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Functional income distribution and aggregate demand in the Euro-area^{*}

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Abstract — An increase in the wage share has contradictory effects on the subaggregates of aggregate demand. Private consumption expenditures ought to increase because wage incomes typically are associated with higher consumption propensities than capital incomes. Investment expenditures ought to be negatively affected because investment will positively depend on profits. Net exports will be negatively affected because an increase in the wage share corresponds to an increase in unit labor costs and thus a loss in competitiveness. Theoretically aggregate demand can therefore be either wage led or profit led depending on how these effects add up. The results will crucially depend on how open the economy is internationally. The paper estimates a Post-Kaleckian macro model incorporating these effects for the Euro area and finds that the Euro area is presently in a wage-led demand regime. Implications for wage policies are discussed.

Keywords: distribution, demand, investment, consumption, foreign trade, macroeconomics, Keynesian economics

JEL-Classification: E12, E20, E22, E25, E61

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1. Introduction

Maintaining international competitiveness has become one of the prime policy objectives of European politics. The Lisbon Agenda aims at making Europe the world's most competitive economic region. In a recent publication the European Commission (2006) argues that „productivity increases, combined with wage moderation, should help to maintain the EU's competitive position in an increasingly integrated world economy“ and encourages member states to „ensure employment-friendly labour cost developments and wage setting mechanisms“ (European Commission 2006, p.40). The term “employment-friendly labour costs developments” is not defined in the text, but from the context it is clear to mean wage moderation.⁵

These policy recommendations, it seems, are heeded by wage setters. The wage share in the Euro area has fallen by 11.6 %-points since 1981 – without a substantial improvement of economic performance. Growth rates (of real GDP) remain well below those of the 1960s and 1970s (Figure 1a). Not only has growth been disappointing, the unemployment rate in the Euro-area has increased from already high levels in 1981 by 1.2% points – despite an almost continuous decline in the wage share (Figure 1b).⁶ Europa has experienced 25 years of „employment-friendly“ wage policy, without employment improving.

⁵ Wage moderation, in this paper, is defined as real wage growth below productivity growth.

⁶ Adjusted wage share at market prices (source: AMECO).

Figure 1a. Adjusted wage share and GDP growth

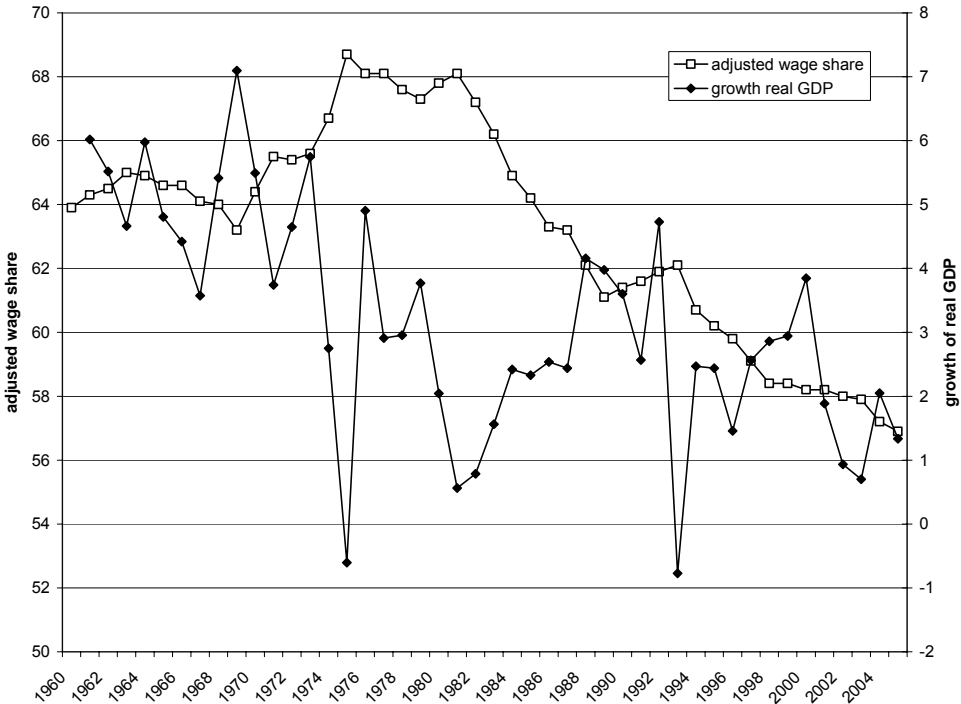
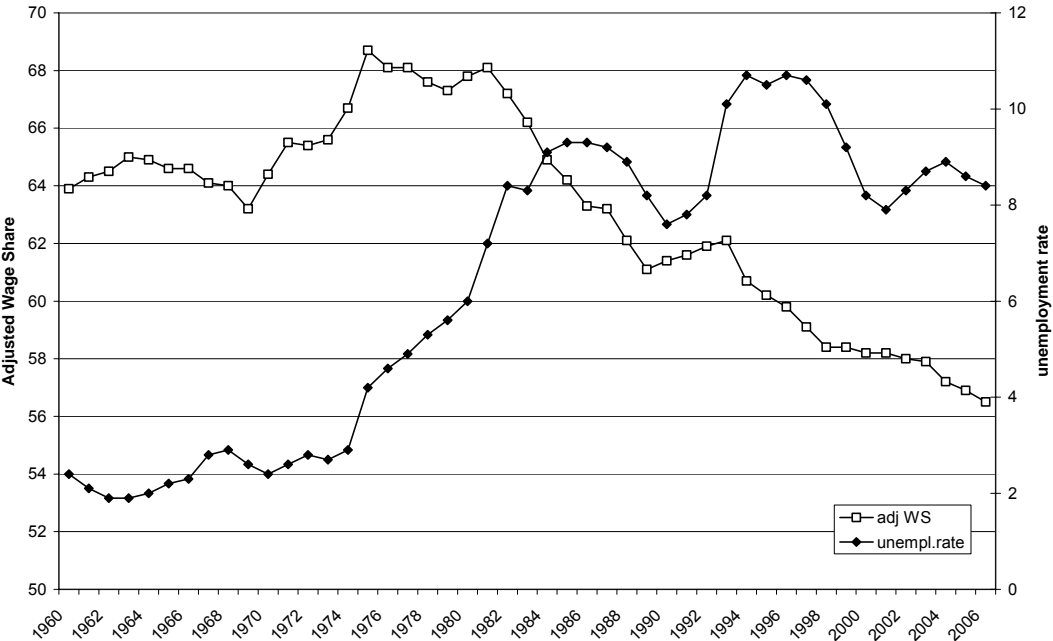


Figure 1b. Adjusted wage share and unemployment



While it is straightforward that wage moderation will, other things equal, improve competitiveness and therefore ultimately net exports, it is not obvious that an improvement of

competitiveness will automatically improve growth and employment. Foreign trade is only one component of final demand. The other components include consumption and investment (as well as the state sector). To assess the effects of wage moderation it is necessary to address the effects on all three components of private demand. In the Euro area, exports and imports only account for only 13.1% and 12.6% of GDP respectively (in 2003 at current prices), for the EU 25 the shares are 8.8% and 9.9%. This research is thus motivated by the hypothesis that wage moderation is likely to have only moderate effects on foreign trade but substantial effects on domestic demand.

