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Distribution and Growth in France and Germany: Single Equation Estimations and Model Simulations Based on the Bhaduri/Marglin Model

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ABSTRACT *We analyse the relationship between functional income distribution and economic growth in France and Germany from 1960 until 2005. The analysis is based on a demand-driven distribution and growth model for an open economy inspired by Bhaduri & Marglin (1990), which allows for profit- or wage-led growth. First, we apply a single equation approach, estimating the effects of redistribution on the demand aggregates and summing up these effects in order to obtain the total effect of redistribution on GDP growth. Since interactions between the demand aggregates are omitted from this approach, we also apply a simulation approach taking into account these interactions. In the single equation approach we find that growth in France was wage-led, whereas the effect in Germany was undetermined. The results of the simulation approach, however, suggest that the wage-led nature of growth in France becomes even more pronounced when considering the interactions between the demand aggregates, while in Germany the simulations show a tendency towards wage-led growth in the longer run.*

1. Introduction

In a seminal paper, Bhaduri & Marglin (1990) have argued that Kaleckian models of distribution and growth may allow for wage- or profit-led growth.[1] Generally, Kaleckian models are characterised by a variable rate of capacity utilisation in the long run. Income distribution is determined by firms' mark-up pricing in incompletely competitive goods markets 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

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

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internal profits, determine capacity utilisation, capital accumulation and growth. In the older 'stagnationist' 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. However, Bhaduri & Marglin (1990) have shown that in a growth model driven by effective demand, long-run growth may be either wage-led or profit-led, if the effects of redistribution between wages and profits on consumption, on the one hand, and on firms' investment, directly via unit profits and indirectly via capacity utilisation, on the other hand, are fully taken into account. Therefore, the identification of an accumulation regime in a certain country during a certain period of time becomes a question of concrete historical and empirical analysis, and the Bhaduri/Marglin approach has increasingly inspired empirical work.

To our knowledge, Bowles & Boyer (1995) have presented the first attempt to determine growth regimes in the Bhaduri/Marglin-model empirically, applying a single equation approach. In this approach, the effects of redistribution on the demand aggregates (consumption, investment, net exports) are separately estimated and then summed up in order to obtain the total effect of redistribution on GDP growth. This method has been followed by other authors.[2] However, the results with respect to France and Germany, but also concerning other countries, are not conclusive. Bowles & Boyer (1995) find that the domestic sectors in France and Germany are wage-led, but including the effects of distribution on net exports turns the two economies profit-led. Ederer & Stockhammer (2007) confirm this result for France. These studies, therefore, seem to support Bhaduri & Marglin's (1990) theoretical conclusion that wage-led growth becomes less feasible when the effects of redistribution on foreign trade are taken into account. Naastepad & Storm (2007) and Hein & Vogel (2008), however, find that the two economies remain wage-led when the effects of distribution on external trade are included. As has been discussed in detail in Hein & Vogel (2008), the different results with regard to the wage-led or profit-led nature of France and Germany are due to different time periods covered and different data sources used, and 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. In that paper we also argued that the single equation approach suffers from a major drawback: estimating single equations for the components of aggregate demand (consumption, investment, net exports) and summing up the partial effects of redistribution on these components does not take into account interactions between the demand aggregates. 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 effects of the associated change in GDP on the growth contributions of investment and net exports are not taken into account. In the present paper, we attempt to remedy

[2]See Hein & Vogel (2008) for a survey of empirical studies based on the Bhaduri/Marglin-model and a discussion of potential reasons for different results.

this deficiency by means of a simulation approach that takes into account interactions between the components of aggregate demand.

The paper is organised as follows. In the second section we present an open economy model without economic activity by the state, which is based on Bhaduri & Marglin (1990) as the theoretical starting point of our analysis. The results of a single equation estimation approach to the effects of redistribution on growth in France and Germany are described in Section 3. The estimated equations are then used in a simulation approach in Section 4 and the results are compared to the single equation estimation method. Section 5 concludes and sums up.

2. The Theoretical Model

The theoretical model is based on the open economy analysis in Bhaduri & Marglin (1990) and 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.

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 in real terms: 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:

$$S = I + X - M = I + NX \tag{1}$$

For convenience, equation (1) is normalised by the real capital stock (K). 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 ($b = NX/K$):

$$\sigma = g + b \tag{2}$$

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), in particular because the latter includes retained earnings of firms. The profit share relates profits to domestic income consisting of wages and profits ($h = \Pi/(W+\Pi) = \Pi/Y$), 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 ($v = K/Y^p$). Thus, we obtain for the saving rate:

$$\sigma = \frac{S_\Pi + S_W}{K} = \frac{s_\Pi \Pi + s_W(Y - \Pi)}{K} = [s_W + (s_\Pi - s_W)h]\frac{u}{v}, \quad 0 \leq s_W < s_\Pi \leq 1 \tag{3}$$

Investment is modelled according to Bhaduri & 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.

$$g = \alpha + \beta u + \tau h, \quad \alpha, \beta, \tau > 0, \quad g > 0 \text{ only if } r > r_{\min} \tag{4}$$

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 (e_r) 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*. Therefore, the domestic rate of capacity utilisation will have a negative impact on net exports.

$$b = \psi e_r(h) - \phi u, \quad \psi, \phi > 0 \tag{5}$$

The real exchange rate, which is determined by the nominal exchange rate (e) and by the relationship between foreign prices (p_f) and domestic prices (p): $e_r = ep_f/p$, is affected by changes in the profit share, but in an ambiguous way, as has been shown in detail in Hein & Vogel (2008).

$$\begin{aligned} e_r = e_r(h), \frac{\partial e_r}{\partial h} &> 0, \text{ if } \Delta z > 0 \text{ and } \Delta m = 0, \\ \frac{\partial e_r}{\partial h} &< 0, \text{ if } \Delta z = 0 \text{ and } \Delta m > 0 \end{aligned} \tag{6}$$

Assuming that firms set prices according to a mark-up on unit variable costs, consisting of imported material costs and labour costs, a change in the profit share can either be caused by a change in the mark-up or by a change in the ratio of unit costs of imported materials to unit labour costs (z). If an increase in the profit share is caused by a rising mark-up, *ceteris paribus*, domestic prices will rise and the real exchange rate and hence international competitiveness will decline. But if an increasing profit share is triggered by a rising ratio of unit imported material costs to unit labour costs, *ceteris paribus*, the real exchange rate will increase and international competitiveness will improve. Nominal depreciation of the domestic currency – that is, an increase in the nominal exchange rate, or falling nominal wages – will increase the ratio of unit material costs to unit labour costs, and will therefore make an increasing profit share go along with improved competitiveness.

