we follow the general approach of explaining differences in the evolution of unemployment across countries by taking into account interactions between macroeconomic shocks and institutions. This follows both our earlier work (see Phelps, 1994) as well as recent contributions such as Blanchard (2000).

Third, there are Keynesian/cyclical influences pulling unemployment above or below its rest point (through incorrect expectations etc.). It is clear that both the size of

[20] They follow Bruno and Sachs (1982), Phelps (1994) and Rotemberg and Woodford (1996)

nominal shocks and the response to these shocks can differ across countries.

We first estimate the equation with share prices only and allow each country to have its own coefficient of share prices in addition to the country-specific fixed effect. The results are in column 1 of Table 5. The countries are ranked in terms of the size of the coefficient of share prices. See appendix for further statistical information. We then add real oil prices to the equation which now contains two right-hand side variables in addition to lagged unemployment. In column 3 we add the world real interest rate and finally the rate of (labour) productivity growth in column 4.

The results are very similar in the four columns. The higher is the level of share prices, the lower is unemployment for all countries having a statistically significant coefficient except Sweden.[21] The coefficient values in column 4 imply that a halving of share prices from their 1970 level (from 1 to 0.5) would be expected to raise the natural rate by around 4.2 points in the U.K., 1.5 points in the U.S., by 2.4 points in Germany, and 0.9 point in France.

Note the ordering of the countries. The Anglo-Saxon countries are in the top half of the ranking – even tiny New Zealand. In contrast, the countries variously called corporatist, neo-corporatist or Rhenish are all found in the bottom half – Germany, Austria, Scandinavia, Italy and Japan. This helps us account for the recent good performance of the first group: not only may share prices have risen more in these countries but also the effects of such increases on unemployment are predicted to be bigger.

[21] Sweden was pushed into a steep recession at the beginning of the 1990s when share prices were at a historically high level.

Table 5. Effect of asset prices on unemployment

	Additional macroeconomic variables added							
	No macro variable (a)		World oil prices (b)		Real interest rates (c)		Productivity growth (d)	
(1)	Spain	-17.70*	Spain	-13.36*	Spain	-14.74*	Spain	-11.86*
(2)	Australia[A]	-10.38*	Australia[A]	-6.36*	Australia[A]	-8.59*	Australia[A]	-9.48*
(3)	U.K.[A]	-9.41*	Belgium	-5.97*	Belgium	-8.01*	Belgium	-8.76*
(4)	Belgium	-8.64*	U.K.[A]	-5.65*	U.K.[A]	-7.72*	U.K.[A]	-8.47*
(5)	Netherl.	-6.40*	Netherl.	-3.68*	Netherl.	-5.44*	Netherl.	-7.52*
(6)	U.S.[A]	-6.37*	Ireland[A]	-3.58	Ireland[A]	-4.93*	Ireland[A]	-5.89*
(7)	Ireland[A]	-5.77*	New Zeal.[A]	-3.21	Germany	-4.13*	Germany	-4.89*
(8)	Germany	-5.71*	Canada[A]	-1.49	New Zeal.[A]	-4.08	Canada[A]	-3.44*
(9)	France	-3.89*	U.S.[A]	-1.48*	U.S.[A]	-3.48*	U.S.[A]	-3.08*
(10)	Canada[A]	-3.83*	Germany	-1.41	Canada[A]	-3.24*	New Zeal.[A]	-2.15
(11)	New Zeal.[A]	-3.36*	France	-0.45	France	-2.79*	Denmark	-2.04
(12)	Austria	-2.50*	Denmark	0.05	Denmark	-2.15	France	-1.83
(13)	Finland	-2.07	Austria	0.58	Italy	-0.67	Norway	-1.20
(14)	Norway	-1.02	Italy	1.27	Japan	0.00	Japan	0.71
(15)	Japan	-0.92*	Japan	1.59	Austria	0.44	Sweden	1.00
(16)	Italy	-0.85	Norway	2.42	Norway	1.39	Italy	1.34
(17)	Denmark	0.12	Sweden	3.75*	Sweden	1.93	Austria	1.49
(18)	Sweden	3.06*	Finland	4.04	Finland	2.09	Finland	2.09
Real oil prices			4.99*		0.56		-0.54	
Real rate of interest					0.41*		0.35*	
Productivity growth							-0.93*	

Note: t-ratios in parentheses. [A] identifies the Anglo-Saxon countries and * significance at the 5% level. The table reports the results of least-squares estimation of an equation of the following form:

$$u_{it} = \alpha_{0i} + \alpha_{1i} u_{it-1} + \alpha_{2i} \left(q / \Lambda\right)_{it} + \alpha_3 M + \varepsilon_{it}$$

using (nonoverlapping) five-year averages from 1960 to 1999. The unemployment rate, u, is the OECD standardised unemployment rate. q/Λ is the ratio of a (nominal) share-price index and (nominal) labour productivity Λ where the latter is measured as the ratio of nominal GDP and the number of employed workers. Finally, M is a vector of macroeconomic variables which includes the real price of oil, the world real rate of interest (average of (long) real interest rates in the G7 countries), and the rate of growth of labour productivity (HP filtered rate of growth of real GDP per employed worker). The last two variables are written as percentages. Source*: Oswald (2000) and the International Financial Statistics*.