The analysis is inspired by the work of Keynes and Kalecki. The model is a version of the model presented by Bhaduri and Marglin (1990). It is a Post-Kaleckian macro model that allows for wage-led as well as for profit-led demand regimes according to the relative size of the consumption differential, the sensitivity of investment to profits and the sensitivity of net exports to unit labor costs.

The paper is structured as follows. Section 2 presents the theoretical background and the post-Kaleckian model, on which the empirical estimations are based. Section 3 summarizes the empirical literature on these models. Section 4 presents the econometric results for the effect of changes in functional income distribution on private consumption, private investment and net exports. Section 5 summarizes the key findings and draws policy conclusions.

2. Theoretical background: wage-led und profit-led demand regimes

This section will present a Post-Keynesian model based on Bhaduri and Marglin (1990) that forms the basis for the empirical investigation. It is used to analyze the effects of changes in functional income distribution on aggregate demand. While in the classical Kaleckian model

(for a closed economy) an increase in the wage share will always lead to an increase in demand (Kalecki 1954, Blecker 1999), this is not necessarily the case in the Bhaduri-Marglin model. Here profit-led as well as wage-led demand regimes are possible since a positive effect of profits on investment is allowed for. The question whether the positive effect of wages on consumption or the negative effect of profits on investment is larger, becomes an empirical one. In an open economy additional negative effects will operate through net exports.

Aggregate demand (Y) is the sum of consumption (C), investment (I), net exports (NX) and government expenditure (G). All variables are in real terms. In a general formulation, consumption, investment and net exports are written as function of income (Y), the wage share (Ω), and some other control variables (summarized as z). These latter are assumed to be independent of output and distribution. Government expenditures are considered a function of output only. Aggregate demand then is:

$$Y = C(Y, \Omega) + I(Y, \Omega, z_I) + NX(Y, \Omega, z_{NX}) + G(Y, z_G) \quad (1)$$

This model is rather general in that it can be reduced to a standard model. Most macroeconomic models pay little attention to the effects of income distribution on consumption and investment. Only in the net exports function does income distribution usually play a role, albeit in an indirect way. Typically export and import functions include a price term and prices are thought to depend (among other things) on unit labor costs. Unit labor costs are closely related to the wage share. The above model therefore denegerates into a standard model if $\partial C/\partial \Omega$ and $\partial I/\partial \Omega$ are assumed to be zero.

The inclusion of income distribution shall briefly be motivated. In the consumption function the basic assertion is that wage incomes (W) and profit incomes (R) are associated with different propensities to consume. The Kaleckian assumption is that the marginal propensity to save is higher for capital incomes than for wage income; consumption is therefore expected to increase when the wage share rises.

Standard investment functions depend on output (Y) and the long-term real interest rate or some other measure of the cost of capital. In our model investment is expected to decrease when the wage share rises because future profits may be expected to fall. In addition it is often argued that retained earnings are a privileged source of finance and may thus influence investment expenditures.

Net exports are a negative function of domestic demand, a positive function of foreign demand, and will depend negatively on unit labour costs (ULC), which are an indicator of international competitiveness. ULC are by definition closely related to the wage share. In macroeconomic models ULC usually affect prices and prices enter the export and import function.

Government expenditures can react to income distribution; however this is ignored in our analysis, which focuses on the private sector. A serious treatment of the public sector is beyond the scope of this paper.

The resulting model is of a basic private open economy type and has several simplifications. Because of our focus on the effect of changes in the functional income distribution the effects of fiscal policy is excluded from the analysis. Income distribution, i.e.

the wage share (Ω),⁷ is taken as exogenous. Thus feedbacks, for example, from growth on income distribution via lower unemployment and a better bargaining position of labour are ignored at this stage.⁸

Differentiating Y with respect to Ω and collecting terms gives

$$\frac{dY^*}{d\Omega} = \frac{h_2}{1-h_1} \quad (2)$$

$$\text{where } h_1 = \left(\frac{\partial C}{\partial Y} + \frac{\partial I}{\partial Y} + \frac{\partial NX}{\partial Y} + \frac{\partial G}{\partial Y} \right) \text{ and } h_2 = \left(\frac{\partial C}{\partial \Omega} + \frac{\partial I}{\partial \Omega} + \frac{\partial NX}{\partial \Omega} \right).$$

The term $1/(1-h_1)$ in equation 2 is a standard multiplier and has to be positive for stability. The sign of the total derivative will therefore depend on the sign of the numerator. h_2 is the sum of the partial derivatives of the components of demand with respect to income distribution. This sum is private excess demand, that is, the change in demand caused by a change in income distribution given a certain level of income. It is impossible to sign h_2 a priori, since we hypothesize that $\partial C/\partial \Omega > 0$, $\partial I/\partial \Omega < 0$, and $\partial NX/\partial \Omega < 0$. The sum of these effects can therefore only be determined empirically. Determining the sign of private excess demand is therefore the focus of the empirical estimations in this study.

The total effect of the increase in the wage share on aggregate depends on the relative size of the reactions of the components of GDP, namely consumption, investment and net exports to changes in income distribution. If it is positive ($\partial Y^*/\partial \Omega > 0$), the demand regime is called *wage-led*. If the effect is negative ($\partial Y^*/\partial \Omega < 0$), it is called *profit-led*.

⁷ Functional income distribution and its measure, the wage share, are used synonymously throughout this paper.

⁸ Endogenizing income distributions raises substantial theoretical as well as econometric issues. It would require a different estimation strategy. Stockhammer and Onaran (2004) present a system estimator approach.

