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Distribution and growth reconsidered: empirical results for six OECD countries

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We analyse the relationship between functional income distribution and economic growth in Austria, France, Germany, the Netherlands, the UK and the USA from 1960 until 2005. The analysis is based on a demand-driven distribution and growth model for an open economy inspired by Bhaduri and Marglin, which allows for either profit- or wage-led growth. We find that growth in France, Germany, the UK and the USA has been wage-led, whereas Austria and the Netherlands have been profit-led. In the case of Austria a domestically wage-led economy changes to profit-led when including the effect of distribution on external trade. The Netherlands, however, are already profit-led without external trade. Our results so far only partially confirm Bhaduri and Marglin's theoretical conclusion that wage-led growth becomes less feasible when the effects of distribution on foreign trade are taken into account.

Key words: Distribution, Growth, Demand-led accumulation regimes
JEL classifications: E12, E21, E22, E23, E25

1. Introduction

The relationships between wages, employment, distribution and growth have been among the most controversial in the history of economic thought. However, taking a look at the state of mainstream macroeconomics today, all of these debates, by and large, seem to have been resolved. In New Classical as well as in mainstream New Keynesian economics there is a clear cut inverse relationship between real wages and employment, at least in the long run. This is also true for 'New Consensus' macroeconomic models.[1] Although the New Classical and the New Keynesian/New Consensus schools of thought differ with respect to the determinants of short-run economic activity, and also with respect to the effectiveness

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[1] On New Classical and New Keynesian models see Snowdon and Vane (2005, 219–71, 357–432). On the New Consensus models see Clarida *et al.* (1999), Meyer (2001), Snowdon and Vane (2005, 419–27) and Carlin and Soskice (2006, 27–172). For a Post-Keynesian critique of these models see Arestis and Sawyer (2004), Lavoie (2004), Setterfield (2004), Fontana and Palacio-Vera (2007), Palacio-Vera (2005) and Hein (2006).

of macroeconomic policies, in the long run it is the real wage rate which is crucial for employment, and employment is crucial for growth. In neoclassical growth theories, old and new, growth is also affected by technological change, which is endogenously driven by investment in human capital and research and development in new growth theories (Grossman and Helpman, 1994; Romer, 1994; Solow, 2000). Nevertheless, these models are completely supply-driven and have no role for effective demand (Dutt, 2003; Kurz and Salvadori, 2003; Setterfield, 1994).

Therefore, the modern mainstream advocates 'structural reforms' in the labour market and in the welfare state when it comes to fighting persistent unemployment and low growth. These structural reforms usually include the reduction of employment protection legislation, of benefit replacement rates and durations, and of the tax wedge as well as the decentralisation of wage setting in order to adjust real wages to work place productivity, which means real wage cuts. Macroeconomic policies are assumed to be ineffective in determining real variables in the long run and should therefore supply a 'stable environment', which means that monetary as well as fiscal policies should aim at assuring price stability. Long-run employment and growth are considered to be purely supply-side determined. 'Employment friendly' reforms of labour markets and social benefit systems and the associated redistribution of income in favour of profits should be conducive to both employment and growth.

Unfortunately for the proponents, this view does not meet the facts: In macro-econometric cross-country studies, the relationship between labour market institutions and unemployment has been found to be rather weak and little robust, while macroeconomic policies explain a major part of unemployment differences between countries (Baker *et al.*, 2005; IMF, 2003; Palley, 2006). The declining trend in nominal wage growth and in the wage share in the European Union (EU) since the early 1980s has been associated with an increasing trend of the unemployment rate, and not with decreasing unemployment (Hein and Schulten, 2004). And a country such as Germany, which has introduced more 'employment friendly' structural reforms than most other Organisation for Economic Cooperation and Development (OECD) or EU countries since the mid 1990s, has shown a particularly weak macroeconomic performance since then (Hein and Truger, 2005, 2007).

Post-Keynesians have retained the role of effective demand in their analysis of long-run economic performance, because their models of distribution and growth are investment driven, independently of saving.[1] In the models by Kaldor and Robinson,[2] assuming full utilisation of productive capacities given by the capital stock in the long run, firms' investment decisions, determined by 'animal spirits' and the expected profit rate, affect growth and functional income distribution. But capital accumulation and the real wage rate or the wage share are still inversely related in these models.[3] In the

[1] Surveys of post-Keynesian growth and distribution theories can be found in Lavoie (1992, 282–347) and Hein (2004, 133–219). For recent developments see the contributions in Setterfield (2002) and in Argyros *et al.* (2004).

[2] See Kaldor (1955/56, 1957, 1961) and Robinson (1956, 1962) and the surveys in Lavoie (1992, 284–96) and Hein (2004, 149–76).

[3] Whereas in Keynes (1936) there is an *ex post* inverse relationship between employment and the real wage rate at less than full employment, due to falling marginal product of labour, in the growth models by Kaldor the additional assumption of full employment is made in order to make use of the Cambridge distribution theory linking growth inversely with the real wage. Since Robinson (1956) was reluctant to assume full employment, she established the positive link between growth and the profit rate through changes in capacity utilisation like Kalecki (Robinson, 1962), but then could not make use of Sraffa's profit-wage-frontier, which is based on the assumption of given capacity utilisation. So she assumed 'normal' capacity utilisation in her later growth models. We are grateful to an anonymous referee for drawing our attention to this development in Joan Robinson's view.

Kaleckian models,[1] however, with a variable rate of capacity utilisation in the long run, income distribution is determined by firms' mark-up pricing and is hence mainly affected by the degree of competition in the goods market and by relative powers of firms and workers in the labour market. Firms' investment decisions, determined by expected sales and internal profits, determine capacity utilisation, capital accumulation and growth.

In the 'underconsumptionist' variant of the Kaleckian model, pioneered by Rowthorn (1981), Dutt (1984, 1987, 1990) and Amadeo (1986A, 1986B, 1987), changes in distribution have unique effects on long-run growth equilibrium: rising wage shares cause higher capacity utilisation, capital accumulation, growth and also a higher profit rate, because a strong accelerator effect in the investment function is assumed. In contrast to this view, the seminal paper by Bhaduri and Marglin (1990) has shown that in a Kaleckian framework different regimes of accumulation are possible. Taking into account the effects of redistribution between wages and profits on consumption demand, on the one hand, and on firms' investment via costs of production and hence unit profits, on the other hand, growth may be either 'wage-led' or 'profit-led' depending on the parameter values in the saving and the investment functions. Therefore, the identification of an accumulation regime in a certain country in a certain period of time becomes a question of concrete historical and empirical analysis, and the Bhaduri and Marglin approach has increasingly inspired empirical work. The results for the long-run relationship between distribution and growth in major OECD countries, however, have not yet been conclusive. Our paper attempts to contribute to this work.

The paper is organised as follows. We develop an open-economy model without economic activity by the state based on the Bhaduri and Marglin (1990) approach in the second section, as a theoretical starting point for our analysis. In Section 3, the empirical literature based on the Bhaduri and Marglin model is reviewed and it is shown that the results with respect to the long-run developments in major OECD countries are not conclusive at all. Applying a single-equation estimation approach for the components of aggregate demand pioneered by Bowles and Boyer (1995), and by now widely used in empirical research on the Bhaduri and Marglin model, we estimate the effects of a change in income shares for Austria and the Netherlands as small open economies and for France, Germany, the UK and the USA as larger and less open economies in the Section 4. Section 5 concludes and draws some economic policy implications.

Before we proceed, the restrictions of the empirical approach followed in this paper should be made clear right at the start. First, we estimate single equations for the components of aggregate demand (consumption, investment, net exports), but we do not take into account interactions between these components. These interactions might modify our results. Second, we do not explicitly address monetary factors in the determination of the components of aggregate demand. This is a serious limitation for post-Keynesian models relying on the long-run independence of investment from saving, because these models should address the questions of investment finance, firms' debt and finance costs.[2] Third, our approach does not include any feedback effects of capital accumulation or growth on distribution. We simply take distribution as the exogenous variable determining growth as the endogenous variable.[3] Fourth, we neither consider

[1] See Kalecki (1954, 1971) and Steindl (1952) as well as the surveys in Lavoie (1992, 297–347), Blecker (2002) and Hein (2004, 177–219).

[2] For post-Keynesian models including monetary variables see the discussion in Lavoie (1995) and in Hein (2007, chapter 3). For an attempt to include the interest rate in empirical estimations of the Bhaduri and Marglin model see Hein and Ochsen (2003).

[3] See Marglin and Bhaduri (1990, 1991), Bhaduri (2006A) and Gordon (1995) for the discussion of feedback effects between economic activity and growth, on the one hand, and distribution on the other.

the productivity enhancing effects of investment in capital stock or output growth through embodied technical change or increasing returns to scale, nor the effects of redistribution on productivity growth.[1] Therefore, the long-run employment effects of effective demand and distribution variations may differ from the growth effects considered in the present paper, because the former are modified by induced changes in productivity growth. Nonetheless, we hold that our approach obtains important insights into the prevailing demand regimes in the countries under investigation. In particular, the single equation estimation approach applied in our paper allows us to examine empirically Bhaduri and Marglin's (1990) theoretical conclusion that wage-led growth becomes less feasible when the effects of distribution on foreign trade are taken into account.