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:

$$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} - \frac{\partial b}{\partial u} > 0 \Rightarrow [s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi > 0 \tag{7}$$

We shall only consider stable goods market equilibria and the effects of changes in distribution on these equilibria. The equilibrium rates (*) of capacity utilisation and capital accumulation are given by:

$$u^* = \frac{\alpha + \tau h + \psi e_r(h)}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} \tag{8}$$

$$g^* = \alpha + \frac{\beta[\alpha + \tau h + \psi e_r(h)]}{[s_W + (s_\Pi - s_W)h]\frac{1}{v} - \beta + \phi} + \tau h \tag{9}$$

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 the rates of capacity utilisation and capital accumulation can be calculated from equations (8) and (9):

$$\frac{\partial u}{\partial h} = \frac{\tau - (s_\Pi - s_W)u/v + \psi(\partial e_r/\partial h)}{[s_W + (s_\Pi - s_W)h]1/v - \beta + \phi} \tag{8a}$$

$$\frac{\partial g}{\partial h} = \frac{\tau(s_w/v + \phi) + (s_\Pi - s_W)(\tau h/v - \beta u/v) + \beta\psi(\partial e_r/\partial h)}{[s_W + (s_\Pi - s_W)h]1/v - \beta + \phi} \tag{9a}$$

Equation (8a) 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 $[-(s_\Pi - s_W)u/v]$ and third, an undetermined effect via net exports $[\psi(\partial e_r/\partial h)]$. The direction of the latter depends on the source of redistribution and can be either negative or positive.

For equilibrium capital accumulation a similar result is obtained, as can be seen in equation (9a). The total effect of an increasing profit share on equilibrium accumulation is not unique and depends on the direction and the magnitude of three effects again. In the numerator we have first the positive effect originating from an increase in unit profits $[\tau(s_w/v + \phi)]$. Then we have the indirect effect via consumption demand and capacity utilisation $\left[(s_\Pi - s_w)(\tau h/v - \beta u/v)\right]$, which can be positive or negative. And finally there is the indirect effect via net exports $[\beta\psi(\partial e_r/\partial h)]$ which may also be positive or negative.

This is as far as equilibrium analysis takes us. 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 and hence on GDP growth.

3. Single Equation Estimations of the Effect of a Change in the Profit Share on Real GDP Growth

Taking the growth of real GDP as a proxy for capacity utilisation and following Bowles & Boyer (1995), we first estimated the overall effect of a change in the profit share on real GDP growth applying a single equation approach. In this way we obtained a first approximation of the nature of the growth regime in the respective countries, France and Germany, disregarding the effects of interdependencies between the demand components. We estimated three separate equations determining the partial effects of a change in the profit share (h) on the GDP growth contributions of consumption (C), investment (I) and net exports (NX). The partial effects were then summed to obtain the total effect of a percentage change in the profit share on the percentage change of GDP (Y):

$$\frac{\partial Y/Y}{\partial h} = \frac{\partial C/Y}{\partial h} + \frac{\partial I/Y}{\partial h} + \frac{\partial NX/Y}{\partial h} \tag{10}$$

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

$$\begin{aligned} &\frac{\partial C/Y}{\partial h} < 0, \ \frac{\partial I/Y}{\partial h} > 0, \ \frac{\partial NX/Y}{\partial h} = ? \\ &\Rightarrow \frac{\partial Y/Y}{\partial h} = ? \end{aligned} \tag{10a}$$

Estimations for France and Germany were carried out for the period 1960 to 2005. All data were obtained from the AMECO database of the European Commission (2006).[3] Variables are generally in real terms. Profits and the profit share were not adjusted for changes in the share of employees in total employment.[4] The results reported below therefore slightly differ from those derived for France and Germany in Hein & Vogel (2008).

[3]See 'Data definitions and Data Source' in the appendix.

[4]We refrained from adjusting profits or the profit share to changes in the share of employees in total employment because this adjustment (and the calculation of a labour income share) has to rely on the rather arbitrary assumption of average labour income of the employers being equal to average labour income of the employees. Here we assume that in the behavioural equations to be estimated and in the model to be simulated it is unadjusted profits or the unadjusted profit share that matters.

Generally, the time series contained in the different equations were first tested for unit roots applying an Augmented Dickey-Fuller Test (ADF). The ADF-Test was generally specified to contain a constant and a linear trend in the test equation, with the exception of the unit root test for the profit share and the share of net exports in GDP, which exhibited no linear trend. Since not all the variables contained in the equations were I(1), we tested for the possibility to estimate an error-correction model applying the bounds testing approach developed by Pesaran *et al.* (2001). With the help of an F-test on all the variables and a t-test on the error-correction term the existence of a long-run relationship between the variables can be determined regardless of whether they are I(1) or I(0), or mutually co-integrated. Bounds of critical values were developed assuming that the underlying variables are either all I(1) or all I(0). If the test values are outside these bounds, the null hypothesis of no long-run relationship can be rejected. 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. In order to avoid instability problems due to structural breaks in the nature of the growth regime, we applied a CUSUM and a CUSUM of squares test to all the single equations estimated and found no indication of parameter instability over the period covered in the analysis.[5]

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 be estimated either directly, taking the profit share as the exogenous variable and the respective share of the demand aggregate in GDP as the endogenous variable. Alternatively, the demand aggregates in logs can be regressed on the level variables in logs for profits (and wages in the consumption function) or the profit share itself, and then the estimated coefficients have to be corrected in order to obtain the effect of a change in the profit share on the GDP-growth contribution of the demand aggregate.[6]

For both countries under investigation we estimated the same equations for consumption and net exports. In the case of the investment function, however, this was not possible due to significance problems. Therefore, we had to try different estimations, as will be seen below.

[5]The results of the CUSUM and the CUSUM of squares tests can be obtained from the authors upon request. We also attempted to estimate single equations for different subperiods, following the suggestion of a regime shift from wage-led to profit-led in the early 1970s by Marglin & Bhaduri (1990, 1991) and of a possible re-shift in the 1980s by Hein & Krämer (1997), but were not able to find evidence in the data.
[6]See 'Estimation Strategy in the Single Equation Approach' in the appendix.

3.1. Consumption

The effect of a change in distribution on aggregate consumption was estimated according to the assumptions contained in the saving function (3) of the theoretical model:

$$C = f(\Pi, W) \tag{11}$$

Compensation of employees represents wages (W) and gross operating surplus 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. Both wages and profits were deflated by the price deflator of GDP in order to obtain the real values. All variables 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 A1 in the appendix). Since the critical values by Pesaran *et al.* (2001) rejected the existence of a long-run level relationship between the variables for both countries, the consumption function was estimated employing first differences:

$$d[\log(C_t)] = c + a_1 d[\log(\Pi_t)] + a_2 d[\log(W_t)] \tag{12}$$

Equation (12) thus estimates the elasticities $a_1 = (\partial C/C)/(\partial\Pi/\Pi)$ and $a_2 = (\partial C/C)/(\partial W/W)$, respectively. Table 1 presents the results. Generally, coefficients were found to be highly significant at the 1% level, suggesting the equation to be robust and well specified. This was confirmed by relatively high values of R-squared and the rejection of general misspecification, autocorrelation or heteroscedasticity of the residuals by various test statistics. When necessary, estimations were corrected for outliers to prevent heteroscedasticity of the residuals.

Table 1. Estimation results for the consumption function.
Equation (12) $d[\log(C_t)] = c + a_1 d[\log(\Pi_t)] + a_2 d[\log(W_t)]$

Country	c	a_1	a_2	Adj. R^2	DW-Statistics	Ramsey RESET Test (prob.)	Q-Statistics (prob. for lag = 1)	White Test (prob.)
France[1]	0.006*	0.136**	0.589**	0.765	1.864	0.380	0.664	0.666
	(0.002)	(0.030)	(0.056)					
Germany[2]	0.006*	0.137**	0.660**	0.923	1.767	0.592	0.451	0.168
	(0.002)	(0.042)	(0.050)					

Notes: ** denotes statistical significance at the 1% level, * significance at the 5% level. Standard errors are in parentheses.
[1] Estimated correcting for an outlier in 1974.
[2] Estimated correcting for outliers in 1975 and 1991.