The correlation between column 1, on the one hand, and columns 2-3, on the other hand, are reported in Table 6 below alongside the rank correlations. These are uniformly high, which suggests that our results are robust to the inclusion of a variety of macroeconomic variables.

Table 6. The correlation between the sensitivity to share prices in the absence of other macroeconomic forces and the sensitivity once we take these into account

	Oil prices	Real interest rates	Productivity growth
Correlation	0.94	0.94	0.89
Rank correlation	0.90	0.90	0.87

We have also sought to test for a systematic difference between the sensitivity to share prices in the so-called Anglo-Saxon countries and the others and found that there is a significant difference between the two groups – the Anglo-Saxon countries having greater sensitivity to share-price changes. We find that there is a significant difference between the Anglo-Saxon and the other countries in terms of the sensitivity to changes in share prices such that unemployment falls more in these countries for a given increase in share prices.[22]

We would like to pinpoint the sources of the larger responsiveness in the Anglo-Saxon countries. We recall in this connection the stress that Nickell (1999) has placed on

[22] This is done by estimating the coefficient of a dummy variable for the Anglo-Saxon countries in our cross-section of 18 countries. The results follow:

Note: The table reports results from the estimation of an equation of the following form: $\hat{\alpha}_2 = \beta_0 + \beta_1 d$ where d is a dummy variable for the Anglo-Saxon countries and $\hat{\alpha}_2$ denotes the estimated coefficients in Table 5. * denotes significance at 5% level.

labour-market institutions: in particular, the unemployment replacement ratio, the (maximum) duration of unemployment benefits, the coverage and density of labour unions, indices of the coordination of unions and employer organisations and, lastly, an index of employment protection.[23] We first test for a difference between the two groups of countries with respect to each of these institutional variables. The results are below.

Table 7. Tests for cross-country differences in several institutional variables

	Estimated difference	t-ratio		Estimated difference	t-ratio
Replacement ratio	-18.00	2.43*	Union coordination	-1.08	4.27*
Duration of unemployment benefits	0.046	0.06	Employer coordination	-1.33	5.84*
Union density	-4.96	0.61	Employment protection legislation	-2.42	11.19*
Union coverage	-0.58	1.75			

Note: The table reports results from the estimation of an equation of the following form: $X = \beta_0 + \beta_1 d$ where X is a matrix of observations on the seven institutional variables and d is a dummy variable for the Anglo-Saxon countries as before. The replacement ratio is defined as the average ratio of unemployment benefits to wages; the duration of benefits is the maximum number of months that workers can collect unemployment benefits; union density measures the proportion of the labour force belonging to labour unions; union coverage shows the proportion of the labour force covered by union wage settlements; union- and employer coordination are indices for coordination among different unions and employers during wage bargraining and, finally; employment protection is measured by the number of months salary that goes into mandatory redundancy payments. All variables refer to the period 1983-88. Observations: 18. Source: Nickell and Layard (1999). * denotes significance at 5% level.

We see that the Anglo-Saxon countries are characterized by a lower replacement ratio, a lower levels of employment protection and lower levels of union- and employer coordination. The relationship with employment protection is especially strong. We

should note that the correlation between the last three variables; employment protection, union- and employer coordination is very high.

We now attempt to explain the variation in the sensitivity of unemployment to share prices, reported in Table 5, with these four institutional variables. Due to the paucity of observations (18 in number) we run separate regressions for each of the regressors. We report the complete results in Table A2 in the appendix.

Of the four variables, union- and employer coordination help explain the higher sensitivity in the Anglo-Saxon countries: The higher is the value taken by these variables, the smaller is the decrease of unemployment resulting from a given (percentage-of-initial-year) increase of the share price index. Thus the two corporatist variables may hold the key to explaining the country ranking in Table 5.