Empirically, given the high levels of international trade, one would expect net exports to play a major role in determining the overall outcome. However, while individual countries can increase demand by increasing exports, the world as a whole of course cannot. Therefore it is important to distinguish between the domestic sector of the economy and the open economy. The *domestic sector* in this case is defined with respect to consumption and investment only, assuming that the net export position does not change (as would be the result if wages were to change simultaneously in all countries). If consumption reacts more sensitively to an increase in the wage share than investment, domestic demand will be wage-led. Then we will integrate the effects of the foreign sector, thus changes in net exports to obtain the aggregate effect in an *open economy*.

3. Related literature

The first paper in the empirical literature on the Bhaduri-Marglin models is that of Bowles and Boyer (1995). They estimated the model by means of separate single equations for savings, investment and net exports for six OECD economies. The exposition of the model and the testing strategy are seminal, however the econometric methods employed are not up-to-date. In particular, they fail to discuss the time series properties of the economic variables and ignore the issue of unit roots. As a consequence, they do not apply difference or error correction models that form the core of modern time series econometrics. The models are estimated in shares rather than in log levels. No discussion of robustness is offered. Moreover, Bowles and Boyer use the employment share as a proxy for capacity utilization. For European countries with a high persistence of unemployment this may be a misleading indicator.

Gordon (1995a) estimates consumption and investment as a function of income distribution for the USA. In a VAR model, various exogenous shocks are simulated. Gordon (1995b) extends the model for an open economy and investigates reactions of aggregate demand on changes in income distribution empirically for the USA. His conclusion is that the growth regime of the USA is profit-led.

Hein and Krämer (1997) as well as Hein and Ochsen (2003) in their studies employ a model for a closed economy based on Marglin and Bhaduri (1990). Hein and Ochsen (2003) extend the model with the interest rate as exogenous variable and elaborate various accumulation regimes, depending on the sensitivity of the savings function and the investment function to the interest rate. In the empirical part, they estimate savings and investment econometrically and try to characterise the accumulation regimes of France, Germany, the USA and the UK.

Stockhammer and Onaran (2004) estimate a structural VAR model consisting of the variables capital accumulation, capacity utilization, profit share, unemployment rate and labour productivity growth for the USA, UK and France. Employing a VAR model, the mutual interaction of the variables is incorporated. The goods market is simulated by a model based on Marglin and Bhaduri (1990). It is supplemented by an equation for income distribution, a productivity function and a function for unemployment. From the empirical investigation it is concluded that unemployment is determined by the goods market, but that the impact of income distribution on demand and employment is very weak. Technical progress is shifting income distribution in favour of profits. Onaran and Stockhammer (2005) employ a similar model for Turkey and Korea.

Naastepad (2006) presents and estimates a model for the Netherlands, in which productivity growth is modeled explicitly. Productivity, savings, investment and exports are estimated by single equations. She finds that “the Dutch demand regime during 1960-2000 is (...) wage-led” (p. 24), however only narrowly so. Overall she concludes that “the growth rate of Dutch aggregate demand is relatively insensitive to changes in real wage growth” (p. 29) in the postwar period.

Naastepad and Storm (2006/2007) estimate a similar model for eight OECD countries that is similar in spirit to the one used here, but differs in detail. The model estimated is strictly derived from the theoretical one. Consequently the estimated equations are typically in ratio form, which are not the ones favoured by modern time series econometrics. No explicit attention is paid to the issues of unit roots. Naastepad and Storm find wage-led demand regimes in all European countries and profit-led ones in Japan and the USA. Compared to our findings, the estimated effects on consumption and investment are high, but those on net exports are modest.

Ederer and Stockhammer (2007) apply a single equation approach to France and estimate consumption, investment and net export functions. As their study is a prequel to the present paper, the estimation strategy is similar, with some changes in the treatment of export and imports. The result is that the French aggregate demand regime is domestically wage led, but international trade turns the demand regime into a profit-led one.

Hein and Vogel (2007) use a similar approach for Austria, France, Germany, the Netherlands, UK and the USA. In the estimation they largely follow Ederer and Stockhammer (2007) with minor differences in the investment specification and some differences in the net export function. Surprisingly, they fail to find effects of income distribution on net exports in

four out of six countries. They also fail to find effects on investment in four out of six countries. Consequently they find profit-led demand regimes only in Austria and the Netherlands, which are also the ones where effects on net exports had been found. The other countries are found to be wage-led.

4. Empirical results

The model will be estimated by means of separate single equations for consumption, investment, exports, and imports. The key differences to the literature are the following. First, the econometric specifications differ. Following standard practice in modern econometric modelling, error-correction models (ECM) are applied whenever feasible. Where results were unsatisfactory and/or there was no indication of cointegration, an unrestricted autoregressive distributed lag (ADL) model was estimated to infer which time series specification would be appropriate. ADL models are general in that various time series specifications can be written as restrictions on an ADL models. In all cases where the ECM specification did not work, ADL specifications suggested that the difference form was applicable. Second, as far as possible the specifications were chosen such as to be consistent with the standard literature and augmented for a distributional variable. Unfortunately there are few reference models for the Euro area (that is aggregate models working with annual data). The ECB Area-wide Model (henceforth: AWM; Fagan, Henry and Mestre 2001), would be an obvious starting point. However, the AWM is characterized by numerous theoretically motivated restrictions that make it incomparable with our model.

There are two major qualifications that apply for all the results to be reported. First, functional income distribution is assumed to be exogenous. Obviously this is not the case. Demand will

affect functional income distribution in at least two ways: mark ups typically vary procyclically (for example if mark ups are set on normal unit labor costs) and unemployment will typically (though usually with a time lag) have a negative effect on the wage share. Endogenizing income distribution would require a different modelling strategy (Stockhammer and Onaran 2004 estimate a similar model for different countries by means of a structural VAR).

Second, the Euro-area is treated as one unit in the estimations, that is, even for the period prior to monetary unification. It is thus assumed that a behavioral function can reasonably be reconstructed for say the 1960s. Attention was thus paid to potential structural breaks, however it turns out that Chow tests and experimentation with dummy variables (around the times of EU extensions) were usually not statistically significant and did not alter results substantially. Thus it seems that, at least statistically, the Euro-area can be treated as one area prior to its coming into existence.

All data is taken from the AMECO database (downloaded in summer 2006), which offers aggregate data for the Euro-area for all relevant series. C , I , NX , X , M , Y , W and R are real consumption expenditures, investment expenditures, net exports, exports (of goods), imports (of goods), GDP, wages and profits respectively. Wages and profits were deflated with the GDP deflator. Variable definitions can be found in the Appendix (Table A.1). Unit root tests suggest that all these variables are integrated of order one ($I(1)$). Thus ECM, cointegration, ADL, or difference specifications are applicable.