2. The theoretical model

Our theoretical model is based on the open economy analysis in Bhaduri and Marglin (1990) concerning the relationship between distribution, the real exchange rate as an indicator of international competitiveness and growth, as well as on the analysis of the relationship between domestic redistribution and international competitiveness contained in Blecker (1989). We assume an open economy without economic activity of the state, which depends on imported inputs for production purposes and the output of which competes in international markets. We take the prices of imported inputs and of the competing foreign final output to be exogenously given and to be moving in step. The nominal exchange rate, the price of a unit of domestic currency in foreign currency, is determined by monetary policies and international financial markets and is also considered to be exogenous for our purposes. Foreign economic activity is also taken to be exogenously given.

2.1 Prices, distribution and international competitiveness

We assume the technical conditions of production and hence labour productivity (y) and the capital–potential-output ratio (v) to be constant. There is no overhead labour and the capital stock (K) is assumed not to depreciate. Domestic prices (p) are set by firms marking up constant unit variable costs, which consist of labour costs and imported material costs. The mark-up (m) is determined by the degree of price competition in the goods market and by relative powers of firms and workers in the labour market (Kalecki, 1954, pp. 11–18). Denoting the nominal wage rate with w, labour productivity with y, unit material inputs with μ, the nominal exchange rate with e and the prices of foreign goods with p_f, we get the following price equation for domestic goods:

$$p = (1+m)\left(\frac{w}{y} + p_f e \mu\right), \quad m > 0. \tag{1}$$

Since the relationship between unit material costs and unit labour costs (z) is given by:

$$z = \frac{p_f e \mu}{\frac{w}{y}}, \tag{2}$$

[1] See Kaldor (1957), León-Ledesma and Thirlwall (2002), Dutt (2003, 2006), Bhaduri (2006B, 2006C), Naastepad (2006) and Vogel (2007).

the price equation can also be written as:

$$p = (1+m)\frac{w}{y}\left(1+\frac{p_f e\mu}{\frac{w}{y}}\right) = (1+m)\frac{w}{y}(1+z). \tag{3}$$

The profit share (h) in domestic value added, consisting of domestic profits (Π) and wages (W), is given by:

$$h = \frac{\Pi}{\Pi+W} = \frac{1}{\frac{1}{(1+z)m}+1}. \tag{4}$$

The profit share in the open economy is determined by the mark-up and by the relationship between unit material costs and unit labour costs.

Before we are able to analyse the effects of changes in distribution on aggregate demand and growth, we have to clarify the relationship between distribution and international competitiveness because the latter will affect net exports. Following Bhaduri and Marglin (1990), we choose the real exchange rate (e_r) as an indicator for international competitiveness:

$$e_r = \frac{ep_f}{p}. \tag{5}$$

An increase in the real exchange rate implies increasing international competitiveness of domestic producers. From equation (5), it follows for the respective growth rates that:

$$\hat{e}_r = \hat{e} + \hat{p}_f - \hat{p}. \tag{6}$$

Increasing competitiveness can be caused by an increasing nominal exchange rate (nominal depreciation of the domestic currency), increasing foreign prices or declining domestic prices.

The effect of changes in distribution on international competitiveness will depend on the cause of distributional change. Applying equations (1) and (5) we can consider three main cases:

- First, if the change in distribution is caused by a change in the mark-up, we get an inverse relationship between the profit share and international competitiveness. A rising (falling) mark-up causes a rising (falling) profit share and falling (rising) international competitiveness of domestic producers:

$$\frac{\partial e_r}{\partial m} = \frac{-ep_f\left(\frac{w}{y}+p_f e\mu\right)}{p^2} < 0. \tag{7}$$

- Second, if a change in the nominal wage rate changes distribution via the effect on the relationship between unit material costs and unit labour costs, we obtain a positive relationship between the profit share and international competitiveness: falling (rising) nominal wages cause a rising (falling) profit share and increasing (decreasing) international competitiveness:

$$\frac{\partial e_r}{\partial w} = \frac{-ep_f(1+m)\frac{1}{y}}{p^2} < 0. \tag{8}$$

- Third, if a change in the nominal exchange rate is the cause for redistribution, we also get a positive relationship between the profit share and international competitiveness: An increasing (decreasing) nominal exchange rate, that is nominal depreciation (appreciation), causes an increasing (decreasing) profit share and increasing (decreasing) international competitiveness:

$$\frac{\partial e_r}{\partial e} = \frac{p_f p - e p_f (1+m) p_f \mu}{p^2} = \frac{p - (1+m)\mu e p_f}{\frac{p^2}{p_f}} > 0. \tag{9}$$

Summing up, changes in the domestic profit share may be associated with either declining or improving international competitiveness depending on the source of the distributional change:

$$e_r = e_r(h), \quad \begin{aligned} &\frac{\partial e_r}{\partial h} > 0, \text{ if } \Delta z > 0 \text{ and } \Delta m = 0, \\ &\frac{\partial e_r}{\partial h} < 0, \text{ if } \Delta z = 0 \text{ and } \Delta m > 0. \end{aligned} \tag{10}$$

2.2 Distribution and growth

In order to analyse the effects of changes in distribution on economic activity and capital accumulation, we start with the goods market equilibrium condition for an open economy without economic activity of the state: Planned saving (S) has to be equal to net investment (I) and net exports (NX), the difference between exports (X) and imports (M) of goods and services:

$$S = I + X - M = I + NX. \tag{11}$$

For convenience, equation (11) is normalised by the capital stock (K), and therefore, we get the following goods market equilibrium relationship between the saving rate ($\sigma = S/K$), the accumulation rate ($g = I/K$) and the net export rate ($b = NX/K$):

$$\sigma = g + b. \tag{12}$$

Saving consists of saving out of profits (S_Π) and saving out of wages (S_W). The propensity to save out of wages (s_W) is assumed to fall short of the propensity to save out of profits (s_Π), because the latter includes retained earnings of firms. Since the rate of capacity utilisation is the relation of output to potential output ($u = Y/Y^P$) and the capital–potential-output ratio relates the capital stock to potential output ($v = K/Y^P$), we obtain for the saving rate:

$$\sigma = \frac{S_\Pi + S_W}{K} = \frac{s_\Pi \Pi + s_W (Y - \Pi)}{K} = [s_W + (s_\Pi - s_W)h]\frac{u}{v}, \quad 0 \le s_W < s_\Pi \le 1. \tag{13}$$

Investment is modelled according to Bhaduri and Marglin (1990): Capital accumulation is a positive function of the profit rate, which can be decomposed into the profit share, the rate of capacity utilisation and the capital–potential-output ratio ($r = hu/v$). With a constant coefficient technology, investment is therefore positively affected by the profit share and by capacity utilisation. Increasing unit profits, and hence a rising profit share, have a positive effect on investment because internal funds for investment finance improve, ceteris paribus. Increasing capacity utilisation has a positive effect on investment because the

relation between (expected) sales and productive capacity improves. In order for domestic capital accumulation to be positive, the expected rate of profit has to exceed a minimum rate (r_{min}), given by the foreign rate of profit or by the rate of interest in financial markets. Both possible minimum rates are considered to be exogenous in the present model.[1]

$$g = \alpha + \beta u + \tau h, \quad \alpha, \beta, \tau > 0, \quad g > 0 \text{ only if } r > r_{min}. \tag{14}$$

The net export rate is positively affected by international competitiveness, provided that the Marshall–Lerner condition can be assumed to hold and the sum of the price elasticities of exports and imports exceeds unity. Under this condition, the real exchange rate will have a positive effect on net exports. But net exports also depend on the relative developments of foreign and domestic demand. If domestic demand grows at a faster rate than foreign demand, net exports will decline, ceteris paribus. With foreign demand given, the domestic rate of capacity utilisation moving in step with domestic demand will have a negative impact on net exports.

$$b = \psi e_r(h) - \phi u, \quad \psi, \phi > 0. \tag{15}$$

Stability of the goods market equilibrium requires that saving responds more elastically towards a change in the endogenous variable, the rate of capacity utilisation, than investment and net exports do together:

$$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} - \frac{\partial b}{\partial u} > 0 \Rightarrow [s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi > 0. \tag{16}$$

The equilibrium rates (*) of capacity utilisation and capital accumulation are given by:

$$u^\star = \frac{\alpha + \tau h + \psi e_r(h)}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi}, \tag{17}$$

$$g^\star = \alpha + \frac{\beta[\alpha + \tau h + \psi e_r(h)]}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} + \tau h. \tag{18}$$

Whereas equilibrium capacity utilisation indicates equilibrium activity with given productive capacities, equilibrium capital accumulation determines the development of productive capacities or potential output. The effect of a change in the profit share on equilibrium domestic economic activity, measured by the rates of capacity utilisation and capital accumulation in the theoretical model, can be calculated from equations (17) and (18):

$$\frac{\partial u}{\partial h} = \frac{\tau - (s_\Pi - s_W)\frac{u}{v} + \psi \frac{\partial e_r}{\partial h}}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi}, \tag{17a}$$

$$\frac{\partial g}{\partial h} = \frac{\tau\left(\frac{s_W}{v} + \phi\right) + (s_\Pi - s_W)\left(\tau\frac{h}{v} - \beta\frac{u}{v}\right) + \beta\psi\frac{\partial e_r}{\partial h}}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} \tag{18a}$$

[1] The choice of a linear Bhaduri and Marglin investment function does not imply that domestic demand is uniquely wage-led (or 'stagnationist' in Bhaduri and Marglin's wording) in our model because we have a positive propensity to save out of wages which allows domestic demand to be profit-led, too (or 'exhilarationist' in Bhaduri and Marglin's wording), also with a linear investment function. See Blecker (2002) for a discussion.