Table 2. Partial effect of a change in the profit share on the growth contribution of consumption.

Equation (13) $\frac{\partial C/Y}{\partial h} = a_1 \frac{C}{\Pi} - a_2 \frac{C}{W}$

Country	C/Π	C/W	$a_1(C/\Pi)$	$a_2(C/W)$	$\partial C/Y/\partial h$
France	2.338	1.112	0.318	0.655	−0.337
Germany	2.075	1.062	0.284	0.701	−0.417

As expected, the long-run elasticities of consumption with respect to wages were significantly higher than those with respect to profits. In order to calculate the partial effect of a change in the profit share on the GDP growth contribution of consumption, we converted the elasticities according to equation (13) (see Table 2):

$$\frac{\partial C/Y}{\partial h} = a_1 \frac{C}{\Pi} - a_2 \frac{C}{W} \tag{13}$$

In both countries, the partial effect of the profit share on consumption was significantly negative: a one percentage point increase of the profit share according to our results reduces private consumption by 0.337 and 0.417 percentage points of GDP, respectively.

3.2. Investment

Capital accumulation in our theoretical model was determined by capacity utilisation and the profit share. In the estimations we used the log of real GDP as a proxy for capacity utilisation and tried the following investment function:

$$I = f(Y, h) \tag{14a}$$

Alternatively, either the log of real gross profits was included instead of the profit share to represent the profitability effect on investment, or the effect of the profit share on the investment share in GDP was estimated:

$$I = f(Y, \Pi) \tag{14b}$$

$$\frac{I}{Y} = f(Y, h) \tag{14c}$$

For the reasons given in the theoretical model, we generally expected a positive influence of both an increase in profitability and in real GDP on investment. As mentioned above, we estimated various specifications for the investment function and report those with the most significant and plausible results for the two countries. The variables were tested for stationarity and we found that they were generally I(1) (Table A2 in the appendix). Again, we tested for the existence of a long-run level relationship between the variables with the bounds testing approach by Pesaran *et al.* (2001) and estimated error correction models, when possible.

For France, the following error correction model could be estimated:

$$\begin{aligned} d[\log(I_t)] = c + a_1 \log(I_{t-1}) + a_2 \log(Y_{t-1}) + a_3 \log(\Pi_{t-1}) \\ + a_4 d[\log(Y_t - I_t)] + a_5 d[\log(I_{t-1})] + a_6 d[\log(\Pi_{t-2})] \end{aligned} \tag{15a}$$

Both the critical bounds values for the t-Statistic for the error correction term and those for the F-Statistic for the three long-term coefficients rejected the null hypothesis of no significance at the 1% level (Table 3(a)). Additionally, a high value of R-squared and the value of the Durbin–Watson Statistic indicated a good specification of the model. We restricted the short-run dynamics between GDP and investment, thus assuming the share of investment in GDP to be constant at least in the short run. In order to obtain the long-run effect of a change in the profit share on the GDP growth contribution of investment, the long-run coefficient of profits was converted according to equation (16a):

$$\frac{\partial I/Y}{\partial h} = \frac{a_3}{-a_1} \frac{I}{\Pi} \tag{16a}$$

In the case of Germany, we were not able to estimate any error correction model and thus directly estimated the effect of the profit share on the investment share. Both shares were included as level variables, but a lagged endogenous variable was included to avoid autocorrelation and spurious results. In order to account for the non-stationarity of the profit share and possible long-run dynamics in its relationship to the investment share, we additionally included both the actual and the lagged value of the profit share in the investment function. We estimated numerous specifications of the investment function for Germany and finally opted for the specification in equation (15b) because it was the one that obtained the most plausible and significant results:[7]

$$\frac{I_t}{Y_t} = c + b_1 d[\log(Y_t)] + b_2 h_t + b_3 \frac{I_{t-1}}{Y_{t-1}} + b_4 h_{t-1} \tag{15b}$$

Again, the equation seems to be well specified, as there was no indication of misspecification, heteroscedasticity or autocorrelation after the equation had been corrected for an outlier in 1974 (Table 3(b)). The effect of the profit share on the growth contribution of investment in GDP could be obtained directly from the long-run coefficient of the profit share:

$$\frac{\partial I/Y}{\partial h} = \frac{b_2 + b_4}{1 - b_3} \tag{16b}$$

[7]Estimating equation (15b) as a difference equation did not yield plausible results.

Table 3. (a) Estimation results for the investment function, effect of profits on investment in ECM.
Equation (15a) $d[\log(I_t)] = c + a_1 \log(I_{t-1}) + a_2 \log(Y_{t-1}) + a_3 \log(\Pi_{t-1}) + a_4 d[\log(Y_t - I_t)] + a_5 d[\log(I_{t-1})] + a_6 d[\log(\Pi_{t-2})]$

Country	a_1	a_2	a_3	Adj. R^2	DW-Statistics	Wald Test[1] (F-Stat.)	Ramsey RESET Test (prob.)	Q-Statistics (prob. for lag = 1)	White Test (prob.)
France	−0.329**	0.211*	0.117*	0.639	2.036	7.887**	0.589	0.757	0.121
	(0.072)	(0.083)	(0.057)						
	[−4.605**]								

Notes: ** denotes statistical significance at the 1% level, * significance at the 5% level. Standard errors are in parentheses, t-Statistics in square brackets.
[1] 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 3. (b) Estimation results for the investment function, effect of profits on the investment share in GDP.
Equation (15b) $I_t/Y_t = c + b_1 d[\log(Y_t)] + b_2 h_t + b_3 I_{t-1}/Y_{t-1} + b_4 h_{t-1}$

Country	b_1	b_2	b_3	b_4	Adj. R^2	DW-Statistics	Ramsey RESET Test (prob.)	Q-Statistics (prob. for lag = 1)	White Test (prob.)
Germany[1]	0.142***	−0.206*	0.923***	0.221**	0.963	1.857	0.824	0.643	0.447
	(0.028)	(0.110)	(0.037)	(0.104)					

Notes: *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level. Standard errors are in parentheses.
[1] Estimated correcting for an outlier in 1974.

Table 4. Partial effect of the profit share on the growth contribution of investment. Equation (16a) $\frac{\partial I/Y}{\partial h} = \frac{a_3}{-a_1}\frac{I}{\Pi}$ or (16b) $\frac{\partial I/Y}{\partial h} = \frac{b_2+b_4}{1-b_3}$

Country	$a_3/\text{-}a_1$ or $(b_2+b_4)/(1-b_3)$	I/Π	$(\partial I/Y)/\partial h$
France (16a)	0.356*	0.757	0.269
Germany (16b)	0.195	/	*(0.195)*

Notes: * significance at the 5% level. Results of a Wald Test for overall significance of the effect.

For the two countries, the partial effects of the profit share on investment are summarised in Table 4. In addition to analysing the significance of the single coefficients in equations (15a) and (15b), we tested for the significance of the long-run coefficients with a Wald Test. For France, we found a significant positive effect of the profit share on the growth contribution of investment: a one percentage point increase in the profit share increases investment by 0.269 percentage points of GDP. In Germany, the long-run coefficient of the profit share was also found to be positive. However, the Wald Test for overall significance did not reject the null hypothesis of no significance, so that when applying this additional significance criterion we have no long-run effect of the profit share on the growth contribution of investment in Germany. However, since both coefficients of the profit share in equation (15b) were found to be significant and since this is the equation that will be included in the simulation later on, the small positive effect of an increase in the profit share on the growth contribution of investment will be considered under a 'weak significance' criterion. As the positive effects on investment in both France and Germany were less pronounced than the negative effects on consumption, both countries display a wage-led regime when disregarding the effects of redistribution on net exports.