4.1 Consumption

The consumption function estimated is of the general form $C = f(W, R)$. This closely resembles standard consumption functions except that income is split into wage income and profit income. For econometric reasons the variables enter the estimation in logarithmic form. The difference in marginal savings propensities (between wage and profit incomes) gives the change of a redistribution of income.

Table 1 reports the regression results for the ADL specification and several difference specifications. The ECM specification did not give meaningful and statistically significant results for the long run effects. Moreover, the ADF test unambiguously rejected cointegration (in log levels). In the case of the consumption function this is somewhat surprising, since consumption functions can usually be modeled with ECM. The ADL specification (1) clearly indicates a specification in differences. The latter was thus applied. Moderate autocorrelation problems persist in various difference specifications. This may be due to the fact that wages and profits are pre-tax values. It was not possible to calculate disposable incomes for wage and profit incomes, because various taxes cannot be assigned. The tax rates may thus be the missing variables that show up as a serially correlated error term. A standard correction for first order autocorrelation was thus applied to some specifications. The results are hardly affected by this.

Table 1. Regression results for consumption equation

	1		2		3		4	
Dep. Variable:	ln C		Δln C		Δln C		Δln C	
Variable	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
const.	0,160	0,420	0,010	6,874	0,014	5,858	0,003	0,762
ln W	0,380	4,082						
ln W(-1)	-0,390	-3,885						
ln R	0,120	1,596						
ln R(-1)	-0,110	-1,607						
ln C(-1)	0,980	14,614						
Δln W			0,490	9,907	0,468	7,440	0,741	7,103
Δln R			0,110	1,671	0,108	1,622	0,259	
AR(1)					0,254	1,629	0,457	2,717
Adj, R ²	1,000		0,780		0,778		0,549	
DW stat.	1,620		1,450		1,996		2,137	

Note: C is real private consumption, W real wages and R real profits. Specification 4 imposes that the coefficients of wages and profits add up to one. Estimation period 1962-2005.

In the basic difference specification (specification 2) the consumption elasticity for wages and profits are 0.49 and 0.11 respectively. The former being statistically significant at the 1% level, the latter is not statistically significant at conventional levels, but close to the 10% level. These elasticities may appear rather low. In the long run, one would expect a value much closer to unity.⁹ However, the wage and profit variable are pre-tax (and also include social security contributions). The tax rate has a rising trend over part of our sample period, which may explain why gross income elasticities of consumption are below one. Correcting for first order autocorrelation (specification 3) virtually does not affect the coefficient estimates. Specification (4) imposes that consumption function (in differences) is homogenous of degree 1 in wages and profits. The elasticity of wages then is 0.74 and that of profits 0.26 (statistically significant at 1%).

⁹ Note that since the estimation is in logarithms, our estimation equation implies a consumption function that is Cobb-Douglas. Therefore the coefficients on wages and profits add up to the elasticity of income.

The hypothesis that consumption propensities vary between profit and wage income is confirmed. Converting elasticities into marginal effects will give different results according to where the partial effect is evaluated. Therefore we calculate two marginal effects, one at the mean of our sample and one at its end, which is the year 2005. At the sample mean the marginal propensity to consume out of wages is 0.52, whereas that out of profits is 0.15, which gives a consumption differential of 0.37.¹⁰ At the levels of 2005 the consumption propensities are 0.58 and 0.16 respectively, which gives a consumption differential of 0.43. This change in the consumption differential is due to the substantial shift in income distribution since 1980. Since the coefficient estimate for the coefficient on profits is not statistically significant different from zero, this has to be regarded as the lower bound of the value. A redistribution of 1%-point of GDP from profits to wages would thus induce additional consumption expenditures of 0.43 %-points of GDP in 2005 (and 0.37 at the sample mean). The restricted version of the estimation gives a consumption differential of 0.51 in 2005 and 0.44 at the sample mean. However, the former estimate is preferred because the restriction is expected to be valid for net rather than gross income.

4.2 Investment

The investment function estimated is of the general form $I = f(Y, R, i)$. As the coefficients are interpreted as the effects in one variable, keeping the other variables constant, the coefficient estimate on profits will give the effect of an increase in profits given the level of income (and the interest) and therefore a change in income distribution.

¹⁰ Because a lograithmic consumption function was estimated, the consumption function is of the Cobb-Douglas type. If the “true” relation is additive in levels rather than in logarithms, this can only be regarded as an approximation. An estimation in levels gives qualitatively similar results but is fraught with (serious) autocorrelation and heteroscedasticity problems.

The investment function was estimated in an ECM form with the restriction that in the long run the investment share in GDP is stable, that is, the long run coefficient of output on investment is unity.¹¹ The investment function includes the profits and the (ex post) real long term interest rate (deflated with the GDP deflator). After experimentation with the lag structure of the differenced variables, a structure with one lag for the short run effects was adopted. The results are summarized in Table 2.

Table 2. Regression results for investment equation

Dep. Variable:	ECM		ECM with lags	
	$\Delta \ln I$		$\Delta \ln I$	
Variable	Coeff.	t-stat.	Coeff.	t-stat.
const.	-0.300	-3.248	-0.590	-4.033
$\Delta \ln Y$	1.890	6.248	1.590	4.885
$\Delta \ln Y(-1)$			0.840	2.355
$\Delta \ln R$	0.130	0.698	0.380	1.965
$\Delta \ln R(-1)$			-0.180	-0.894
$\ln I(-1)/Y(-1)$	-0.140	-2.820	-0.210	-3.130
$\ln R(-1)$	0.010	0.512	0.030	1.910
$i(-1)$			0.000	-0.808
Adj, R ²	0.720		0.730	
DW stat.	1.730		1.750	

Note: I is real private investment, Y real GDP, R real profits and i the long-term real interest rate. Estimation period 1968-2005

The regression performs reasonably well overall. In accordance with the literature (Chirinko 1993, Ford and Poret 1992) demand is playing the key role in determining investment expenditures. The accelerator effects are well above two (1.59+0.84) in the short run and have

¹¹ A similar investment function with the same restriction was used by Baumgartner, Breuss and Kaniovski (2005). Hein and Vogel (2007) use different specification for different countries. They utilize the profit share rather than profits. Naastepad and Storm (2006) estimate investment as $\ln(I/Y)=f(\ln(R/Y),\ln(Y))$. The coefficients of the latter can be readily transformed to be comparable with our results. The time series properties of the variables, however, are inconsistent, because $\ln(Y)$ is typically $I(1)$, whereas I/Y and R/Y supposedly are $I(0)$.

been restricted to one in the long run. The interest rate has the expected sign, but is not statistically significant. The long-run elasticity of profits is 0.15 and statistically significant only at the 10% level. Again this is line with the literature. While firm-level investment functions usually find a larger effect of cash flow on investment (Fazzari and Mott 1986), in aggregate investment functions this effect is more tenuous (Chirinko 1993). Our results correspond to a marginal effect of profits on investment of 0.07.¹² Since the investment to profit ratio is stable in the sample period, the partial effects are virtually identical at the mean and in 2005.