Equation (17a) shows that an increasing profit share will have no unique effect on equilibrium capacity utilisation. From the numerator it can be seen that the total effect of redistribution in favour of profits is composed of three effects: First, there is a positive effect via investment demand (τ), second, a negative effect via consumption demand $[-(s_\Pi - s_W)\frac{u}{v}]$ and third, an undetermined effect via net exports ($\psi\frac{\partial e_r}{\partial h}$). The direction of the latter depends on the source of redistribution and can be either negative or positive, as has been derived above. For equilibrium capital accumulation a similar result is obtained, as can be seen in equation (18a). Equilibrium analysis takes us this far. In what follows we shall confine the empirical study to the analysis of the effects of a change in distribution on the components of aggregate demand. Before doing this, however, we shall review the empirical literature on the Bhaduri and Marglin model in the following section.

3. Survey of the empirical literature

Since the publication of the seminal article by Bhaduri and Marglin in 1990, a number of empirical studies dealing with the relationship between distribution, aggregate demand and accumulation have been published. Regardless of the method applied or the main focus of the empirical analysis, they all tackle the question of the type of the demand-led growth regime in the countries under investigation.

Table 1 presents an overview of the main studies dealing empirically with the issue of distribution and demand. To our knowledge, Bowles and Boyer (1995) present the first attempt to determine growth regimes empirically applying a single-equation estimation approach. They estimate separate equations for the three demand aggregates consumption (saving), investment and net exports, subject to a change in the profit share in the consumption function or in the profit rate and in the employment rate, as an indicator for economic activity, in the investment and the net exports function. By doing so, they can determine the growth regime supposing a closed economy and considering the effects of distribution on consumption and investment first. Then they determine the growth regime for the open economy including the effects on net exports. The domestic sectors of the five countries France, Germany, Japan, the UK and the USA are found to be wage-led. However, when including the effect of redistribution on net exports, France, Germany and Japan become profit-led, while the UK and the USA remain wage-led.

Other studies employing the single-equation approach for the demand aggregates are Gordon (1995), Naastepad (2006), Naastepad and Storm (2007), Stockhammer, Onaran and Ederer (2007) and Ederer and Stockhammer (2007). In contrast to the results of Bowles and Boyer, Gordon (1995) finds the USA to be profit-led. He focuses on the effect of the profit rate as distribution parameter on capacity utilisation, observing a positive relationship between the two variables for the closed economy as well as for the open economy. Naastepad (2006) and Naastepad and Storm (2007) analyse the growth regime for the Netherlands in the first paper and for a number of OECD countries in the second paper by estimating the effects of a change in the profit share on saving, investment and exports. In both papers it is assumed that imports grow in line with domestic output and that there is no direct effect of the change in the profit share on this variable. The authors find relatively weak effects of redistribution on the growth of exports. The wage-led results for the domestic sectors of the majority of the countries under investigation are therefore maintained when adding the effects on exports. Only Japan and the USA are found to be profit-led. Stockhammer Onaran and Ederer (2007) as well as Ederer and Stockhammer (2007) apply two similar approaches to the Euro area in the first paper and to France in the

second paper. They estimate a number of export and import functions and introduce the relationships between export prices, import prices and domestic prices as additional variables. While they find wage-led regimes with respect to domestic demand, when including the effects of external trade, only the Euro area remains wage-led, whereas France becomes profit-led.

A different methodological approach is presented by Stockhammer and Onaran (2004) and Onaran and Stockhammer (2005) (summarised in Onaran and Stockhammer, 2006), who estimate two slightly different structural Vector antoregressious (VARs) for France, the USA and the UK, on the one hand, and for Turkey and South Korea, on the other hand. They find no significant effects of the profit share on the accumulation rate in the industrial countries analysed. Results for the two developing countries, however, suggest a wage-led growth regime for both countries.

4. Empirical method and results

Following Bowles and Boyer (1995) we applied a single-equation approach in order to determine the effects of a change in distribution on economic activity for some major OECD countries. In our theoretical model developed above, capacity utilisation was used as an indicator for economic activity. But reliable data for the development of capacity utilisation over longer periods of time in international comparison is difficult to obtain for empirical analysis. Therefore, we used real gross domestic product (GDP) as a proxy for capacity utilisation and hence economic activity, and estimated the direct partial effects of a change in the profit share, adjusted for the labour income of the self-employed, on the GDP growth contribution of consumption (C), investment (I) and net exports (NX). These partial effects were finally added up to obtain the total effect of a one percentage point increase in the profit share on the increase (or decrease) of real GDP (in %):

$$\frac{\frac{\partial Y}{Y}}{\partial h} = \frac{\frac{\partial C}{Y}}{\partial h} + \frac{\frac{\partial I}{Y}}{\partial h} + \frac{\frac{\partial NX}{Y}}{\partial h}. \tag{19}$$

For the reasons outlined in the theoretical model we expected the following signs of the derivatives:

$$\frac{\frac{\partial C}{Y}}{\partial h} < 0, \frac{\frac{\partial I}{Y}}{\partial h} > 0, \frac{\frac{\partial NX}{Y}}{\partial h} = ?, \Rightarrow \frac{\frac{\partial Y}{Y}}{\partial h} = ?. \tag{19a}$$

The empirical analysis was carried out for the period 1960–2005 for Austria and the Netherlands as small open economies, for France, Germany and the UK as medium-sized and less open economies, and for the USA as a large and rather closed economy. Due to problems with data availability, the consumption function for the UK could only be estimated for the period 1970–2005. All data were obtained from the AMECO database of the European Commission (2006). With the exception of the shares used in the estimations, variables are in real terms (see data definitions and data source in the Appendix).

Generally, the time series contained in the different equations were first tested for unit roots applying an Augmented Dickey–Fuller test (ADF). Since most equations contained variables that were both I(0) and I(1), we tested for the possibility to estimate an error-correction model applying the bounds testing approach developed by Pesaran, Shin and Smith (2001). In this approach, bounds of critical values are developed for an F-test testing for the significance of all long-term equilibrium coefficients and for a *t*-test for the error

Table 1. *Overview of empirical studies on distribution and growth*

Author	Countries in the analysis	Period covered	Estimation method	Function: Consumption/ Saving	Function: Investment	Function: Exports & Imports	Total effect: closed economy	Total effect: open economy
Bowles and Boyer (1995)	France, Germany, Japan, UK and USA	1961-1987 (saving) 1953-1987 (investment) 1961-1987 (net exports)	OLS (sometimes with an AR(1) adjustment)	$S/Y = f(h)$	$I/K = f(r,l)$	$NX/Y = f(r,l)$	All wage-led	France, Germany, Japan: profit-led; UK, US: wage-led
Gordon (1995)	USA	1955:1-1988:4	Two-stage LS (with an ARMA adjustment)	$S^n = f(u,r,i)$	$I^n = f(u,r,i)$	$NX = f(u,r,i)$	Profit-led	Profit-led
Stockhammer and Onaran (2004)	France, UK and USA	1972:1-1997:1 (France) 1966: 1-1997:2 (USA) 1970:1-1997:2 (UK)	SVAR	Variables: I, u, h, υ, $\hat{y}$. Contemporaneous effects: $I \rightarrow u, \upsilon, \hat{y}$; $u \rightarrow h, \upsilon, \hat{y}$; $\hat{y} \rightarrow \upsilon, h$. Accumulation: $g = I/K = f(u,h,\hat{y})$			Not estimated	No significant results
Onaran and Stockhammer (2005)	Turkey, South Korea	1965-1997 (Turkey) 1970-2000 (South Korea)	SVAR	Variables: I/Y, h, X/Y, M/Y, u, E. Contemporaneous effects: $I/Y \rightarrow u$; $h \rightarrow X/Y, M/Y, u$; $X/Y \rightarrow u$; $u \rightarrow M/Y, E$. Accumulation: $g = I/K = f(u,h)$			Not estimated	Wage-led, in the short term for Turkey and in the long term for South Korea.