The estimated sensitivity may not only reflect labour-market institutions, however. Access to the capital market may, if anything, be *more* important for the effect on managers investment behaviour. We use four variables to measure and compare capital markets across countries. The *first* is the level of stock-market capitalisation as a ratio to GDP in 1988 about a decade prior to the investment boom found in several economies.[24] The response to the strong stock-market climb of recent years should be greater in countries where companies rely relatively heavily on the stock market for external financing or where venture capitalists rely on the stock market to dispose of their shares in the start-ups they financed. The *second* is stock-market turnover as a share of capitalisation. This varies from a high ratio of 90% in Finland to around 20% in the U.S. The *third* is the share of the top ten firms in total stock-market capitalisation in spring 2000. This is highest in Sweden (around 320%) but relatively low in the U.S. (55%). The

last variable is a recently published measure of red tape which may capture the difficulty of getting the requisite permissions to start an investment project. Results are reported in Table A3 in the appendix.

The results suggest that capitalisation and the share of the top ten companies may both affect the sensitivity to share price changes in the expected manner: the greater was the level of capitalisation in 1988 and the greater the share of the top ten companies, the greater was the responsiveness to share-price changes. In a separate regression we found that sensitivity was inversely related to the red tape index.

The question remains which structural variables are most likely to create a fertile environment for structural booms, i.e. if there is any correlation between the rise in the stock market and our labour-market and capital-market variables. Table A4 shows the results of regressions using small cross sections to test for this relationship where a structural boom is measured by the absolute change in the normalised share price between 1990 and 1997.

The table suggests that the absolute increase in the (normalised) share price was a positive function of market capitalisation in 1988 and the proportion of people in the age group 25-34 in 1990 and a decreasing function of the rate of turnover. The remaining variables are not significant at the 5% level although there is also some evidence that the rise in the stock market was a decreasing function of the degree of employment protection.

It is important that we apparently succeeded in pinpointing some of the institutional features that inhibit the response of corporatist nations to the occasional Casselian opportunity for a boom. Table 8 encapsulizes our main results in addition to

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[24] We came upon these data in *The Economist*, September 25, 1999.

reporting the increase in our normalised share price variable during the emergence of the present boom, 1990-1997. Column (1) reports the absolute change in the normalised share prices, column (2) the sensitivity – taken from Table 5 – and column (3) has the product of the two. Column (3) thus shows the change in unemployment which is implied by the observed change in share prices. Columns (4)-(7) then report values for the underlying determinants of both the stock-market boom as well as the sensitivity of employment to this boom.

We note the clear distinction between the first two sets of countries – those showing signs of a boom and those showing few such signs – in the rise in share prices, the predicted fall in unemployment, market capitalization in 1988, the index of red tape, the proportion of the population with a university degree and the extent of employment protection.[25]

Tables A2-A4 and Table 8 suggest that free and well-functioning capital- and labour markets are conducive to generating and responding to a structural boom. We also conclude that education may also play a big role in this regard. The continental economies appear to be lagging on most fronts.

[25] The only exceptions are the poor performance of the Swedish stock market and extensive employment protection in Holland and Sweden.

Table 8. The Proximite and Underlying Determinants of the Strength of the Investment Boom: Selected Large Western Advanced Economies

	The proximate determinants			The underlying determinants			
	Rise in share prices 90-97 (1)	Sensitivity to share prices (2)	Implied change in unempl. (%) (1)*(2)	Market cap. in 1988 (%)	Red tape	Tertiery educ. (%)	Empl. prot.
A strong broad investment boom in evidence							
U.K. (1996)	0.20	-8.5	*-1.7*	80	0.5	21	0.5
U.S. (1996)	0.73	-3.1	*-2.3*	50	1.3	33	0.2
Canada(1996)	0.29	-3.4	*-1.0*	45	--	37	0.6
Netherlands (1997)	0.88	-7.5	*-6.6*	40	1.4	22	3.4
Sweden (1997)	-0.07	1.0	*-0.1*	50	1.8	28	3.6
Few signs of such a boom driving the expansion (if any)							
Spain	0.04	-11.9	*-0.5*	25	1.8	16	3.7
Belgium	-0.06	-8.8	*0.5*	42	2.6	25	3.1
France	0.09	-1.8	*-0.2*	25	2.7	19	2.8
Italy	-0.05	1.3	*-0.1*	18	2.7	8	4.0
Germany	0.15	-4.9	*-0.7*	22	2.1	23	3.8
Unclassifiable cases							
Australia	0.15	-9.5	*-1.4*	50	--	24	1.2
Austria	-0.40	1.5	*-0.6*	13	--	8	2.6

Source: OECD Economic Outlook June 2000, Appendix and Ch. VII, and other data.

Notes on Some Policy Ramifications

Three areas for reflection suggest themselves here. The bearing on a nation's choice of a economic system. The question of stabilisation. And finally whether it is desirable to stabilise.