4.3 Net exports

As the estimation of the net export effect is probably the most sensitive part of the estimation, two estimation methods were applied. First the net exports (as a share of GDP) were estimated directly as a function of domestic GDP growth, the GDP growth of the most important trading partners, nominal exchange rates and real unit labor costs

($\frac{NX}{Y} = f(Y, Y_w, E, RULC)$). This approach closely corresponds to the theoretical model.¹³

However, it is not consistent with the import and export functions as currently used in most macroeconomic models, since in these prices rather than unit labor costs enter import and export functions. Throughout this section unit labor costs, rather than the wage share, will be used as explanatory variable, since this variable is the one that is relevant for competitiveness

¹² This is the conversion from elasticities to partial effects: $\frac{\partial I}{\partial R} = e_{IR} \frac{I}{R}$.

¹³ The net export equations estimated by Naastepad and Storm (2006) and by Hein and Vogel (2007) are similar to this one. The former use exports (rather than net exports) as dependent variable and relative ULC as explanatory variable. The latter estimate the above equation without the nominal exchange rate and with the profit share instead of RULC.

and the effects of (changes in) real unit labor costs can easily be converted into effects of (changes in) the wage share.¹⁴

A second approach follows standard modeling practice more closely. Here domestic prices (or export prices) enter the export and import functions. In a second estimation equation domestic prices are estimated as a function of nominal unit labor costs and import prices. This latter equation also allows to calculate by how much an increase in real unit labor costs (of say one percent) will (on the average) raise domestic prices.

For the trading partners' GDP a trade-weighted GDP based on the trade shares of the year 1990-2005 was calculated for the largest trading partners. From 1992 on these include Eastern European countries and China, prior to 1992 only OECD countries. In the same fashion a trade-weighted effective exchange rate was calculated.

Unfortunately export and import data for extra-EU12 trade only exists for goods, but not for services. Thus all estimations had to be performed for goods trade only and then the results were multiplied by a fixed factor (1.25, which is the share in the year 2005 for which data exists) to account for trade in services. For the USA data on trade in goods and services exist and the share of services in total exports and imports is stable (with temporary changes in the 1970s, which are presumably due to the oil price shock). Thus, the error arising from our adjustment for EU trade is probably small.

¹⁴ Real unit labor costs are $RULC = \frac{W}{Y} \frac{ET}{EE}$, where ET and EE stand for total employment and dependent employment respectively. In the conversion differences between consumer prices and GDP-prices are ignored. Since we are interested in medium term developments and the two indices are highly correlated over longer periods, an additional step in lengthy transformation is avoided.

The time series properties for the variables used in the following specifications are not straightforward. Unit root tests suggest at the 5% level that NX/Y and $\ln Px/Pm$ are $I(0)$ as expected, $\ln E$ is also $I(0)$ and $RULC$ is $I(1)$. The latter is surprising since $RULC$ is also a ratio. $\ln Yw$ also seems to be $I(0)$. For consistence $\ln Yw$ and $\ln Y$ are both treated as $I(1)$. In the case of $RULC$ experiments with additional lags were performed.

Table 3 summarizes the results of the estimations of the net export share according to the first, direct estimation strategy. Table 3 reports two specifications where $RULC$ is entered in levels and one (specification 3) where it is entered in difference form. The unit root tests suggest the latter specification. However this specification implies that changes in the unit labor costs have a one time effect on net exports, which is to say there is no long-term effect. From an economic point of view this is not plausible. Therefore specifications 1 and 2 are preferred. In specifications 1 and 2 all variables show the expected sign and, with the exception of the exchange rate, are statistically significant at the 5% level. Specification 1 was performed with an autocorrelation correction (for first order autocorrelation). Autocorrelation problems persist, however the coefficient estimates seem to be robust. A 1% increase in real unit labor costs leads to a 0.08% decrease of net exports (of goods). After appropriate transformation this the effect of a 1%-point increase in the wage share leads to a 0.13%-point (of GDP) of net exports in goods and services.¹⁵ In specification 3 $RULC$ enter in difference form. The coefficient estimate for $RULC$ is not statistically significant at 10% level. The other variables are barely affected by this change in specification. The coefficient estimate from specification 1 forms the basis for later calculations.

¹⁵ Real unit labor costs have to be adjusted for the ratio of total employment to dependent employment. This value is 1.27. See Marterbauer and Walterskirchen (2003) for more discussion on the relation of wage shares and unit labor costs. These values are also summarized in Table 6.

Table 3. Regression results for net export share equation

	1		2		3	
Dep. Variable:	NX / Y		NX / Y		NX / Y	
Variable	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
const.	0.046	1.852	0.053	3.836	-0.006	-2.368
$\Delta \ln Y$	-0.185	-4.334	-0.120	-2.285	-0.201	-4.342
$\Delta \ln Y_w$	0.131	2.898	0.137	2.304	0.116	2.526
$\ln E$	-0.012	-1.012	-0.014	-1.347	-0.007	-0.546
RULC	-0.084	-2.133	-0.095	-4.396		
$\Delta RULC$					-0.147	-1.472
AR (1)	0.667	5.383			0.747	7.632
Adj. R ²	0.719		0.462		0.708	
DW stat.	1.469		0.688		1.549	

Note: NX are the net exports, Y real GDP, Yw real GDP of the main trading partners, E a trade-weighted exchange rate, RULC the real unit labour costs. Estimation period 1962-2005.