Naastepad (2006)	The Netherlands	1960-2000	OLS (sometimes with an AR(1) adjustment)	$S/Y = f(h)$	$\hat{I} = f(\hat{h}, \hat{Y})$	$\hat{X} = f(\hat{Y}_{world}, \hat{ULC}_{relative})$	Wage-led	Wage-led (but only marginally)
Naastepad and Storm (2007)	France, Germany, Italy, Japan, the Netherlands, Spain, UK, USA	1960-2000	OLS (sometimes with an AR or ARIMA adjustment)	$S/Y = f(h)$	$I/Y = f(h, Y)$	$\hat{X} = f(\hat{Y}_{world}, \hat{ULC}_{relative})$	France, Germany, Italy, Spain, Netherlands, UK: wage-led; Japan, US:profit-led.	France, Germany, Italy, Spain, Netherlands, UK: wage-led; Japan, US: profit-led.
Stockhammer, Onaran and Ederer (2007)	Euro area	1962-2005 (consumption and net exports) 1968-2005 (investment)	OLS (sometimes with an AR(1) adjustment)	$C = f(W, \Pi)$	$I = f(Y, \Pi, i)$ (estimated as ECM)	1) $NX/Y = f(\hat{Y}, \hat{Y}_{trade}, e, (1\text{-}h))$ Exports: 2a) $\hat{X} = f(\hat{Y}_{trade}, \hat{e}, \hat{p}_x/\hat{p}_m)$ 2b) $\hat{p}_x = f(\hat{p}_m, \hat{p})$ Imports: 3a) $\hat{M} = f(\hat{Y}, \hat{e}, \hat{p}/\hat{p}_m)$ 3b) $\hat{p} = f(\hat{p}_m, \hat{ULC})$	Wage-led	Wage-led.
Ederer and Stockhammer (2007)	France	1960-2004	OLS	$C = f(W, \Pi)$ (also estimated as ECM)	$I = f(Y, \Pi, i)$ (estimated as ECM)	Exports: 1.1) $\hat{X} = f(\hat{Y}_{trade}, d(p_m), d(1-h))$ 1.2.a) $\hat{X} = f(\hat{Y}_{trade}, \hat{p}_x/\hat{p}_m)$ 1.2.b) $p_x = f((1\text{-}h))$ Imports: 2.1) $\hat{M} = f(\hat{M}_{t-1}, \hat{Y}, \hat{p}_{mt-1}, d(1-h)_{t-1})$ 2.2.a) $\hat{M} = f(\hat{M}_{t-1}, \hat{Y}, \hat{p}/\hat{p}_m)$ 2.2.b) $p_m = f((1\text{-}h))$	Wage-led	Profit-led

Notes: C = real aggregate consumption, e = nominal exchange rate, E = level of employment, g = accumulation rate, h = profit share, i = real interest rate, I = real gross investment, I^n = real net investment, K = capital stock, l = employment share, M = real imports, NX = real net exports, p = domestic prices, p_m = import prices, p_x = export prices, r = profit rate, S = real gross saving, S^n = real net saving, u = capacity utilisation, ULC = real unit labour costs, $ULC_{relative}$ = real unit labour costs relative to trading partners/world exports, W = real wages, y = labour productivity, Y = real aggregate output or demand, Y_{trade} = real aggregate output of the main trading partners, $\hat{Y}_{world}$ = growth rate of world trade, X = real exports, Π = real gross profits, υ = unemployment rate, $\hat{x}$= growth rate of variable x.

correction term. If the test values lie outside these bounds, the null hypothesis of no significance of the coefficient can be rejected, regardless of the order of integration or the mutual cointegration of the variables. For the specification of the lag-structure of the error-correction models, the 'general to specific' approach by Granger (1997) was adopted, starting with a relatively high number of lags and successively eliminating insignificant coefficients. If the estimation of an error-correction model according to this approach was not possible, the equation was estimated using first differences of the variables in order to avoid the problem of spurious regressions. All regressions were estimated with the method of ordinary least squares.

Assuming away interactions between the demand aggregates, and hence assuming that the profit share has no effect on the GDP variable as a determinant in the estimated equations, the effects of a change in the profit share on the GDP growth contributions of the demand aggregates can either be estimated directly, regressing the profit share on the share of the respective demand aggregate in GDP. Alternatively, level variables in logs for profits (and wages in the consumption function) or the profit share can be regressed on the demand aggregates in logs, and then the estimated coefficients have to be corrected for by the average share of the respective aggregates in profits or in GDP in order to obtain the effect of a change in the profit share on the GDP-growth contribution of the demand aggregate. We tried both estimation strategies and report the more significant and plausible results in the main text.[1]

4.1 Consumption

The effect of a change in distribution on aggregate consumption was estimated according to the assumptions contained in the saving function (13):

$$C = f(\Pi, W). \tag{20}$$

Compensation of employees represents wages (W), and gross operating surplus adjusted for the compensation of the self-employed represents profits (Π) in the empirical analysis. We used gross instead of net profits to ensure that the partial effects can be added up to the total effect on the percentage change of real GDP. Private consumption and both variables determining consumption were deflated by the price deflator for private consumption in order to obtain real values. They were then converted into logarithms, so that elasticities instead of direct partial effects were estimated. Following our theoretical model, we generally expected the elasticity of consumption with respect to wages to be significantly higher than the elasticity with respect to profits.

The time series of real consumption, real profits and real wages were found to be almost completely I(1) at the 1% significance level (Table A.1 in the Appendix). Since the critical values by Pesaran, Shin and Smith (2001) rejected the existence of a long-run level relationship between the variables, the consumption function was estimated employing first differences:

$$d[\log(C_t)] = c + a_1 d[\log(\Pi_t)] + a_2 d[\log(W_t)] + a_3 d[\log(C_{t-1})]. \tag{21}$$

Equation (21) thus estimates the elasticities $a_1 = (\partial C/C)/(\partial \Pi/\Pi)$ and $a_2 = (\partial C/C)/(\partial W/W)$, respectively. Table 2 presents the results. For the consumption function of the Netherlands and the Euro area, a lagged endogenous variable was included in order to

[1] Remarks on the results of the other procedures can be found in footnotes and detailed results can be obtained from the authors on request.

Table 2. *Estimation results for the consumption function from equation (21)*

Country	c	a_1	a_2	a_3	Adj. R^2	Durbin-Watson statistics	Ramsey RESET Test (*P*)	Q statistics (*P* for lag = 1)	White test (*P*)
Austria[a]	0.011*** (0.003)	0.113*** (0.036)	0.460*** (0.075)	/	0.575	2.333	0.529	0.246	0.224
France	0.007*** (0.002)	0.113*** (0.027)	0.552*** (0.050)	/	0.783	2.015	0.209	0.906	0.357
Germany[b]	0.008*** (0.002)	0.117*** (0.033)	0.527*** (0.034)	/	0.949	2.140	0.430	0.612	0.474
The Netherlands[c]	/	0.212*** (0.032)	0.774*** (0.101)	0.182 (0.120)	0.858	1.726	0.224	0.444	0.820
UK	0.008*** (0.003)	0.180*** (0.030)	0.631*** (0.080)	/	0.704	1.566	0.653	0.213	0.448
USA	0.013*** (0.002)	0.170*** (0.030)	0.472*** (0.051)	/	0.827	1.690	0.318	0.360	0.461

Notes: *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors are in parentheses.
[a]Estimated correcting for an outlier in 1978.
[b]Estimated correcting for outliers in 1975 and 1991.
[c]Estimated correcting for outliers in 1964 and 1975 and including a lagged variable $d[\log(W_{t-1})]$ (coefficient: -0.213** (0.096)). We continue with the long-run coefficients $a_1/(1-a_3)$ and $(a_2+a_4)/(1-a_3)$ in Table 3.

avoid first order autocorrelation in the residuals. In this case, long-run coefficients of a_1 and a_2 were calculated by dividing them by one minus the coefficient of the lagged variable (a_3). In the case of the Netherlands, an additional lagged variable $d[\log(W_{t-1})]$ had to be included to correct for first order autocorrelation. The long-run coefficient of the elasticity of consumption with respect to wages was then estimated by summing up the two coefficients and correcting with the lagged endogenous variable: $(a_2+a_4)/(1-a_3)$. All corrected long-run variables were additionally tested for significance with a Wald-test.

Estimates for the constant, as well as for the coefficients a_1 and a_2, were found to be highly significant at the 1% level in each of the estimations, suggesting the equations to be robust. This was confirmed by relatively high values of the adjusted R-squared. Additionally, the estimations were tested for general misspecification with the Ramsey RESET test, for first order autocorrelation in the residuals by analysing the Durbin–Watson statistics and the Q statistics, and for heteroskedasticity applying the White test. At the 10% level, indication of misspecification, autocorrelation or heteroskedasticity could be rejected for each of the estimations, confirming the results again. When necessary, the estimations were corrected for outliers in order to prevent heteroskedasticity.