3.3. Net Exports

Based on the arguments in our theoretical model, we assumed net exports and thus also the share of net exports in GDP to be affected by domestic and foreign demand on the one hand, and by the profit share, through its effect on the real exchange rate, on the other hand:

$$\frac{NX}{Y} = f(h, Y, Y^f) \tag{17}$$

We expected domestic demand, represented by domestic GDP, to have a negative influence on the share of net exports, and foreign demand, represented by GDP of the main trading partners (Y^f), to have a positive influence on net exports. According to the theoretical model, the sign of the effect of the profit share on the share of net exports is not clear in advance, but depends on the source of the change in the profit share and the concomitant effect on the real exchange rate.

In order to make use of the estimated net export functions in the simulations in the next section, the share of net exports was calculated from real variables. We converted domestic and foreign GDP into logarithms and, for simplicity, generally assumed the Euro area and/or the USA to be the main trading partners of our two countries. We tested both possibilities for each country and eliminated the coefficient that was not significant. Thus, for Germany we obtained the Euro area to be the main trading partner. In the estimation for France, neither Euro area GDP nor US GDP was found to be significant, and coefficients also did not show the expected signs, so that instead the GDP of Germany was assumed to represent that of the main trading partner.

Stationarity for the time series contained in equation (19) was rejected by the ADF Test (Table A3 in the appendix). Still, estimation in an error-correction model was not possible according to the special critical values by Pesaran *et al.* (2001). Hence, the equation was estimated in first differences in order to avoid spurious results:

$$d\left(\frac{NX_t}{Y_t}\right) = c + a_1 d[\log(Y_t)] + a_2 d\left[\log(Y_t^f)\right] + a_3 d(h_t) \qquad (18)$$

With the exception of the coefficients of the profit share and of foreign GDP in the estimation for France, which were insignificant, coefficients were significant at least at the 10% level (Table 5). When necessary, we corrected for outliers to avoid heteroscedasticity. As expected, we found a significantly negative effect of GDP growth on the share of net exports, which was somewhat smaller in France than in Germany. The growth of the foreign demand proxy was found to exert a positive influence on the share of net exports in GDP, but this effect was not statistically significant in the estimation for France.

Table 5. Estimation results for the net exports function.
Equation (18) $d(NX_t/Y_t) = c + a_1 d[\log(Y_t)] + a_2 d\left[\log(Y_t^f)\right] + a_3 d(h_t)$

Country	a_1	a_2	a_3	Adj. R^2	DW-Statistics	Ramsey RESET Test (prob.)	Q-Statistics (prob. for lag = 1)	White Test (prob.)
France[1]	−0.122*	0.017	−0.122	0.149	1.966	0.560	0.905	0.664
	(0.062)	(0.039)	(0.110)					
Germany[2]	−0.423***	0.356***	0.359**	0.477	1.814	0.903	0.540	0.161
	(0.079)	(0.121)	(0.179)					

Notes: *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level. Standard errors are in parentheses.
[1] Estimated correcting for outliers in 1997 and 2005. The growth of GDP of Germany was taken as Y^f.
[2] Estimated correcting for an outlier in 1974. The growth of GDP of the Euro area is taken as Y^f.

Table 6. Partial effect of a change in the profit share on the share of net exports.

Equation (19) $\dfrac{\partial NX/Y}{\partial h} = a_3$

Country	a_3	$(\partial NX/Y)/\partial h$
France	/	/
Germany	0.359	**0.359**

The partial effect of the profit share on the GDP growth contribution of net exports could be obtained directly from the coefficient of the profit share (Table 6):

$$\frac{\partial NX/Y}{\partial h} = a_3 \tag{19}$$

In the case of France, we found no significant effect of the profit share on net exports.[8] For Germany, we estimated a positive effect on the growth contribution of net exports of 0.359 percentage points of GDP, which seems to be rather strong. We hold that the result obtained here constitutes the maximum possible effect of an increase in the profit share on the growth contribution of net exports in Germany and continue with this result.[9] Thus, it is suggested that an increase of the profit share has a favourable effect on international competitiveness in Germany, while the effect in France remains undetermined.

3.4. Total Effect

The total effect of a change in the profit share on the percentage change of GDP was calculated by adding up the three partial effects on the GDP growth contributions of the demand aggregates consumption, investment and net exports, according to equation (10).

Without consideration of foreign trade, both France and Germany show a wage-led growth regime over the period covered in the analysis (Table 7). When considering the effect of a change in the profit share on growth via net exports and disregarding the 'weakly significant' positive effect on investment

[8]We tried different specifications, but we were not able to find a significant effect of the profit share on net exports for France. See also Hein & Vogel (2008).

[9]In Hein & Vogel (2008) we refrained from estimating the net exports function in differences and argued that from a theoretical point of view the share of net exports in GDP and the profit share have to be stationary in the long run. With this specification we were not able to estimate any significant effect of an increase in the profit share on the growth contribution of net exports in Germany when applying the strict significance criterion and only a small positive effect under the 'weak significance' criterion. Naastepad & Storm (2007) in a recent paper covering a similar period (1960–2000) obtained a significant but very small effect of redistribution on net exports for Germany applying a somewhat different estimation method. Bowles & Boyer (1995), however, find a similarly strong impact as we do in this paper, but for a different time period (1961–1987). The results of the net export function should therefore be interpreted with great care.

Table 7. Total effect of a change in the profit share on the percentage change of real GDP.

Equation (10) $\frac{\partial Y/Y}{\partial h} = \frac{\partial C/Y}{\partial h} + \frac{\partial I/Y}{\partial h} + \frac{\partial NX/Y}{\partial h}$

	France	Germany
$(\partial C/Y)/\partial h$	−0.337	−0.417
$(\partial I/Y)/\partial h$	0.269	(*0.195*)
$(\partial NX/Y)/\partial h$	/	0.359
$(\partial Y/Y)/\partial h$	−0.068	−0.058 (*0.137*)

in Germany, the two countries remain wage-led, since we found no significant effect on net exports in France and the rather strong positive effect in Germany cannot overcome the strong negative effect on consumption: a one percentage point increase in the profit share results in a decrease of GDP by 0.068% in France and 0.058% in Germany. Hence, in both countries the single equation approach suggests a slightly wage-led growth regime. When taking into account the 'weakly significant' positive effect of an increase in the profit share on investment in Germany, however, the overall effect points to a profit-led growth regime in this country. From the single equation approach it was thus not possible to obtain a satisfyingly conclusive result regarding the wage-led or profit-led nature of growth in Germany.

4. Model Simulations of the Effect of a Change in the Profit Share on Real GDP Growth

Estimating single equations for the components of aggregate demand and summing up the partial effects of redistribution on these components does not take into account interactions between the demand aggregates. In this section we attempt to remedy this deficiency by applying a simulation approach that takes into account interactions between the components of aggregate demand. This means, for example, that the effect of redistribution on the growth contribution of consumption and hence on GDP growth is also included as an indirect effect in the influence of redistribution on investment and net exports, respectively.