The second estimation strategy is more roundabout. In a first step exports are estimated as function of prices (and other control variables) and in a second step prices are estimated as function of (nominal) unit labor costs (and other control variables). Then the same procedure is applied to imports. Table 4 summarizes the results of the export function. The explanatory variables are export prices relative to import prices (measured in a hypothetical world currency),¹⁶ the output of trading partners and the exchange rates. Since no support for a cointegrating relation was found, the equation was estimated in difference form. A correction for first order autocorrelation was applied. The coefficients have the expected signs and are statistically significant at the 5% level or higher. The results indicate that a one percent increase in foreign demand leads to a 1.34% increase of exports (of goods). Exports also react strongly to the exchange rate, with an elasticity of -1.54. The coefficient on relative prices is statistically significant at the 1% level and has an elasticity of -1.17.

Table 4. Regression results for export and import equations

	1	2	3
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¹⁶ $P_{mwc} = P_m * E$

Dep. Variable: $\Delta \ln X$			Dep. Variable: $\Delta \ln M$				
Variable	Coeff.	t-stat.	Variable	Coeff.	t-stat.	Coeff.	t-stat.
const.	0.018	0.905	const.	-0.006	-0.309	-0.034	-1.555
$\Delta \ln Y_w$	1.337	2.322	$\Delta \ln Y$	1.977	3.219	2.339	3.868
$\Delta \ln E$	-1.537	-5.274	$\Delta \ln E(-1)$	0.364	1.580		
$\Delta \ln P_x/P_{mwc}$	-1.173	-3.173	$\Delta \ln P(-1)/P_{mwc}(-1)$	0.007	0.029		
AR (1)	0.415	2.795	$\Delta \ln P(-1)/P_{meu}(-1)$			0.183	0.941
			T95			0.058	2.653
Adj. R ²	0.388		Adj. R ²	0.247		0.326	
DW stat.	1.802		DW stat.	1.742		1.938	

Note. Y_w is the GDP of main trade partners, E the trade-weighted exchange rate. P_x the export price deflator, P_{mwc} the import price deflator in a (hypothetical, trade-weighted) world currency, Y is GDP, P the GDP-deflator, P_{meu} is the import price deflator in euros. T95 is a dummy variable that takes on the value of 1 from 1995. Estimation period 1962-2005.

For the import estimation a difference equation was applied after cointegration tests failed. Overall, the import regression did not work very well. While domestic demand consistently has the expected sign and is statistically significant at the (1% level), the domestic price level, import prices and the exchange rate frequently had perverse signs and/or were statistically insignificant. In particular, contemporaneous prices showed “perverse” signs (possibly because of a J-curve effect). Table 4 reports two specifications. Specification 2 includes the exchange rate and the ratio of domestic to import prices (in world currency), both lagged. Relative prices in this specification are not statistically significant and the coefficient estimate has a value that is economically negligible. Specification 3 includes domestic prices and import prices (in domestic currency), both lagged. In addition a dummy variable that takes the value of one from 1995 onwards was used.¹⁷ Since this specification was adopted after experimentation, inference based on t-values may be misleading (Charemza and Deadman 1997, chap 2). This specification is one of the few, where the domestic price level has the expected sign and an economically significant coefficient, though at 0.18 it is low and it is not

¹⁷ The motivation for this dummy variable is purely statistical. One possible explanation is the increased integration with Eastern Europe after the fall of the wall.

statistically significant. Domestic GDP on the other hand is statistically significant at the 1% level. The estimated income elasticity of imports is 2.34 which is rather high.¹⁸ The conclusion thus is that domestic prices have a weak, if any, effect on imports. Based on our results a coefficient estimate of zero is equally arguable.

In two auxiliary regressions the inflation (of the GDP deflator) was explained by (nominal) ULC and import prices and export prices were explained by domestic prices and import prices. Both estimations were performed in difference form (after ECM specifications proved unsuccessful) and autocorrelation procedures had to be applied. An increase of nominal unit labor costs by 1% increases domestic inflation by 0.45. An increase of domestic prices by 1% increases export prices by 0.47. From the price equation it can be derived that nominal unit labor costs have to increase by 1.82% such that real unit labor costs increase by 1% (because prices would rise by 0.82%).

¹⁸ This value is high compared to the demand elasticity of exports. Our results imply that if the EU and its trade partners grow at the same rate, the EU would experience a widening current account deficit, which is not very plausible.

Table 5. Regression results for price equations

Dep. Variable: $\Delta \ln P$			Dep. Variable: $\Delta \ln PX$		
Variable	Coeff.	t-stat.	Variable	Coeff.	t-stat.
C	0.029	3.087	C	0.000	-0.921
$\Delta \ln PM$	0.036	2.269	$\Delta \ln PM$	0.510	15.943
$\Delta \ln ULC$	0.449	7.139	$\Delta \ln P$	0.470	4.648
AR(1)	0.887	12.038	AR(1)	0.440	3.161
Adj. R ²	0.950		Adj. R ²	0.940	
DW stat.	2.120		DW stat.	2.150	

Note: P is the GDP deflator, PM the import price deflator, PX the export price deflator and ULC the nominal unit labour costs. Estimation period 1962-2005.

The calculation of the effects of a change in income distribution on exports and imports involves several steps. These are summarized in Table 6. As import and export shares display a clear trend (reflecting globalisation), the transformation from elasticities to marginal effects will yield different results according to the point (in time) where marginal effects are calculated. Values for mean exports and imports as well as value at the end of the period are reported.

The total effect of a change in functional income distribution on exports includes the effect of real unit labor costs on prices, the effect of prices on export prices. This value has to be transformed from an elasticity into a marginal effect.¹⁹ Then the effects of changes in the unit labor costs have to be transformed to effects of changes in the wage share. The result of this has to be adjusted for services. These transformations are summarized in Table 6. Overall an increase in the wage share by 1%-point currently leads to a reduction in exports by 0.12%-points of GDP. In the middle of the sample (roughly the 1970s) the respective effect would have been 0.08%-points of GDP. The corresponding values of the reduction of imports are 0.04 and 0.03 %-points of GDP.