Estimates of the elasticity of consumption with respect to wages were significantly higher than those with respect to profits. In order to calculate the direct partial effects of a change in the profit share on the GDP growth contribution of consumption, the elasticities were converted according to equation (22), using average values over the whole period for (C/Π) and (C/W):

$$\frac{\frac{\partial C}{Y}}{\partial h} = a_1 \frac{C}{\Pi} - a_2 \frac{C}{W} \tag{22}$$

As expected, the overall effect of an increase in the profit share on consumption was significantly negative in the six countries (Table 3). The strongest negative impact on consumption was found in the case of France and Germany, where a one-percentage-point rise in the profit share, according to our results, reduces private consumption by 0.350% of GDP and 0.317% of GDP, respectively. The findings for Austria and the Netherlands suggest a slightly less negative influence of the profit share on consumption (–0.238% and –0.218% of GDP, respectively). Both the estimations for the UK and the USA yielded significantly smaller effects on consumption than those found in the continental European countries (–0.186% and –0.141% of GDP, respectively).[1]

In accordance with the studies surveyed in Section 3, and also in accordance with Marglin and Bhaduri (1991), our results confirm the hypothesis of a lower propensity to consume out of profits than out of wages and hence a negative effect of an increase in the profit share on aggregate consumption. The two income classes Kaldorian/Kaleckian saving hypothesis is therefore supported, irrespective of changes in the structure of saving in corporate capitalism (retained earnings, pension funds) (e.g. Pitelis, 1997).[2] Comparing the countries under investigation, however, the relative magnitudes of the redistribution effects in our study differ from some of the other findings, which may be due to different time periods and/or data sources. In Bowles and Boyer (1995), for instance, the effect of redistribution on consumption in the UK and the USA is equal to, or even more than, the effect in France and Germany. Gordon's (1995) estimates for the USA yield roughly the

[1] An additional function relating the profit share to the saving ratio was estimated to test the robustness of our results. Generally, results from the alternative estimation were similar to those obtained from equation (21) and, in the case of different results, did not change the overall effect.

[2] Bowles and Boyer (1995) present a survey of further empirical studies confirming the two propensity saving function.

Table 3. *Partial effect of a change in the profit share on the growth contribution of consumption from equation (22)*

Country	C/Π	C/W	a_1(C/Π)	a_2(C/W)	**$(\partial C/Y)/\partial h$**
Austria	2.441	1.118	0.276	0.514	**−0.238**
France	2.338	1.112	0.264	0.614	**−0.350**
Germany	2.075	1.062	0.243	0.560	**−0.317**
The Netherlands	1.764	0.984	0.457	0.675	**−0.218**
UK	2.781	1.089	0.501	0.687	**−0.186**
USA	2.292	1.124	0.390	0.531	**−0.141**

same result as Bowles and Boyer. Naastepad and Storm (2007) also report higher effects of a change in the profit share on consumption in the Anglo-Saxon countries. Although they generally find higher effects on consumption than we do, their results for Germany, France and the Netherlands confirm our finding that these countries show quite similar results of a change in the profit share on consumption. Ederer and Stockhammer (2007) find a relatively small effect of redistribution on consumption in France compared to our result.

4.2 Investment

The rate of capital accumulation in our theoretical model was determined by capacity utilisation and the profit share [equation (14)]. For the estimation of the investment function, we used the log of real GDP as a proxy for capacity utilisation. We also included the real long-term interest rate (deflated by the private consumption deflator), as in Hein and Ochsen (2003), in order to control for the influence of monetary factors on investment.

$$I = f(Y,h,i). \tag{23}$$

For the reasons given in the model presented above, we generally expect a positive influence of both an increase in the profit share and in real GDP on investment. The real long-term interest rate is supposed to have a negative impact on accumulation decisions because, on the one hand, it represents the opportunity costs of real investment compared to financial investment. On the other hand, a higher interest rate diminishes retained profits and internal funds, and also the access to external funds in incomplete financial markets (Kalecki, 1954, pp. 91–108). However, coefficients of the interest rate were not significant, so that the variable was omitted from equation (23).

Stationarity could not be confirmed for all the variables contained in equation (23) (Table A.2 in the Appendix), so that the bounds-testing approach by Pesaran, Shin and Smith (2001) was again employed to test for the existence of a long-run level relationship between the variables in an error correction model. This was confirmed only for the Netherlands. Consequently, we estimated the following error correction model for this country (Table 4):

$$\begin{aligned} d[\log(I_t)] = {} & c + a_1 \log(I_{t-1}) + a_2 \log(Y_{t-1}) + a_3 h_{t-1} \\ & + \sum_{i=0}^{n} b_i d[\log(Y_{t-i})] + \sum_{i=0}^{n} c_i d(h_{t-i}) + \sum_{i=1}^{n} d_i d[\log(I_{t-i})]. \end{aligned} \tag{24a}$$

Table 4. *Estimation results for the investment function as ECM from equation (24a)*

Country	a_1	a_2	a_3	Adj. R^2	Durbin-Watson statistics	Wald test (F stat.)[a]	Ramsey RESET test (*P*)	Q statistics (*P* for lag = 1)	White test (*P*)
The Netherlands[b]	−0.335*** (0.063) [−5.323***]	0.255*** (0.057)	0.485** (0.210)	0.673	2.234	11.265***	0.783	0.359	0.343

Notes: *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors are in parentheses, t statistics in square parentheses.
[a]Bounds testing for H_0: $a_1=a_2=a_3=0$ to test for the existence of a long-run relationship between the variables. We assume an unrestricted constant and use special critical values from Pesaran *et al.* (2001).
[b]Estimated correcting for an outlier in 1963.

All coefficients in the error correction models were highly significant and rejected both the F-test for overall non-significance of the long-run coefficients and the *t*-test for non-significance of the error correction term at the 1% level. The long-run elasticity of investment with respect to the profit share was found to be positive. A high value of R-squared and the test results indicated a good specification of the equation. For the remaining countries, the investment equation was estimated in first differences (Table 5):

$$d[\log(I_t)] = c + b_1 d[\log(Y_t)] + b_2 d(h_t) + b_3 d[\log(I_{t-1})]. \tag{24b}$$

Generally, coefficients of the GDP variable were highly significant at the 1% level, while coefficients for the profit share were significant only for the UK, but with a negative sign. In the estimations for France and the USA, lagged variables had to be included to account for first order autocorrelation. The effect of the profit share on the logarithm of investment in equation (24b) could not be determined consistently. While the elasticities estimated for Austria and France where positive but insignificant, in the other countries we found negative elasticities, which in most cases were also insignificant.[1] Insignificant or negative elasticities of investment were not included in the calculation of the effect of a change in the profit share on the growth contribution of investment.[2]

Because results from equation (24b) were unsatisfactory, we also estimated an additional investment function relating investment to output and profits in an error correction model:

$$\begin{aligned} d[\log(I_t)] = {} & c + c_1 \log(I_{t-1}) + c_2 \log(Y_{t-1}) + c_3 \log(\Pi_{t-1}) \\ & + \sum_{i=0}^{n} d_i d[\log(Y_{t-i})] + \sum_{i=0}^{n} e_i d[\log(\Pi_{t-i})] + \sum_{i=1}^{n} f_i d[\log(I_{t-i})]. \end{aligned} \tag{24C}$$

However, only the estimation for France yielded significant and plausible coefficients (Table 6), so that we do not report the results for the other countries in the sample here. To obtain the partial effect of a change in distribution on the growth contribution of investment, the estimates of the long-run elasticity of investment with respect to the profit share were multiplied by the average investment share in GDP over the whole period covered in the analysis:

$$\frac{\partial \frac{I}{Y}}{\partial h} = \frac{a_3}{-a_1} \frac{I_n}{Y_n}. \tag{25A}$$

Alternatively, the estimates of the long-run elasticity of investment with respect to profits had to be corrected with the average share of investment in profits:

$$\frac{\partial \frac{I}{Y}}{\partial h} = \frac{c_3}{-c_1} \frac{I}{\Pi}. \tag{25B}$$

The ratio of the coefficients a_3 and a_1, i.e. c_3 and c_1, was again tested for significance with a Wald test (Table 7). They were found to be significant at least at the 10% level and were thus included in the further calculations. Changes in the profit share seem to have a rather

[1] For the UK, the estimation yielded a significant but negative elasticity of investment with respect to the profit share. This result seems implausible from a theoretical point of view.

[2] We additionally estimated the relationship between the profit share and the investment share in order to directly obtain the partial effect of the profit share on the growth contribution of investment. Partial effects for all the countries under investigation were negative, and insignificant in some cases. This result is both implausible and surprising and suggests that the relationship between the profit share and investment is not a very robust one.