For most economists the overwhelming significance of this paper's findings will lie in what it suggests about the power of non-monetary forces to generate long swings in economic activity. Since the low-frequency fluctuation in economic activity, as measured by the unemployment rate, is not apparently mirrored by any coinciding fluctuation in the inflation rate or in the acceleration of prices – quite the contrary, structural booms seem to bring the blessing of low and falling inflation, if there is any association at all – it is hard to avoid the conclusion that the root cause of the long swings in activity observed over recent decades is the shifts in expected future profitability signaled, however imperfectly, by the stock market.

The policy problem raised by this finding, the tenor of which is already present in a great many policy discussions of the present stock-market boom, is that monetary policy aimed at stabilising the inflation rate or the price level will leave the real causes and their real channels to work their full effects on the equilibrium path of unemployment; while a monetary policy aimed at stabilizing the unemployment rate would, in the best of cases, produce large swings in the inflation rate and, in the worst of cases, produce an explosion or implosion in the inflation rate.

When, then, can a country or union of countries do? Historically, a great many countries in the West responded to perceptions of this problem by stepping farther back from capitalism than they had already done through real measures such as increased public employment, increased public expenditure financed to reduce private expenditure,

and increased social control over the private corporate sector. Unfortunately, the same structural-equilibrium theory that makes sense of the long swings in economic activity in spite of good monetary policy casts grave doubt on the efficacy of high and stable public employment and public expenditure as means of stabilising employment. The reason is that such government interventions theoretically crowd out a roughly equal volume of private sector employment and expenditure; there is no change in the "constant term" representing the autonomous employment or expenditure that is invariant to private-sector forces. (Maybe, in boom conditions, it would take longer for the private sector to raise employment from 30 to 35 per cent of the labour force than it would to raise employment from 90 to 95; but the rest point unemployment rate is not unambiguously improved by a large public presence.)

Supply-side economists, most famously Mundell (1971), have suggested that tax rates could play the role of 'stabilising' employment in the face of real-based fluctuations while the central bank attended to its monetary goal. But this prescription is problematic for a couple of reasons. One is that the unemployment rate does not appear on present econometric evidence to be highly sensitive to a moderate change in tax rates, especially at low or average initial rates. (Tax rates become seriously non-neutral when they reach the levels found in Italy, for example, where they have encouraged expansion of the underground economy.) The other reason for skepticism has to do with sustainability. Suppose the economy starts in a feasible steady state with a zero or positive budgetary deficit. In the event of a rise of the unemployment rate that is not transient, reducing the tax rate and maintaining the reduction will then send the public debt upward so that the same deficit will require rising tax rates from its initially reduced level. The reduced tax

rates will eventually have to be paid for with rising tax rates that ultimately bring a *net* increase of tax rates. We are seeing now that Japan is reaping the whirlwind as its public debt approaches levels requiring tax increases if the deficit is not to go above its already high level.

As if sensing these things, several of the Western economies drawing farther from capitalism opted for a Third Way, which we may call corporatism. First introduced by the interwar fascist movements, perhaps most explicitly by Mussolini, it was rolled back a bit by Ludwig Erhard (and maybe Luigi Einaudi) in the early postwar years, but in the vestiges of that system have remained visible: the rationalization of the heavy industries into one or two dominant firms, the use of the large banks to assure their financing in return for an insider position, industry-wide wage setting as a further safeguard against newcomers, and the presence of the government in big decisions on the direction and scale of the industrial behemoths. Through these ties among industrialists, bankers, unions and the state it was possible to simulate – through credit guarantees and investment subsidies – a semi-profitable heavy industry in times when, if the industries were left to competition in product and capital markets, there would have been cutbacks and ultimately transformations. At the same time, some other countries, notably Norway and perhaps Austria, went in a direction that might better be described as socialist. However, the instruments of industrial subsidies and credit guarantees were implicitly present in that system too.

It is extraordinary to see confirmation of this stylised history in Table 9. It shows six countries where the sensitivity of employment to the stock market is vastly below that of the others. There we see Norway and Austria, near the bottom. And we also see Italy

and Germany. The two others on the list are Sweden and Japan, which are no longer corporatist, but they were strongly so as recently as the 1980s. Their low estimated sensitivity may be in some part due to their being geographically small economies, where most firms are in a small number of cities. Still it is significant that their sensitivity falls well below than in Denmark and New Zealand, which are also quite small, even smaller. The place of France in this ranking is not clear but the evidence is not clear enough to lift from it the suspicion that it was fairly corporatist over the sample period.