¹⁹ $\frac{\partial M / Y}{\partial RULC} = e_{MP} e_{PRULC} \frac{M}{Y} \frac{1}{RULC}$

Table 6. Calculation of partial effects on net exports, exports and imports

	1	2	3	4	5	6	7	8
Net exports			e_{PRULC}	$1/RULC$		ET/ED	$G\&S/G$	Effect
NX/Y	-0,084					1,27	1,25	-0,13
Exports	e_{XPx}	e_{PxP}			X/Y			
2005	-1.17	0.47	0.82	1.76	0.10	1.18	1.25	-0.12
mean	-1.17	0.47	0.82	1.58	0.07	1.27	1.25	-0.08
Imports	e_{MP}				M/Y			
2005	0.18		0.82	1.76	0.11	1.18	1.25	0.04
mean	0.18		0.82	1.58	0.08	1.27	1.25	0.03

Note: column (1) estimates from Tables 3 and 4 respectively. Column 2 estimates from Table 5. Column 3: $\partial P/\partial RULC$ is calculated as $\partial P/\partial ULC$ (from Table 5) divided by $1-\partial P/\partial ULC$. Column 6: ET is total employment, ED dependent employment. Column 7: G&S: extra-EU12 exports of goods and services, G: extra-EU12 exports of goods.

The effect of an increase in the wage share by 1%-point on the net export share thus totals -0.16 (and was -0.11 at the mean of the period). The difference between these two values reflects the increasing importance of international trade or globalization. Conveniently, the differences are not large enough to modify the overall result.

4.4 Total effects

Table 7 puts together the partial results presented above. The results of the different ways to calculate the effect on net exports are listed separately. The positive effect of an increase in the wage share by one percentage point on private consumption is 0.37 %-points of GDP at mean values and 0.43 %-points in 2005. Either is substantially larger than the negative effect on investment (0.07 %-points of GDP). The *domestic sector* of the economy is thus clearly wage led. Our estimations suggest that a 1 %-point increase of the wage share (assuming no changes in government expenditures and income) leads to an increase of domestic demand by 0.3 %-points increase in GDP at sample means and and by 0.35 in 2005.

Table 7. Private excess demand (in %-points of GDP) caused by a 1%-point increase of the wage share

	Effects at mean levels, NX-share regression	Effects in 2005, X, M - regression	Effects at mean levels, X, M - regression
Consumption	0.37	0.43	0.37
Investment	-0.07	-0.07	-0.07
<i>Domestic excess demand</i>	<i>0.30</i>	<i>0.35</i>	<i>0.30</i>
Net exports	-0.13	-0.16	-0.11
Private excess demand (h2):	0.19	0.17	0.19

Note. Column “NX-share” estimation of net export share as a function of real unit labor costs and other control variables (based on results in Table 3). Columns X, M-regression: based on estimation of exports and imports as a function of domestic prices (and other control variables) and of prices as a function of unit labor costs (and import prices) (based on results from Table 4 and 5). Private excess demand (h2) is the sum of the effects of a change in income distribution on consumption, investment, and net exports given the level of income.

The effect of an increase of the wage share on net exports is stronger than the effect on investment. Table 7 lists all three variants of calculating the effect on net exports. First, the direct estimation of the net export share as a function of real unit labor costs (and standard control variables). This method (labeled “NX-share regression” in Table 7) gives a medium effect on net exports, which is -0.13 %-points of GDP. This estimation procedure, however, is not how modern macroeconomic models treat foreign trade. Second, exports and imports were regressed on the domestic price level (and other control variables) and prices were regressed on nominal unit labor costs and import prices. The price equation allows for the calculation of the effects of an increase in real unit labor costs. This approach is consistent with the present modeling strategy in macroeconomic models. Since the estimations give elasticities rather than partial effects, the elasticities have to be converted. As the import and exports shares in GDP show a strong trend the results differ (for a given elasticity) if evaluated at the mean or at the end of the period. In table 7 the evaluation with the current value is referred to as “X, M-regressions, 2005 levels” and gives a value of -0.16. An increase of the wage share by one percentage point today would thus decrease net exports by 0.16%-point of GDP. Alternatively, column “X, M regressions, mean levels” evaluates the marginal

effect for the export and import shares at the mean values of our sample. This gives an effect of -0.11. This can be interpreted as a one percentage point increase in the wage share in the middle of the period, i.e. the 1970s, causing a decrease of net exports by 0.11 %-points of GDP.

The total effect of a one percentage point increase in the wage share on *private excess demand* (h_2 in equation 2) ranges between +0.17 and +0.19 %-points of GDP. In all cases the effect is positive. These are conservative estimates. The effect of domestic prices on imports is not statistically significant and the coefficient estimate is not robust. The qualitative result of this study is thus clear: wage moderation will overall have negative effects on (private) aggregate demand in the Euro-area. A plausible, conservative point estimate of the total effect is 0.2 % points of GDP. The net results at mean levels are similar to those for 2005. However the components do differ. The decreasing wage share has led to a increase in the consumption differential, while increases in international trade have led to stronger effect on net exports. The fact that these two developments in opposite directions almost cancel out, is mere coincidence.

To get the total private effects of a change in income distribution on *equilibrium demand* excess demand has to be multiplied by the multiplier of equation 2, that is $\frac{1}{1-h_1}$. This is done in Table 8. These calculations have to be interpreted with care for two reasons. First, these results are equilibrium effects. The exogeneity assumptions outlined in section 2 seem rather strong in this context.²⁰ Second, more technically, the results are very sensitive to the specific parameters applied and lack the robustness of the results for excess demand. h_1 consists of the

²⁰ Note that the private excess demand effects discussed above are by definition partial (and disequilibrium effects). Here, however, the effects are general equilibrium effects. The assumption that other control variables are exogenous with respect to income and income distribution, is therefore much more restrictive.

partial effects of changes in income on consumption, investment and imports. Table 1, 2 and 4 contain the relevant coefficient estimates. Again, the coefficient estimates are elasticities that have to be converted into partial effects.²¹ For the case of consumption, this elasticity was estimated to be 0.6 (Table 1). In the literature the assumption of a long-run elasticity of one is frequently found. By assumption, the long-run demand elasticity of investment was one (Table 2). The income elasticity of imports is 2.34 (Table 4), which is a rather high value. Moreover, it makes a big difference if the elasticity is converted into a partial effect at the mean import share or its 2005 value. Depending on the assumption of the long-run consumption elasticity and on where the import elasticity is converted the private multiplier ranges from 1.38 (with the $e_{CY}=1$ and the M/Y of 2005) to 2.69 (with $e_{CY}=0.6$ and the mean M/Y).²² The latter values seem rather high. The state sector has been excluded from the analysis in this paper. If automatic stabilizers are operating, then the values will be accordingly smaller. Assuming an income elasticity of consumption of 0.6 the total effect of a 1%-point increase in the wage share on equilibrium income is 0.23 %-points of GDP (evaluated at the mean import share).