The simulation models for France and Germany were built as follows. The three single equations explaining consumption, investment and net exports in the single equation approach were incorporated into the model. Only significant coefficients were included so that the net exports function for France had to be re-estimated without foreign GDP and the profit share. The effect of an increase in the profit share on net exports thus enters only via its effect on domestic GDP. Note that the coefficient of domestic GDP in the French net export function without foreign GDP and the profit share (equation (25a)) does not differ much from the one estimated in equation (18) for this country. In the simulation model for Germany we have included the 'weakly significant' positive effect of the profit share in the investment function and the perhaps too strong positive effect of the profit share in the net export function in order to check whether the simulations sustain the profit-led nature of growth with these functions.

The model was then closed by the accounting equations (20) and (21) and by the definition equation (22) below. In equation (20), ε_1 includes those components of aggregate demand not explicitly analysed in the estimations and the model; that is, public consumption and public investment. In equation (22), ε_2 includes those components of gross domestic product at constant market prices that are not distributed as domestic private factor income (profits and wages); that is, the difference between value added taxes and subsidies as well as net factor income flows between the domestic economy and foreign countries.

The model for France thus takes on the following form:

$$Y_t = C_t + I_t + NX_t + \varepsilon_{1t} \tag{20}$$

$$Y_t = W_t + \Pi_t + \varepsilon_{2t} \tag{21}$$

$$\Pi_t = h_t Y_t \tag{22}$$

$$d[\log(C_t)] = 0.006 + 0.136^* d[\log(\Pi_t)] + 0.589^* d[\log(W_t)] \tag{23a}$$

$$d[\log(I_t)] = -0.416 - 0.329^* \log(I_{t-1}) + 0.211^* \log(Y_{t-1}) + 0.117^* \log(\Pi_{t-1}) + 1.844^* d[\log(Y_t - I_t)] + 0.282^* d[\log(I_{t-1})] + 0.216^* d[\log(\Pi_{t-2})] \tag{24a}$$

$$d\left(\frac{NX_t}{Y_t}\right) = 0.004 - 0.127^* d[\log(Y_t)] \tag{25a}$$

The model for Germany was built as follows:

$$Y_t = C_t + I_t + NX_t + \varepsilon_{1t} \tag{20}$$

$$Y_t = W_t + \Pi_t + \varepsilon_{2t} \tag{21}$$

$$\Pi_t = h_t Y_t \tag{22}$$

$$d[\log(C_t)] = 0.006 + 0.137^* d[\log(\Pi_t)] + 0.660^* d[\log(W_t)] \tag{23b}$$

$$\frac{I_t}{Y_t} = 0.008 + 0.142^* d[\log(Y_t)] - 0.206^* h_t + 0.923^* \frac{I_{t-1}}{Y_{t-1}} + 0.221^* h_{t-1} \tag{24b}$$

$$d\left(\frac{NX_t}{Y_t}\right) = 0.001 - 0.423^* d[\log(Y_t)] + 0.356^* d\left[\log(Y_t^f)\right] + 0.359^* d(h_t) \tag{25b}$$

First we compared the model solutions for the endogenous variables to the time series in order to check for the fit of the model with historical data.

The model specifications for both countries fit the data quite well, especially when considering the simple nature of the model.[10] We then simulated a permanent one percentage point shock to the profit share and tracked its impact on the endogenous variables of the model. The reactions of the variables for France are presented in Figure 1(a).

In the simulation, a one percentage point increase in the profit share in France immediately increases profits by nearly 1.2% of the baseline value and reduces wages by about 1.5%. Although the change in distribution has favourable effects on profits, both consumption and investment decrease after the shock, which then negatively feeds back on both wages and profits. However, soon after the shock, the positive effect of the increase in the profit share on investment sets in, resulting in a positive deviation of investment from its baseline after three years. Profits further increase, and to a lesser degree also wages and consumption improve but remain considerably below baseline. The increases in consumption and investment reach their peak after about five years, then turn into a downward trend and finally converge to their seemingly stable long-run values. The effect of changes in the profit share on net exports mirrors those on investment and consumption: after a significant decrease in response to the shock to the profit share, a recovery sets in after about five years with values of net exports fluctuating around their baseline. Finally, a downward trend leads to a convergence below baseline, indicating in accordance with our, albeit insignificant, results from the single equation estimation, a negative relationship between the profit share and net exports in France.

The same pattern as for consumption, investment and net exports, with cyclical short-run dynamics and convergence to a relatively stable value, at least during the time span of the simulation, can be observed for real GDP in France in Figure 1(b). The permanent negative effects on wages and consumption, and also on net exports, are stronger than the positive effects on profits and investment, resulting in an overall negative effect of a one percentage point increase in the profit share on GDP of about -0.1% at the end of the simulation period, and hence a wage-led growth regime. Thus, the simulation does not change the overall qualitative result of the single equation approach for France, but suggests the wage-led nature of the growth regime to be even stronger when taking into account the interdependencies between the demand aggregates.

In the model simulation for Germany, shown in Figure 2(a), a one percentage point increase in the profit share immediately increases profits by more than 0.8% of the baseline value and reduces wages by about 0.8%. Thus, in contrast to the results for France, the positive effect on profits is found to be stronger than the negative effect on wages. However, this does not prevent consumption and investment from reacting negatively immediately after the shock. After the initial shock, the negative effect on investment is lessened and after about seven years the deviation from baseline becomes positive. The increase in profits roughly remains at its high initial level, and investment stabilises at a

[10]Results for the deviation of the model baseline from the actual data can be obtained from the authors upon request.