The past decade has seen a cultural shift, however, as many managers of large companies in Germany and France seem to be reoriented toward serving “shareholder value” and many enterprises, including start-ups, now have access to equity finance on organised stock exchanges. For better or worse, parts, if not all, of continental Europe seem embarked on a capitalist phase. If so, the greater role accorded to stock markets and to international competition in the supply of funds, will expose these countries to greater swings than they would otherwise have felt. In such an emerging system the hard question is what, if anything, can policy do to dampen the worst declines in stock-market valuations and, in the interests of stretching out booms, to temper the largest rises in stock market valuations.

The answer to that question is surely not to put up walls closing off economies to the global capital market. Perhaps the main benefit of the formation of the European Monetary Union, it seems now to be agreed, is that it serves to reduce considerably the country risk in investments and loans to any country belonging to the union. It would seem anomalous if restrictions were to be placed on international transactions in national capital markets.

A plausible answer to the question is that governments should begin to do for the capital market what they have long done for the product market and the labor market: monitor and regulate to provide product safety and product information for consumers and similarly to foster workers' security in their employment. There is surely room in capital markets for instituting and enforcing requirements for much greater transparency and disclosure. The OECD Secretariat has been doing avant garde work recently in preparing *Principles of Corporate Governance* that address the need for better guidance about companies' business plan.[26] Of course, every precaution must be taken to ensure that governments do not in effect act as central planners deciding which enterprises will receive a seal of approval and which will not.

The most profound question, by all odds, is whether there is a strong case for stabilization. In economic theory it is regularly taught that a company or a country for that matter will receive vast quantities of financing as long as the valuation of the assets in which it proposes to invest exceed the reproduction cost of acquiring them. And as soon as it fails to continue to meet that market test, the financing will be whisked away and awarded elsewhere for better use. When the International Monetary Fund spoke piously of the importance of getting back to "stability" in the supply of international finance to east Asia it could hardly have been in more radical disagreement with accepted political economy. Similarly, it is not clear that there is a *net* benefit from government measures that would stabilise the employment or the revenues of a company or a country, since there are important efficiency losses from doing so and, more important, an inevitable loss of dynamism in the economy as a result of the foreknowledge of subsidies

[26] See the dispatch by Barry James, 'How can companies price a brainstorm?: OECD grapples with intangibles on corporate balance sheets,' *International Herald Tribune*, June 1999.

and guarantees in the event of trouble. We are reminded of the work of Ricardo Caballero and Muhammed Hammour (199X) who draw attention to the potentially beneficial cleansing effects of recessions.

At a deeper level, at the risk of seeming fanciful, one might look into some developments in psychology that view personal depression as a necessary cost on the way to personal growth and also a kind of tool for cutting losses and solving problems.[27] Similarly, as Jeremy Greenwood has argued, an economic depression is a time in which some firms are forced to stop doing the things they had been doing and, as a result, resources owners are compelled to rethink their directions. Of course, Hayek would not have been surprised by this suggestion, as he had frequently likened business crises to a purge and catharsis that was necessary before the economy could move on vigorously to the next thing. One wonders how it happened that economists, from Keynesians to monetarists to supply siders, all became obsessed with stability. The only variable that Keynes contemplated the stabilization of was the average money wage and even that was modified later to the stabilization of exchange rates – which is obviously a very long way from a call to stabilize employment or any other real magnitude. It seems inconceivable that Keynes, for whom the vitality of the mind and the free play of ideas were so important, could have conceived stability as one of the highest goods.

[27] See Erica Goode, 'Depression: survival tool,' New York Times, February 1, 2000.

Appendix

Table A1 – Country-specific coefficients from Table 5d

	constant	share prices	lagged dep.	R^2	DW
Spain	18.30 (8.64)	-11.86 (4.39)	0.20 (2.05)	0.96	2.8
Australia	11.14 (5.43)	-9.48 (3.28)	0.17 (1.19)	0.87	2.8
Belgium	16.24 (10.08)	-8.76 (7.15)	-0.04 (0.39)	0.95	2.1
U.K.	12.02 (6.32)	-8.47 (3.87)	0.30 (2.36)	0.85	3.5
Netherl.	12.75 (8.12)	-7.52 (4.82)	-0.16 (1.14)	0.86	2.9
Ireland	15.85 (4.74)	-5.89 (2.68)	0.22 (1.18)	0.77	1.5
Germany	9.00 (7.56)	-4.89 (4.93)	0.40 (5.17)	0.99	1.5
Canada	11.27 (5.42)	-3.44 (2.22)	0.08 (0.41)	0.71	2.4
U.S.	13.48 (12.06)	-3.08 (5.89)	-0.65 (5.97)	0.97	2.8
New Zeal.	7.46 (5.40)	-2.15 (1.22)	0.30 (2.65)	0.93	2.3
Denmark	7.89 (2.50)	-2.04 (0.76)	0.39 (1.74)	0.67	2.5
France	7.98 (7.48)	-1.83 (2.33)	0.46 (7.54)	0.99	2.3
Norway	7.15 (6.02)	-1.20 (1.17)	0.32 (0.96)	0.85	2.5
Japan	13.47 (7.66)	0.71 (1.16)	-4.46 (6.27)	0.86	2.8
Sweden	4.71 (2.62)	1.00 (0.63)	0.02 (0.04)	0.57	1.7
Italy	7.34 (4.34)	1.34 (1.17)	0.36 (2.29)	0.95	2.7
Austria	4.61 (3.71)	1.49 (1.25)	0.04 (0.20)	0.95	1.6
Finland	5.97 (1.07)	2.09 (0.31)	0.26 (0.66)	0.37	2.5