Table 5. *Estimation results for the investment function in differences from equation (24b)*

Country	c	b_1	b_2	b_3	Adj. R^2	Durbin-Watson statistics	Ramsey RESET test (*P*)	Q statistics (*P* for lag = 1)	White test (*P*)
Austria[a]	−0.021** (0.009)	1.789*** (0.273)	0.198 (0.429) [*P* = 0.647]	/	0.622	2.056	0.783	0.674	0.540
France[b]	/	1.605*** (0.265)	0.583 (0.446) [*P* = 0.198]	0.565*** (0.121)	0.729	2.047	0.144	0.702	0.135
Germany[c]	−0.023*** (0.005)	1.613*** (0.130)	−0.176 (0.463) [*P* = 0.705]	/	0.809	1.717	0.181	0.342	0.897
UK[d]	−0.028*** (0.009)	2.560*** (0.313)	−0.887** (0.410)	/	0.601	1.912	0.078	0.893	0.317
USA[e]	−0.018* (0.010)	2.423*** (0.184)	−0.553 (0.636) [*P* = 0.390]	0.528*** (0.143)	0.848	1.811	0.017	0.622	0.765

Notes: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Standard errors are in parentheses.
[a]Estimated correcting for an outlier in 1982.
[b]Estimated including a lagged variable $d[\log(Y_{t-1})]$ (coefficient: −1.102*** (0.304)) to correct for first order autocorrelation.
[c]Estimated correcting for an outlier in 1974.
[d]Estimated correcting for outliers in 1963 and 1973.
[e]Estimated including a lagged variable $d[\log(Y_{t-1})]$ (coefficient: −1.279*** (0.419)) to correct for first order autocorrelation.

Table 6. *Estimation results for the investment function, effect of profits on investment in ECM from equation (24c)*

Country	c_1	c_2	c_3	Adj. R^2	Durbin-Watson statistics	Wald test[a] (F stat.)	Ramsey RESET test (*P*)	Q statistics (*P* for lag = 1)	White test (*P*)
France	−0.212*** (0.047) [−4.555***]	0.169*** (0.051)	0.062* (0.037)	0.849	1.976	13.512***	0.496	0.858	0.858

Notes: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Standard errors are in parentheses, t statistics in square parentheses. [a]Bounds testing for H_0: $a_1=a_2=a_3=0$ to test for the existence of a long-run relationship between the variables. We assume an unrestricted constant and use special critical values from Pesaran *et al.* (2001).

Table 7. *Partial effect of the profit share on the growth contribution of investment from equation (25a) or equation (25b)*

Country	$a_3/-a_1$ or $c_3/-c_1$	I/Y	I/Π	**(∂I/Y)/∂h**
Austria	/	0.235	/	/
France	0.292*	/	0.757	**0.221**
Germany	/	0.224	/	/
The Netherlands	1.448**	0.235	/	**0.340**
UK	/	0.183	/	/
USA	/	0.185	/	/

Notes: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Results of a Wald Test for overall significance of the effect.

large impact on the growth contribution of investment in the Netherlands (0.340% of GDP). The effect is larger than that on consumption, resulting in a profit-led nature of the domestic part of the economy when disregarding the effects on net exports. In France, we find a smaller positive effect of the profit share on investment (0.221% of GDP), so that the domestic sector, on the whole, has a wage-led nature. In the other countries under investigation, there are insignificant and/or negative effects of the profit share on investment. This suggests a wage-led growth regime in the domestic sectors of these countries.

Our results largely contradict those by Bowles and Boyer (1995), Gordon (1995), Ederer and Stockhammer (2007) and Naastepad and Storm (2007) who find positive effects of the profit share on investment for the countries they are examining, respectively. However, there seem to be major problems with the specifications of the investment function and the significance of the estimated effects in these papers. Bowles and Boyer (1995) use the profit rate and the employment rate as determinants in their investment function, which raises two problems. First, the profit rate is also affected by capacity utilisation and the capital–potential-output ratio. Changes in the profit rate may hence not adequately reflect changes in distribution. Second, the employment rate may be a rather weak indicator for changes in economic activity because it is also affected by changes in productivity growth and in working hours per employee. Naastepad and Storm (2007) explain the log of the ratio of gross fixed investment to GDP by the lagged log of the profit share and the lagged log of real GDP. In this unusual specification they find a significantly positive effect of the profit share, but real GDP as an indictor of demand has no significantly positive effect in most of the countries. These findings contradict most of the empirical studies on investment functions, saying that the demand variable has strong and significantly positive effects on investment, whereas profitability has rather weak and hardly significant effects.[1] Ederer and Stockhammer (2007) have some problems with statistical significance of the profit variable in their unrestricted estimation and with general misspecification.

[1] See the surveys by Jorgensen (1971) and Chirinko (1993), and the more recent empirical studies by Ford and Poret (1991), Bhaskar and Glyn (1995) and Ndikumana (1999), for example.

4.3 Net exports

Net exports in our model are positively affected by the real exchange rate as a measure of international competitiveness, and negatively by domestic activity, taking foreign activity as a constant [equation (15)]. The real exchange rate, in turn, is dependent on the profit share. As described in detail in Section 2, this effect is ambiguous and depends on the cause of the change in the profit share. Therefore, the sign of the effect of a change in the profit share on net exports is not clear in advance. For the estimation of the nominal share of effects of distribution on the net exports in nominal GDP, we thus included the profit share, domestic real GDP as well as real GDP of the main trading partners ($Y^{foreign}$), as indicators of domestic and foreign demand, as exogenous variables.[1]

$$\frac{NX_n}{Y_n} = f(h, Y, Y^{foreign}). \tag{26}$$

While the sign of the effect of a change in the profit share on net exports is not clear in advance, we expect domestic GDP to have a negative influence on net exports, since higher domestic demand will result in higher imports and, thus, decrease net exports. In contrast, a higher GDP in trading partner countries will cause an increase of exports and will thus increase net exports.

We converted domestic and foreign GDP into logarithms and for simplicity reasons generally assumed the Euro area and/or the USA to be the main trading partner. We tested both possibilities for each country and eliminated the coefficient that was not significant. Thus, for Austria, Germany, the UK and the USA we assumed the Euro area to be the main trading partner. For France the USA was taken to be the main trading partner. In the case of the Netherlands, neither the GDP of the Euro area, nor that of the USA was found to be significant, so that the variable was omitted from the equation.

Stationarity for most of the time series contained in equation (27) was rejected by the ADF test (Table A.3 in the Appendix). Estimation in an error-correction model was not possible according to the special critical values by Pesaran, Shin and Smith (2001). Although the share of net exports as well as the profit share was not stationary in some of the countries analysed, we did not estimate them in first differences for theoretical reasons, but instead included lagged variables to account for first order autocorrelation:

$$\frac{NX_{nt}}{Y_{nt}} = c + a_1 d[\log(Y_t)] + a_2 d\left[\log(Y_t^{foreign})\right] + a_3 h_t + a_4 \frac{NX_{nt-1}}{Y_{nt-1}} + a_5 h_{t-1}. \tag{27}$$

Results of the estimation of equation (27) are shown in Table 8. The estimations were corrected for outliers when necessary in order to avoid heteroskedasticity. Significance of the coefficients was found at least at the 5% level, with relatively high values of R-squared and no indication of misspecification.

As expected, the coefficients of domestic GDP had negative signs and those of foreign GDP showed positive signs for all countries, confirming our theoretical assumptions with respect to the direction of influence of domestic and foreign demand on net exports. The long-run partial effect of a change in the profit share on the share of net exports in GDP is

[1] We also estimated an equation relating the logarithm of net exports to domestic and foreign GDP and the profit share, but found no significant and plausible results.

Table 8. *Estimation results for the net export function from equation (27)*

Country	a_1	a_2	a_3	a_4	a_5	Adj. R^2	Durbin-Watson statistics	Ramsey RESET test (*P*)	Q statistics (*P* for lag = 1)	White test (*P*)
Austria[a]	−0.332**	0.229*	0.115**	0.666***	/	0.679	1.931	0.185	0.916	0.792
	(0.126)	(0.132)	(0.053)	(0.138)						
France[b]	−0.139*	0.121*	0.000	0.734***	/	0.619	1.721	0.641	0.574	0.634
	(0.071)	(0.066)	(0.007)	(0.095)						
Germany[c]	−0.502***	0.425***	0.368**	0.882***	−0.358**	0.761	1.842	0.530	0.595	0.123
	(0.077)	(0.116)	(0.167)	(0.083)	(0.168)					
The Netherlands[d]	−0.256***	/	0.513***	0.822***	−0.477***	0.888	1.876	0.299	0.762	0.356
	(0.085)		(0.138)	(0.066)	(0.136)					
UK[e]	−0.444***	0.178**	0.345***	0.832***	−0.334***	0.806	2.321	0.518	0.174	0.934
	(0.075)	(0.071)	(0.118)	(0.077)	(0.118)					
USA[f]	−0.166***	0.143***	0.265**	0.991***	−0.267**	0.936	1.622	0.159	0.222	0.639
	(0.038)	(0.048)	(0.113)	(0.047)	(0.114)					

Notes: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Standard errors are in parentheses.
[a]The growth of GDP of the Euro area is taken as $Y^{foreign}$.
[b]Estimated correcting for outliers in 1975 and 1980. The growth of GDP of the US is taken as $Y^{foreign}$. An additional lagged variable $d[\log(Y_{t-1})]$ (coefficient: 0.274*** (0.100)) was found significant.
[c]The growth of GDP of the Euro area is taken as $Y^{foreign}$.
[d]Estimated correcting for an outlier in 1972. Since neither the GDP of the Euro Area, nor that of the US was found significant, the variable was omitted from the equation.
[e]Estimated correcting for outliers in 1974 and 1975. The growth of GDP of the Euro area is taken as $Y^{foreign}$.
[f]The growth of GDP of the Euro area is taken as $Y^{foreign}$.