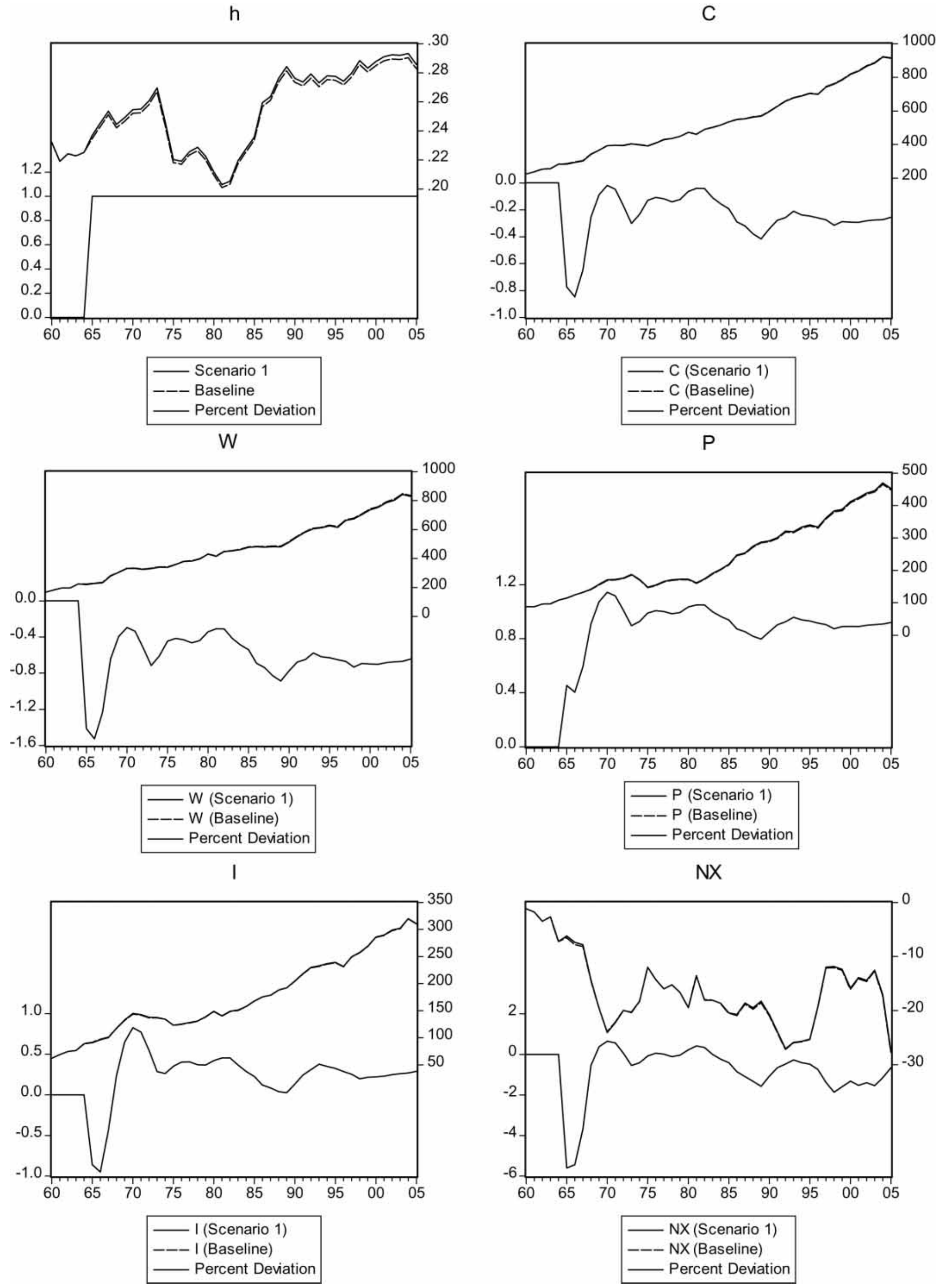

Figure 1. (a) Effect of a one percentage point increase in the profit share on profits, wages and the demand aggregates in France: percentage deviation from baseline.

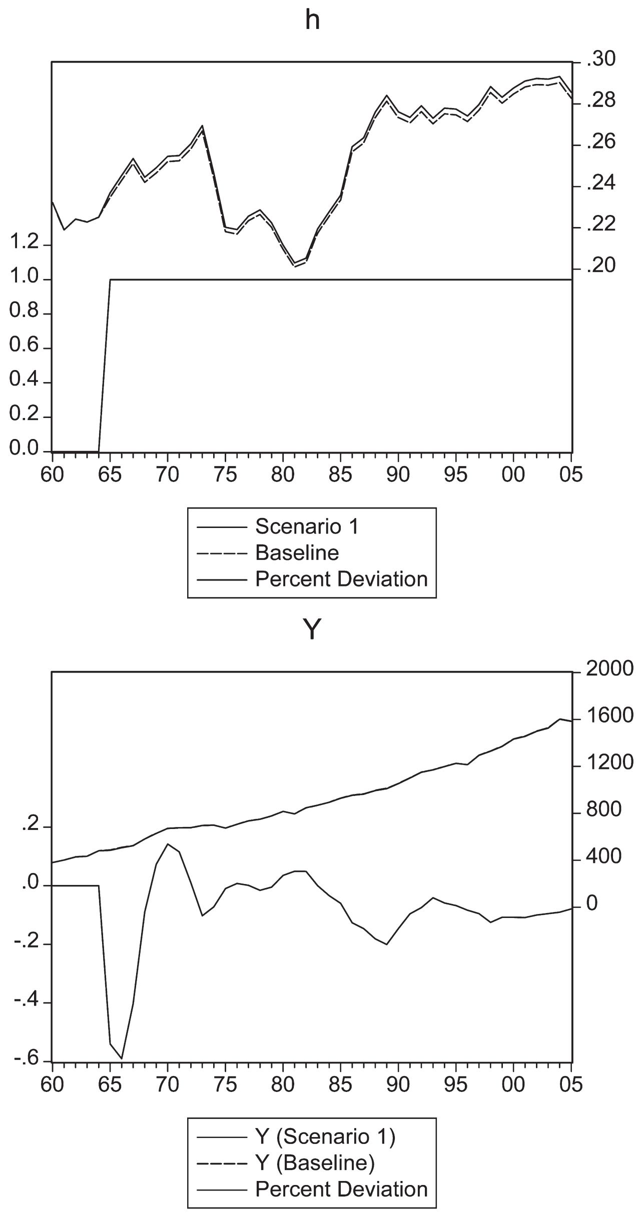

Figure 1. (b) Effect of a one percentage point increase in the profit share on real GDP in France: percentage deviation from baseline.

level above baseline after about 15 years. Similar but less pronounced than the simulation results for France, wages and consumption experience an upturn a few years after the shock, but also remain below baseline in Germany. About 15 years after the shock, however, both wages and consumption then show a slightly downward trend. It thus seems that despite the lasting positive effect