Common coefficients:

real oil prices	world real interest rates	productivity growth rates
-0.54 (0.70)	35.36 (6.09)	-92.67 (7.33)

Table A2. Sensitivity to share prices and labour-market institutions

	(1)	(2)	(3)
Union coordination * employer coordination	0.63* (3.2)	0.59 (1.6)	1.09* (2.9)
Employment protection		0.15 (0.1)	-0.34 (0.4)
Replacement ratio			-0.09 (1.6)
R^2	0.45	0.45	0.53
Observations	18	18	18

Note: The table reports results from the estimation of an equation of the following form: $\alpha_2 = \beta_0 + \boldsymbol{\beta_1} Y$ where $\boldsymbol{\beta_1}$ is a vector of coefficients, Y stands for one of the four significant institutional variables in Table 4 and α_2 measures the sensitivity to stock-market changes reported in Table 3. t-ratios in parentheses. Number of observations: 18. Spain is an outlier.

Table A3. Sensitivity to share prices and the capital market

	(1)	(2)	(3)
Market capitalization	-0.02 (1.5)	-0.03* (3.0)	-0.03 (1.4)
Turnover		0.03* (4.3)	0.04* (3.7)
Share of top ten companies			-0.12* (2.3)
R^2	0.45	0.63	0.66
Observations	15	14	11

Note: Capitalization measures stockmarket capitalisation in 1988 as a proportion of GDP. The share variable measures the capitalisation of top ten firms as a proportion of total market capitalisation in April 2000. Turnover measures the value of shares changing hands as a proportion of market capitalisation in 1999. Source: Morgan Stanley Capital International. Red tape is an index of red tape taken from *The Economist*, July 1999. t-ratios in parentheses. Finland as outlier is a strong outlier in all regressions involving the stock market and we correct for this. Spain and Finland are outliers.

Table A4. The Determinants of Structural Booms

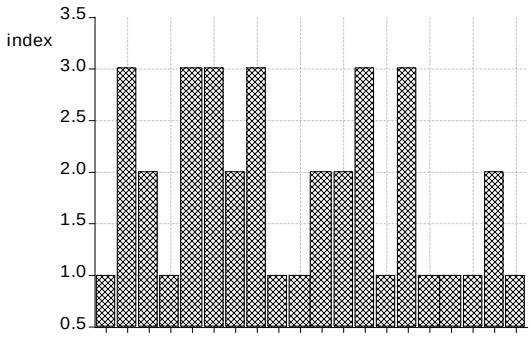
Dependent variable: rise in share prices 1990-1997

	(1)	(2)	(3)	(4)	(5)	(6)
Capitalization	0.004* (2.3)	0.004* (2.8)	0.006* (2.8)	0.005* (2.8)	0.002 (1.5)	0.006* (2.4)
Turnover		-0.001 (1.2)	-0.004* (2.0)	-0.003 (1.7)	-0.006* (1.9)	-0.004* (2.1)
Share of top ten			0.02 (1.0)	0.026 (1.2)	0.051 (1.4)	0.024 (0.9)
union oordination*employer coordination				-0.071 (1.0)		
employment protection					-0.36 (1.3)	
replacement ratio						0.00 (0.02)
R^2	0.22	0.26	0.43	0.50	0.60	0.43
Obs.	15	14	11	11	11	11

	(7)	(8)	(9)
Capitalization	0.005* (2.2)	0.003 (1.5)	0.004* (5.0)
Turnover	-0.004* (1.9)	-0.004* (1.9)	-0.003* (3.8)
Share of top ten	0.023 (1.0)	0.027 (1.5)	0.025* (6.4)
Secondary education	-0.001 (0.1)		
Tertiery education		0.038 (1.1)	
Aged 25-34			29.36* (4.9)
R^2	0.43	0.51	0.92
Obs.	11	11	11