Table 9. *Partial effect of a change in the profit share on the share of net exports from equation (28)*

Country	**(∂NX/Y)/∂h**
Austria	**0.344*** **
France	/
Germany	/
The Netherlands	**0.202*** **
UK	/
USA	/

Notes: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Results of a Wald test for overall significance of the effect.

given by the sum of the coefficients a_3 and a_5 in equation (28), correcting for the effect of the lagged endogenous variable, which is summarised in Table 9:

$$\frac{\partial \frac{NX}{Y}}{\partial h} = \frac{a_3 + a_5}{1 - a_4}. \tag{28}$$

Again, we tested for the significance of the long-run effect of the profit share on the growth contribution of net exports to GDP with a Wald test. In the estimation for France, where the coefficient of the lagged profit share was insignificant, the effect of the profit share on the share of net exports in GDP was insignificant and even estimated to be zero. In the cases of Germany, the UK and the USA, the coefficients of the profit share and of the lagged endogenous variable were significant, but the Wald test rejected the significance of the long-run effect of the change in the profit share on net exports. This can be explained by the fact that the sum of the coefficients of the profit share was close to zero. In addition to the zero effect in France, effects of the profit share on net exports also seem to be zero in these three countries. In contrast, estimations for Austria and the Netherlands yielded significantly higher partial effects of the change in the profit share on net exports (0.344% and 0.202% of GDP, respectively). As expected, the small open economies of Austria and the Netherlands show significantly stronger effects of a change in distribution on the growth contribution of net exports. The larger and less open economies of France, Germany, the UK and the USA, all display zero effects of a change in the profit share on net exports.

Our results in some cases differ substantially from those of the studies summarised in Table 1. Naastepad (2006) and Naastepad and Storm (2007) generally find relatively small effects of redistribution on exports. In contrast to our results, they find small positive partial effects in Germany, the UK and in France but also a zero effect in the USA. They find no effect of the profit share on exports in the Netherlands, also contradicting our results. However, Naastepad (2006) and Naastepad and Storm (2007) only consider the effect of redistribution on export growth assuming the growth of imports to be proportional to domestic GDP. Therefore, they omit to take into account the effects of redistribution on imports. Ederer and Stockhammer (2007) estimate various approaches and report a relatively strong positive effect of a change in distribution on the growth contribution of net exports in France. However, their export and import functions suffer from theoretical problems because they include both an equivalent of the profit share and the nominal exchange rate. But the effect of the latter on international competitiveness of

domestic producers is already contained in the profit share, as we have shown above. Bowles and Boyer (1995) report relatively strong effects of changes in distribution on net exports. They find positive effects for Germany, the UK and the USA, but the effect in France is close to zero. Gordon (1995), in a different framework, finds a very strong effect on net exports in his estimation for the USA, which is not consistent with our results and those of the other authors.

4.4 Total effect

The total effect of a change in the profit share on aggregate demand and hence on the growth of output can be calculated by adding up the direct partial effects on the growth contributions of consumption, investment and net exports according to equation (19).

The results for the total effect are shown in Table 10. Without consideration of external trade, the overall effect of an increase in the profit share on aggregate demand and economic activity is negative in Austria, France, Germany, the UK and the USA. This effect is stronger in the three former countries than in the latter two due to a stronger negative effect on private consumption. Regarded as closed economies, thus, all five economies are wage-led. In the Netherlands, however, the positive effect of a change in distribution on investment is stronger than the negative effect on consumption, resulting in a profit-led growth regime for the domestic sector.

When adding the effect of a change in the profit share on external trade, Austria becomes profit-led in addition to the Netherlands, while the other countries remain wage-led. In Austria and the Netherlands, a one-percentage point increase in the profit share increases GDP by 0.106% and 0.324%, respectively. The significantly positive effects on GDP are due to a strong positive effect on net exports in the case of Austria, and to strong positive effects on investment and on net exports in the Netherlands.

In the wage-led regimes in France and Germany a one-percentage-point increase in the profit share reduces GDP by 0.129% and 0.317%, respectively. In France, the smaller negative effect on GDP is due to a significant positive partial effect on investment, which reduces the strong negative effect on consumption. In Germany, the negative effect of an increase in the profit share on consumption is not reduced by any positive effects on investment or net exports, resulting in a strong negative overall effect. In the case of the UK and the USA, we also find overall wage-led regimes, but due to the smaller negative effects of redistribution on consumption they are less pronounced than in Germany: a one-percentage point increase of the profit share reduces GDP by 0.186% and 0.141%, respectively.

Although, of course, we do not take our results literally, because this would be interpreting too much into the simple estimation method used, they nevertheless indicate

Table 10. *Total effect of a change in the profit share on the percentage change of real GDP from equation (19)* $\frac{\partial \dot{Y}}{\partial h} = \frac{\partial \dot{C}}{\partial h} + \frac{\partial \dot{I}}{\partial h} + \frac{\partial \dot{NX}}{\partial h}$

	Austria	France	Germany	The Netherlands	UK	USA
$\frac{\partial \dot{C}}{\partial h}$	−0.238	−0.350	−0.317	−0.218	−0.186	−0.141
$\frac{\partial \dot{I}}{\partial h}$	/	0.221	/	0.340	/	/
$\frac{\partial \dot{NX}}{\partial h}$	0.344	/	/	0.202	/	/
$\frac{\partial \dot{Y}}{\partial h}$	**0.106**	**−0.129**	**−0.317**	**0.324**	**−0.186**	**−0.141**

a tendency: aggregate demand in the larger and less open economies, namely in France and Germany, the UK and the USA reacts negatively to an increase in the profit share, resulting in overall wage-led regimes. These are less pronounced in the Anglo-Saxon economies of the UK and the USA due to smaller negative effects on consumption and in France due to a positive effect on investment. In the small, open economies of Austria and the Netherlands, however, an increase in the profit share has favourable effects on aggregate demand. It yields smaller negative effects on consumption than in France and Germany and strong positive effects on net exports in the case of Austria and the Netherlands, and on investment in the Netherlands.

Comparing our overall results to those of the other studies reviewed in Section 3, we can summarise as follows. Our results with respect to the wage-led nature of the growth regime in France, Germany and the UK are in line with those of Naastepad and Storm (2007), but we disagree with their classification of the USA as profit-led. Our results of a wage-led regime in the UK and the USA support those by Bowles and Boyer (1995), but we disagree with respect to their finding of a profit-led regime in France and Germany. We also disagree with Ederer and Stockhammer's (2007) classification of France as profit-led. Finally, we also disagree with Gordon's (1995) assessment of the USA as being profit-led. Apart from different time periods covered and different data sources used, these differences are mainly caused by differences in the estimated investment and net export functions, whereas the results for the consumption functions are more or less similar.

5. Summary and conclusions

We analysed the relationship between functional income distribution and economic growth in the small open economies of Austria and the Netherlands, and of the larger and less open economies of France, Germany, the UK and the USA from 1960 until 2005. The analysis was based on a demand-driven distribution and growth model for an open economy inspired by Bhaduri and Marglin (1990), which allows for profit- or wage-led growth. We found that growth in France, Germany, the UK and the USA was wage-led, whereas Austria and the Netherlands were profit-led. In the case of Austria, a domestically wage-led economy was turned to profit-led when including the effect of distribution on external trade. The Netherlands, however, was already profit-led without external trade. Our results so far only partially confirm Bhaduri and Marglin's (1990) theoretical conclusion that wage-led growth becomes less feasible when the effects of distribution on foreign trade are taken into account. If our results can be sustained, this is only true for small open economies, but not for larger, less open economies. However, there remain some major open questions to be answered before drawing economic policy conclusions.

First, although the studies reviewed in our paper also find that domestic demand in most of the countries under investigation has been wage-led since the early 1960s, there remain some differences with respect to the USA, the domestic sector of which is found to be profit-led in some studies, but wage-led in others. Major differences between the recent studies, however, arise when the effect of distribution on net exports is considered. These diverse results require further research and clarification, in particular with respect to the relationship between income shares and net exports, but also with respect to the effects of redistribution on investment, which show major differences in recent work.

Second, interactions between demand aggregates should be taken into account in order to overcome the limitations of the single equation estimation approach. For example, in a single equation approach the effect of redistribution on the contribution of consumption

demand to GDP growth is estimated, but the indirect accelerator effects of the associated change in GDP on the growth contributions of investment and net exports are not taken into account.