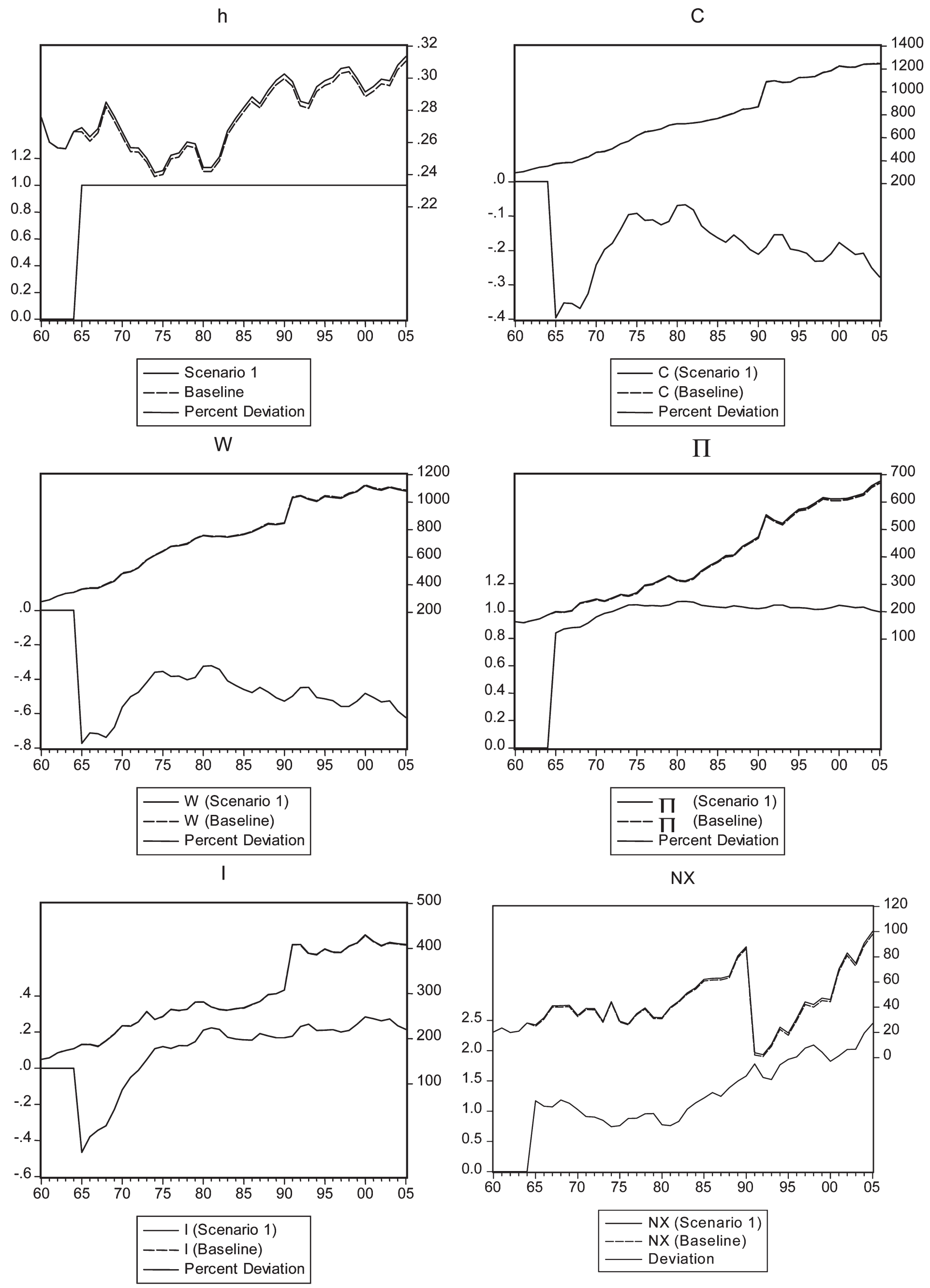

Figure 2. (a) Effect of a one percentage point increase in the profit share on profits, wages and the demand aggregates in Germany: percentage or absolute deviation from baseline.

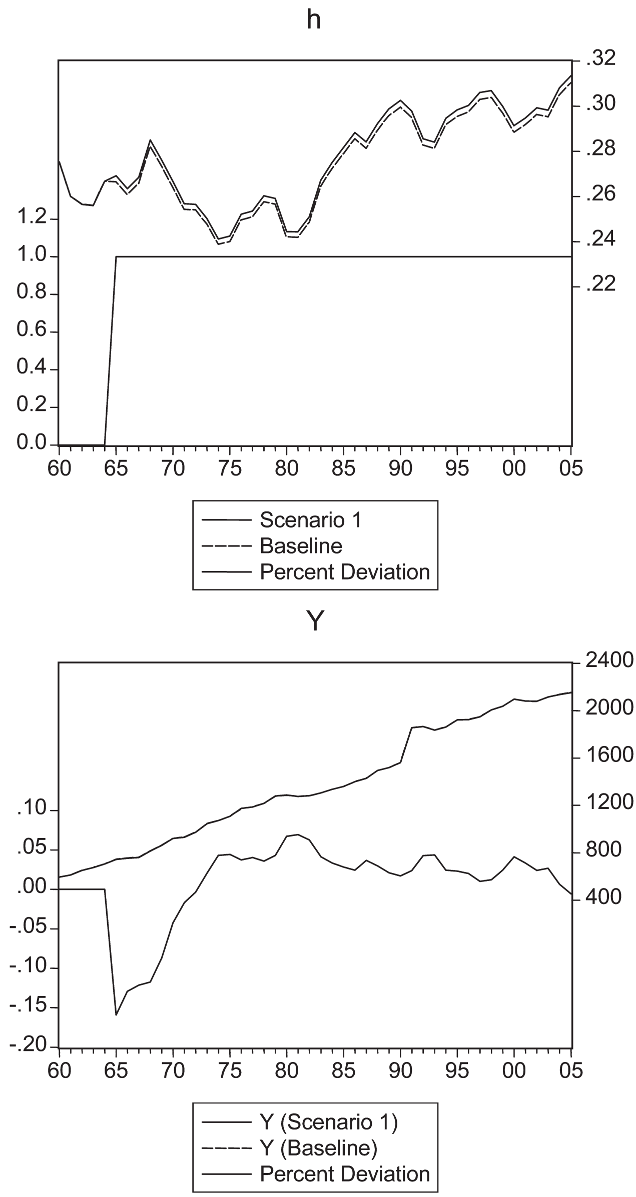

Figure 2. (b) Effect of a one percentage point increase in the profit share on real GDP in Germany: percentage deviation from baseline.

of the increase in the profit share on profits in Germany, the positive effect on investment in the long run is smaller than that on wages and consumption, which even show a downward trend towards the end of the simulation period. The percentage deviation of net exports from their baseline values after the shock to the profit share was found to be quite small. Therefore, we show their absolute deviation from baseline in Figure 2(a), which confirms the positive relationship between the profit share and net exports found in the single equation approach for Germany.

The overall effect of the increase in the profit share on GDP exhibits similar short-run dynamics as those of consumption, wages and investment, as can be seen in Figure 2(b). After the initial decline of GDP, the simulation shows a rise above baseline after seven years. About 15 years after the shock, however, a negative trend sets in, reaching below baseline values towards the end of the simulation period. Although the 'weakly significant' positive relationship between the profit share and investment from the single equation approach was integrated into the simulation, and despite the rather strong positive effect of a rise in the profit share on net exports, it seems that due to the interactions of the demand aggregates the profit-led nature for Germany suggested by the single equation estimations cannot be verified. It rather seems that when taking account of the interactions, there is not only a strong negative impact of an increase in the profit share on GDP in the short run, but also a slightly negative long-run effect.[11] Therefore, wage-led growth is also possible in the long run.

On the whole, the model simulations for France and Germany suggest a wage-led nature of demand and growth in both countries. While wage-led growth was already found for France in the single equation approach, it becomes more pronounced in the simulation. For Germany, the single equations suggested a weak profit-led nature when taking into account the 'weakly significant' positive effect of an increase of the profit share on investment and the very strong positive effect on net exports. In contrast, the simulation based on these equations denies an overall profit-led nature of German growth, but rather suggests weakly wage-led growth in the long run. The simulation approach therefore qualitatively confirms the single equation estimation results for the two countries by Naastepad & Storm (2007) and by Hein & Vogel (2008), and it contradicts the findings by Bowles & Boyer (1995) for the two countries and by Ederer & Stockhammer (2007) for France.

5. Conclusions

We have analysed the relationship between functional income distribution and economic growth in France and Germany from 1960 until 2005. The analysis was based on a demand-driven distribution and growth model for an open economy inspired by Bhaduri & Marglin (1990), which allows for profit- or wage-led growth. First, we applied a single equation approach, estimating the effects of redistribution on the demand aggregates and summing up these effects in order to obtain the total effect of redistribution on GDP growth. We found that GDP growth in France was wage-led, while the effect in Germany

[11]It should not come as a surprise that excluding the 'weakly significant' positive effect of the profit share from the investment function, and therefore taking statistical significance seriously, amplifies the negative effect of a change in the profit share on GDP in the simulation exercise. Results can be obtained from the authors on request.

was undetermined, depending on the consideration of the only 'weakly significant' positive effect of an increase in the profit share on the growth contribution of investment. Since interactions between the demand aggregates were omitted from the single equation approach, we also applied a simulation approach taking into account these interdependencies. This approach suggested that the wage-led nature of GDP growth in France was even more pronounced, while profit-led growth for Germany was negated by the simulation and weakly wage-led growth was indicated instead. Bhaduri & Marglin's (1990) theoretical conclusion that wage-led growth becomes less feasible when the effects of redistribution on foreign trade are taken into account, therefore, cannot be confirmed by our empirical analysis. Medium-sized open economies, such as France and Germany, seem to remain wage-led even when taking into account the effects of redistribution on foreign trade and net exports.[12]

Of course, the simulation approach presented in this paper still suffers from major shortcomings, which should be overcome in future empirical research. First, we have not explicitly addressed monetary factors in the determination of the components of aggregate demand. This is a serious limitation for Post-Keynesian/Kaleckian 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.[13] Second, our approach has not yet included any feedback effects of capital accumulation or growth on distribution. We have simply taken distribution as the exogenous variable determining growth as the endogenous variable.[14] Third, we have neither considered 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.[15] More empirical research in these areas, based on Post-Keynesian or Kaleckian distribution and growth models, seems to be required for a more complete understanding of the long-run development of the relationship between income distribution and economic growth.