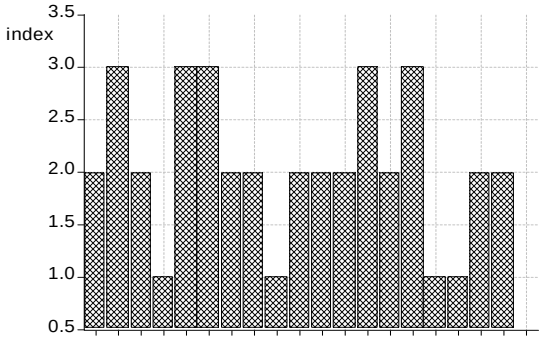
Secondary education is measured by the proportion of the population aged 25-64 years having completed secondary education, Tertiery eduction shows the corresponding number for university education and the age distribution has the proportion of the total population between the ages of 25 and 34 years in 1990. All three variables are written in percentages. Source: OECD. t-ratios in parentheses.

Employer coordination



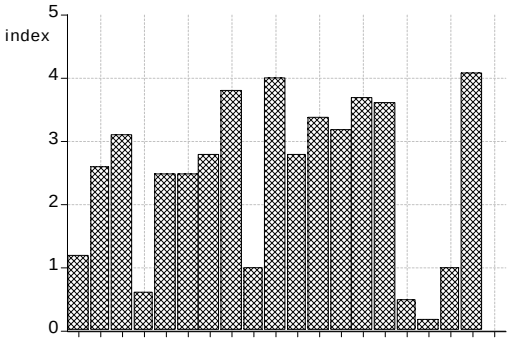
Source: Nickell and Layard

Union coordination



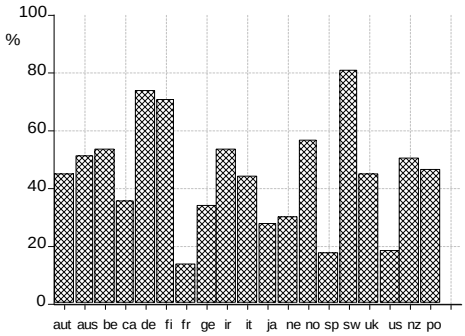
Source: Nickell and Layard

Employment protection



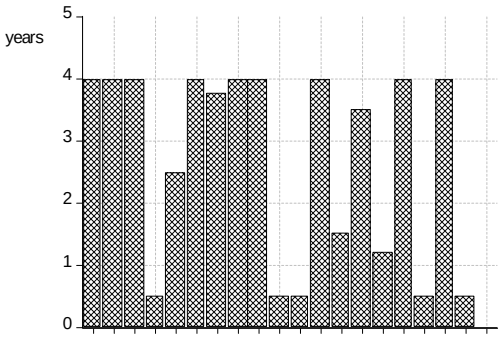
Source: Nickell and Layard

Union density
(proportion of labour force)



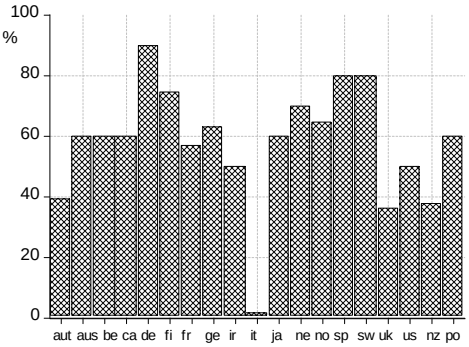
Source: Nickell and Layard

Duration of unemployment benefits



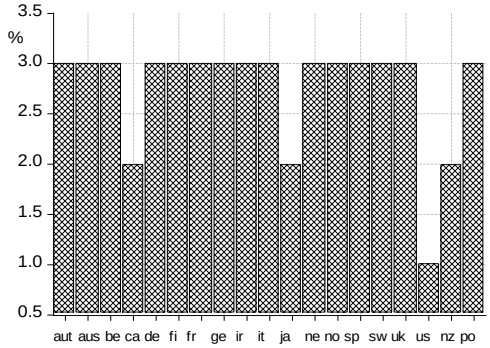
Source: Nickell and Layard

Unemployment-benefit replacement ratio



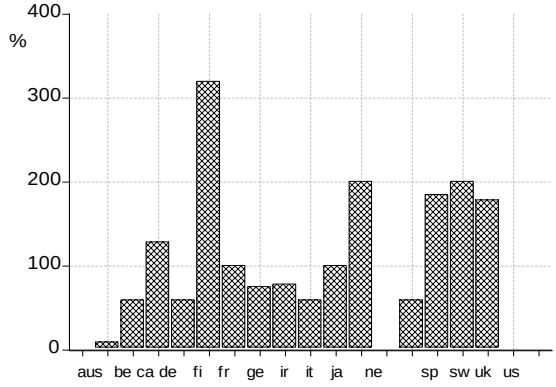
Source: Nickell and Layard

Union coverage
(proportion of labour force)