Third, the question arises whether there have been shifts in the growth regimes over time within the countries considered. Following their seminal theoretical contribution, Marglin and Bhaduri (1990, 1991) argued that there was a shift of demand regimes in the main OECD countries in the early 1970s, from wage-led growth to profit-led growth. Accordingly, the continued increase of the wage share during the 1970s, together with increasing energy prices, a decline in aggregate demand management policies and the collapse of the international currency system, was responsible for low growth in this period. Hein and Krämer (1997) confirmed this view and argued that there might have been a reshift of regimes during the 1980s, but the potentials for wage-led growth were not exploited. However, neither Marglin and Bhaduri nor Hein and Krämer applied econometric tools. Therefore, estimations for the demand regimes of sub-periods should be produced.

Fourth, further developments should be included to gain a more complete understanding of the development of distribution and growth during the recent decades. In a study on the Netherlands, Naastepad (2006) shows that low real wage growth and hence redistribution in favour of profits has caused a considerable slowdown in real wage induced productivity growth since the beginning of the 1980s. Together with a slowdown in world trade growth this has caused low Dutch growth during the last two decades. Under these conditions low growth is associated with improved employment in the short run. But in the medium to long run, low productivity growth and decreasing competitiveness feeds back negatively on net exports, growth and also employment. Naastepad's approach to supplement the analysis of the demand regime with the analysis of the productivity regime and to take into account interactions of these regimes should therefore be applied to other countries as well.

Fifth, another route to explore is related to monetary and financial developments since the early 1980s, as well as to changes in the economic policy stance. The tentative inclusion of the rate of interest into the estimations for the investment function has not shown any significant results for the whole period since the early 1960s, neither in our study nor in the other studies reviewed here. But the possible regime shift from a wage-led 'golden age' regime in the 1950s/1960s to a profit-led regime in the 1970s—and a potential reshift towards a wage-led regime in the 1980s/1990s—was not only associated with redistribution at the expense of labour, but also with major changes within the capitalist class and in the economic policy stance: increasing interest rates associated with the rise of the power of the rentiers' class, increasing shareholder-value orientation of firms associated with changes in the national and international financial system, increasing capital account openness, restrained fiscal policies and the introduction of independent central banks focussing exclusively on price stability. These effects should be included into the analysis in order to gain a broader understanding of the relationship between distribution and growth, in particular since the early 1980s.[1]

If further analysis confirms our preliminary conclusion with respect to the prevalence of wage-led growth in the major continental European countries, but also in the UK and the USA, the economic policy implications are quite straightforward. Pursuing a strategy of

[1] For preliminary but incomplete attempts see Hein and Ochsen (2003), Stockhammer (2004A, 2004B 2005–6), and van Treeck (2007).

profit-led growth via the net export channel, and therefore relying on a kind of 'beggar thy neighbour' policy, may be a successful way for small open economies, but it cannot be recommended for larger and less open economies. Such a strategy will not only be harmful for the trading partners of the respective countries and, in the long run, hence for the world economy as a whole, it will also lower GDP-growth in the countries pursuing such a strategy in the short run. Wage-led strategies are therefore more promising.

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Appendix

Data definitions and data source

C	real private final consumption expenditure, obtained directly from the AMECO database.
h	adjusted profit share, as percentage of GDP at current market prices, calculated as 1 minus adjusted wage share (total economy) from the AMECO database.
i	real long-term interest rate (deflator private consumption), obtained directly from the AMECO database.
I	real gross fixed capital formation, total economy, obtained directly from the AMECO database.
I_n	nominal gross fixed capital formation, total economy, obtained directly from the AMECO database.
NX	real net exports, calculated from the difference of real exports of goods and service and real imports of goods and services from the AMECO database.
NX_n	nominal net exports of goods and services, obtained directly from the AMECO database.
Π	real gross operating surplus, adjusted for the imputed compensation of the self-employed (total economy), deflated by the price deflator of private consumption, both obtained from the AMECO database.
W	real compensation of employees (total economy), deflated by the price deflator of private consumption, both obtained from the AMECO database.
Y	real GDP (at 2000 market prices), obtained directly from the AMECO database.
Y_n	nominal GDP (at current market prices) obtained directly from the AMECO database.

Table A1 *Tests for unit roots on the variables of the consumption function. Null hypothesis: The variable has a unit root.*

Country	Variable	ADF (t-statistics)
Austria	log(C)	-1.128
	Δ log(C)	-7.403***
	log(Π)	-3.700**
	Δ log(Π)	-8.916***
	log(W)	-2.552
	Δ log(W)	-2.403
	Δ Δ log(W)	-7.556***
France	log(C)	-4.058**
	Δ log(C)	-2.997**
	Δ Δ log(C)	-7.014***
	log(Π)	-2.968
	Δ log(Π)	-4.703***
	log(W)	-2.677*
	Δ log(W)	-2.537
	Δ Δ log(W)	-8.907***
Germany	log(C)	-2.381
	Δ log(C)	-4.523***
	log(Π)	-1.329
	Δ log(Π)	-5.347***
	log(W)	-2.226
	Δ log(W)	-3.634***
Netherlands	log(C)	-2.830
	Δ log(C)	-2.889
	Δ Δ log(C)	-6.753***
	log(Π)	-3.439*
	Δ log(Π)	-6.535***
	log(W)	-2.456
	Δ log(W)	-1.893
	Δ Δ log(W)	-5.944***
UK	log(C)	-2.935
	Δ log(C)	-4.168***
	log(Π)	-4.935***
	log(W)	-2.372
	Δ log(W)	-4.584***
USA	log(C)	-3.742**
	Δ log(C)	-4.629***
	log(Π)	-3.574**
	Δ log(Π)	-6.114***
	log(W)	-3.384*
	Δ log(W)	-4.221***

Notes: *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level

Table A2 *Tests for unit roots on the variables of the investment function. Null hypothesis: The variable has a unit root.*

Country	Variable	ADF (t-statistics)
Austria	log(I)	-2.905*
	Δ log(I)	-5.995***
	log(Y)	-1.547
	Δ log(Y)	-6.009***
	h	0.281
	Δ h	-7.241***
France	log(I)	-1.869
	Δ log(I)	-3.607***
	log(Y)	-3.293*
	Δ log(Y)	-4.585***
	h	-0.926
	Δ h	-5.024***
Germany	log(I)	-1.480
	Δ log(I)	-4.978***
	log(Y)	-2.339
	Δ log(Y)	-5.125***
	h	-1.598
	Δ h	-5.175***
Netherlands	log(I)	-1.594
	Δ log(I)	-4.733***
	log(Y)	-2.631
	Δ log(Y)	-3.896***
	h	-1.180
	Δ h	-4.515***
UK	log(I)	-0.449
	Δ log(I)	-4.859***
	log(Y)	-3.287*
	Δ log(Y)	-5.202***
	h	-3.564***
USA	log(I)	-0.247
	Δ log(I)	-5.761***
	log(Y)	-4.276***
	h	-2.618
	Δ h	-6.802***

Notes: *** denotes statistical significance at the 1% confidence level, ** significance at the 5% level, * significance at the 10% level.

Table A3 *Tests for unit roots on the variables of the function of net exports. Null hypothesis: The variable has a unit root.*

Country	Variable	ADF (t-statistics)
Austria	NX_n/Y_n	0.054
	$\Delta\ NX_n/Y_n$	-7.364***
	log(Y)	-1.547
	Δ log(Y)	-6.009***
	$\log(Y^{foreign})$	-2.159
	$\Delta \log(Y^{foreign})$	-4.736***
	h	0.281
	Δ h	-7.241***
France	NX_n/Y_n	-2.813*
	$\Delta\ NX_n/Y_n$	-7.450***
	log(Y)	-3.293*
	Δ log(Y)	-4.585***
	$\log(Y^{foreign})$	-4.276***
	h	-0.926
	Δ h	-5.024***
Germany	NX_n/Y_n	-2.453
	$\Delta\ NX_n/Y_n$	-6.041***
	log(Y)	-2.339
	Δ log(Y)	-5.125***
	$\log(Y^{foreign})$	-2.159
	$\Delta \log(Y^{foreign})$	-4.736***
	h	-1.598
	Δ h	-5.175***
Netherlands	NX_n/Y_n	-4.383***
	log(Y)	-2.631
	Δ log(Y)	-3.896***
	$\log(Y^{foreign})$	-4.276***
	h	-1.180
	Δ h	-4.515***
UK	NX_n/Y_n	-2.142
	$\Delta\ NX_n/Y_n$	-5.937***
	log(Y)	-3.287*
	Δ log(Y)	-5.202***
	$\log(Y^{foreign})$	-2.159
	$\Delta \log(Y^{foreign})$	-4.736***
	h	-3.564***
USA	NX_n/Y_n	-1.891
	$\Delta\ NX_n/Y_n$	-4.997***
	log(Y)	-4.276***
	$\log(Y^{foreign})$	-2.159
	$\Delta \log(Y^{foreign})$	-4.736***
	h	-2.618
	Δ h	-6.802***

Notes: *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.