If further analysis confirms our preliminary conclusion with respect to the prevalence of wage-led growth in major medium-sized open economies, such as France or Germany, the economic policy implications are quite straightforward: pursuing a strategy of profit-led growth by means of deregulation of the labour market, redistribution at the expense of labour and improving international

[12]In the single equations approach applied to six countries in Hein & Vogel (2008), we have found that only the small open economies Austria and the Netherlands were profit-led, whereas France, Germany, the UK and the US were wage-led.

[13]For Post-Keynesian models including monetary variables see the discussion in Lavoie (1995) and in Hein (2008, part II). For attempts to include the interest rate or other financial variables in empirical estimations of the Bhaduri/Marglin or other Kaleckian models see Hein & Ochsen (2003), van Treeck (2007) and Stockhammer (2004a, 2004b, 2005–06).

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

[15]See Kaldor (1957), León-Ledesma & Thirlwall (2002), Dutt (2003, 2006), Bhaduri (2006b, 2006c), Naastepad (2006), and Vogel (2009).

competitiveness cannot be recommended for these countries. Such a strategy will not only be harmful for the trading partners of these countries and in the long run for the Euro area and world economic growth, it will also lower GDP-growth in the countries pursuing such a strategy in the short run. Wage-led strategies are therefore more promising – but they might be difficult to implement.

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Appendix

Data Definitions and Data Source

C	real private final consumption expenditure, obtained directly from the AMECO database (European Commission 2006).
h	profit share, as percentage of GDP at 2000 market prices, calculated as the ratio of real profits (deflated by the GDP deflator) and real GDP from the AMECO database.
I	real 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.
Π	real gross operating surplus, deflated by the price deflator of GDP, both obtained from the AMECO database.
W	real compensation of employees (total economy), deflated by the price deflator of GDP, both obtained from the AMECO database.
Y	real GDP (at 2000 market prices), obtained directly from the AMECO database.

Estimation Strategy in the Single Equation Approach

In order to determine the effect of a change in the profit share on real GDP growth, we estimate the effects of a change in the profit share on the GDP growth contributions of the demand aggregates and sum up these partial effects:

$$\frac{\partial Y/Y}{\partial h} = \frac{\partial C/Y}{\partial h} + \frac{\partial I/Y}{\partial h} + \frac{\partial NX/Y}{\partial h} \tag{A1}$$

For example, in order to determine the effect of a change in the profit share on the growth distribution of consumption demand, we can start from:

$$\begin{aligned} C = C_\Pi + C_W = c_\Pi \Pi + c_W(Y - \Pi) = c_W Y + (c_\Pi - c_W)\Pi \\ = c_W Y + (c_\Pi - c_W)hY \end{aligned} \tag{A2}$$

with C as total consumption, C_Π as consumption out of profits, C_W as consumption out of wages, c_Π as the propensity to consume out of profits, c_W the propensity to consume out of wages, Π as total profits, W as total wages, Y as GDP, and h as the profit share. Assuming that the effect of a change in the profit share has no further effect on GDP, hence assuming that there are no interactions between the demand aggregates, we obtain from equation (A2):

$$\frac{\partial C}{\partial h} = (c_\Pi - c_W)Y \tag{A3}$$

and hence:

$$\frac{\partial C/Y}{\partial h} = c_\Pi - c_W \tag{A4}$$

Given the assumption for the derivation above and starting from (A2), this is equivalent to estimating:

$$\frac{C}{Y} = c_W + (c_\Pi - c_W)h \tag{A5}$$

Alternatively, a saving function with S as total saving, s_Π as the saving propensity out of profits and s_W as the saving propensity out of wages can be estimated:

$$\frac{S}{Y} = s_W + (s_\Pi - s_W)h \tag{A6}$$

From equations (A5) or (A6) we obtain:

$$\frac{\partial(C/Y)}{\partial h} = c_\Pi - c_W = (1 - s_\Pi) - (1 - s_W) = s_w - s_\Pi \tag{A7}$$

For investment and net export a similar strategy can be applied.

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)	Test specification	Lag Length
France	C	–2.378	trend & intercept	1
	ΔC	–4.268*	trend & intercept	0
	Π	–1.632	trend & intercept	0
	$\Delta\Pi$	–5.057*	trend & intercept	0
	W	–2.377	trend & intercept	1
	ΔW	–3.059	trend & intercept	0
	$\Delta\Delta W$	–6.781*	trend & intercept	0
Germany	C	–2.159	trend & intercept	1
	ΔC	–4.867*	trend & intercept	0
	Π	–1.703	trend & intercept	0
	$\Delta\Pi$	–6.048*	trend & intercept	0
	W	–2.759	trend & intercept	1
	ΔW	–4.566*	trend & intercept	0

Notes: * denotes statistical significance at the 1% confidence 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)	Test specification	Lag Length
France	I	−3.061	trend & intercept	1
	ΔI	−3.778*	trend & intercept	0
	Y	−2.718	trend & intercept	1
	ΔY	−4.875**	trend & intercept	0
	Π	−1.632	trend & intercept	0
	$\Delta\Pi$	−5.057**	trend & intercept	0
Germany	I/Y	−2.654	trend & intercept	1
	$\Delta I/Y$	−4.314**	trend & intercept	0
	Y	−2.180	trend & intercept	1
	ΔY	−4.960**	trend & intercept	0
	h	−1.198	intercept	1
	Δh	−5.140**	intercept	0

Notes: ** denotes statistical significance at the 1% confidence level, * significance at the 5% 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)	Test specification	Lag Length
France	NX/Y	−1.656	intercept	0
	$\Delta\ NX/Y$	−6.019*	intercept	0
	Y	−2.718	trend & intercept	1
	ΔY	−4.875*	trend & intercept	0
	$Y^{foreign}$	−2.180	trend & intercept	1
	$\Delta Y^{foreign}$	−4.960*	trend & intercept	0
	h	−1.672	intercept	1
	Δh	−4.907*	intercept	0
Germany	NX/Y	−2.065	intercept	0
	$\Delta NX/Y$	−5.521*	intercept	0
	Y	−2.180	trend & intercept	1
	ΔY	−4.960*	trend & intercept	0
	$Y^{foreign}$	−2.331	trend & intercept	1
	$\Delta Y^{foreign}$	−4.829*	trend & intercept	0
	h	−1.198	intercept	1
	Δh	−5.140*	intercept	0

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