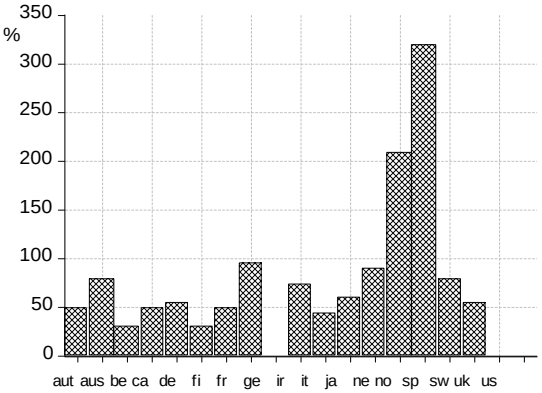
Source: Nickell and Layard

Market capitalization
(share of GDP)



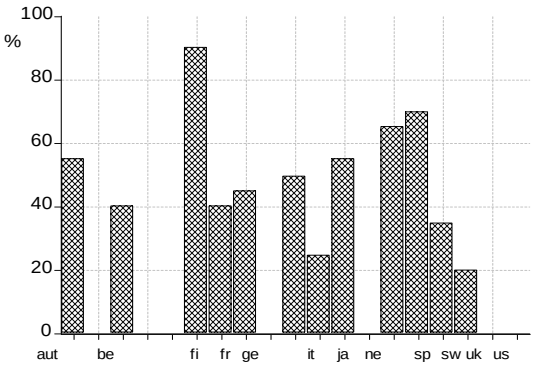
Source: Morgan Stanley Capital International

Stock market turnover
(share of capitalization)



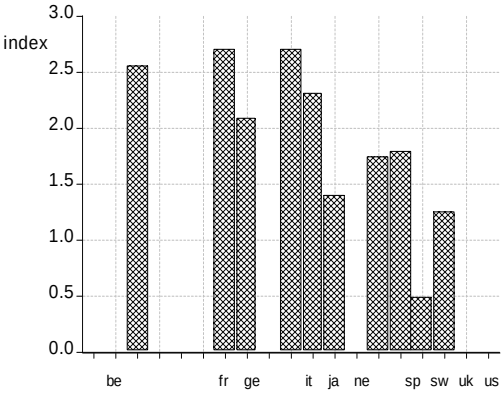
Source: Morgan Stanley Capital International

Share of top 10
(share of total capitalization)



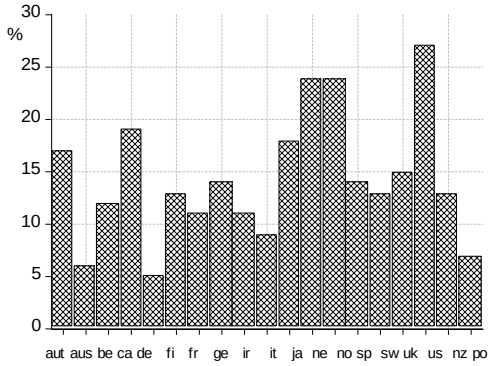
Source: Morgan Stanley Capital International

An index of red tape



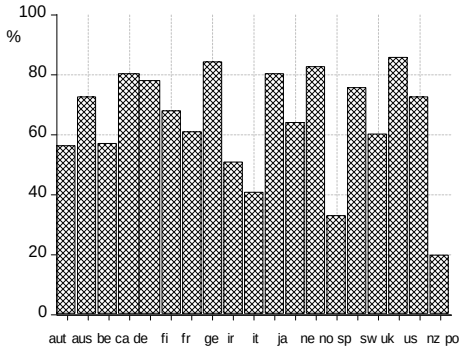
Source: The Economist, July 1999.

Tertiery education
(share of population 25-64)



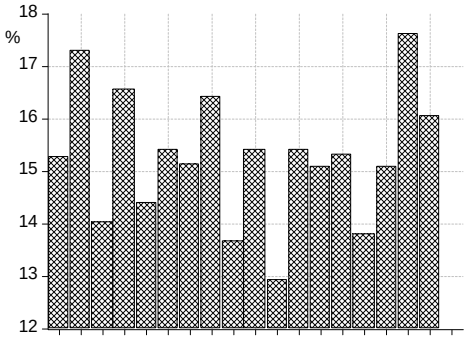
Source: OECD

Secondary education
(share of population aged 25-64)



Source: OECD

Population aged 25-34



Source: OECD

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