²¹ $h_1 = \frac{\partial C}{\partial Y} + \frac{\partial I}{\partial Y} + \frac{\partial NX}{\partial Y} = e_{CY} \frac{C}{Y} + e_{YI} \frac{I}{Y} - e_{MY} \frac{M}{Y}$

²² The multiplier values are 1.66 assuming $e_{CY}=0.6$ and mean M/Y and 2.01 assuming $e_{CY}=1$ and 2005 M/Y .

Table 8. Private equilibrium demand (in %-points of GDP) caused by a 1%-point increase of the wage share

	NX-share regression	X, M - regression, 2005 levels	X, M - regression, mean levels
Private excess demand (h2):	0.19	0.17	0.19
Total private demand effects (h2/(1-h1); M-share 2005):	0.234	0.263	0.265

Total private demand effects is private excess demand multiplied by the sum of the effects of a change in income on consumption, investment and imports. Row $e_{CY}=0.6$ calculates total effects based on a long run income elasticity of consumption of 0.6 (Table 1).

5. Implications for wage policy

The first, and most obvious, policy implication of our findings is that wage moderation in the EU is unlikely to stimulate employment. The results presented above suggest that wage moderation leads to a (moderate) contraction in output. Since an expansion in output can be regarded as a necessary (but not sufficient) condition for an expansion in employment, wage moderation (at the EU level) is not an ‘employment-friendly’ wage policy. This finding is consistent with the fact that unemployment has been stable or increasing in the last two decades despite substantial declines in real unit labor costs. Thus the first conclusion is that rather than wage moderation a return to productivity-oriented wage setting has to be part of macroeconomic policy package that is aimed at stimulating demand and employment in Europe.

A second implication refers to wage coordination. While our findings suggest that demand is wage-led in the Euro area, this finding does not extend to individual Euro member states. While the Euro area is a relatively closed economy, its member states typically are rather open economies, with most of their trade conducted with other member states. Indeed, the

parameters estimates imply that the Euro area would switch from a wage-led to a profit-led demand regime at export and import shares of 23% to 30%.²³ Most EU members have export and import shares in this order of magnitude or even higher. It seems therefore likely that many EU member states exhibit (individually, not collectively) profit-led demand regimes. In other words, small open economies are likely to be profit-led, because foreign trade constitutes a much larger share of their GDP.

If this is the case, European wage policy is in a prisoners' dilemma-type situation. While for each country it may be expansionary to exercise wage moderation (assuming constant wages abroad), wage moderation in all countries will have a contractionary effect. This is likely to generate a downward bias in wage settlements if wages are negotiated nationally. The actual situation of course much more complicated. First, the EU consists of countries of varying size, with some of them, most notably Germany, being large enough to make a wage-led demand regime likely. Second, wage negotiations in fact do not take place at the national level, but at the sectoral level or the firm level, with substantial differences in national labor relations systems persisting (Visser 2004, Marginson and Sisson 2004). Any concrete policy suggestion would have to take into account these complications. However, at the general level it seems likely that wage competition fostered by trade integration and increasing FDI flows has contributed to reduction in wage growth (Rodrik 1997, Hatzius 2000). A coordination of wage bargaining across the Euro area (or the EU in general) therefore seems desirable.

The third conclusion concerns the macro economic policy package currently in place in the Euro area, which is defined as a common currency directed by an independent ECB, almost

²³ Both figures are based on the second, indirect estimate of the effect on exports and imports (referred to as X, M-estimates in Table 7). If the statistically insignificant (and not robust) effect of prices on imports is taken at face value, then the switch from a wage-led to a profit-led demand regime occurs at export and import shares of 23%. If the effect of prices on imports is assumed to be zero, the switch occurs at 30%.

exclusively concerned with price stability, and a national fiscal policies which is (asymmetrically) severely constrained by the Stability and Growth Pact. In this setting wage policy plays a crucial role as a shock absorber for asymmetric as well as for symmetric shocks, which is why the ECB is consistently insisting that labor market flexibility is needed to ensure the proper functioning of the monetary union (Alsopp and Artis 2003). However, if demand is wage-led in the EU, then flexible wage will send perverse signals in the case of adverse demand shocks. Rather than stimulating demand, falling wages (or more precisely wage shares) will dampen demand further. Therefore the whole design of the policy package in Europe has to be modified. Monetary policy would have to get reoriented to output stabilization or fiscal policy would need more room (and coordination) for counter-cyclical policy.

6. Literature

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Appendix

Table A.1: Variable definitions

Notation	Ameco- Nota tion	Description	Notes
C	OCPH	Private consumption, real	-
E	-	Exchange rate	Index (1960=100). growth rate of trade-weighted exchange rates. Exchange rate in price notation (1 € in foreign currency). Weights: see YW
E _D	NWTD	dependent employment, private sector	-
E _T	NETD	employment, private sector	-
Y	OVDG	GDP, real	-
YW	-	Trade-weighted GDP of main trading partners, real	Index (1960=100). Weighted growth rates of real GDP of main trading partner. Weights: shares of exports of EU12, 2000-2005 Main trading partners: USA, UK, Sweden, Japan, Switzerland, Turkey; from 1991 also: China, Russia, Czech Republic, Hungary, Poland. (source: Eurostat).
I	OIGT	Private Investitionen, real	-
i	-	Long-run interest rate, real: deflated by the GDP deflator	source: OECD Economic Outlook: IRL

M	DMGE	Imports, real	extra EU12 imports of goods Belgium, Lux from 1999.
NX	-	Net exports, real	$NX = X - M$
R	-	Gross operating surplus, real	$R = UOGD/PVGD$
P	PVGD	GDP deflator	-
P_M	PXGS	Import price deflator	-
P_X	PMGS	Export price deflator	-
ULC	PLCD	Unit labor costs	-
RULC	ALCD	Real unit labor costs	-
W	-	Compensation of employees, real	$W = UWCD/PVGD$
X	DXGE	Exports, real	extra EU12 imports of goods. Belgium, Lux from 1999.

Table A.2. Unit root tests

Variable	Levels				Differences			
	Deterministic	Lags	Test stat.	Significance	Deterministic	Lags	Test stat.	Significance
ln C	c,t	1	-2.054	-	c	0	-2.985	***
ln W	c,t	1	-2.090	-	c	0	-2.405	**
ln R	c,t	0	-2.161	-	c	0	-5.204	***
ln I	c,t	1	-2.878	*	c	0	-3.823	***
ln Y	c,t	0	-2.607	-	c	0	-3.969	***
i	c	0	-1.370	-	c	0	-6.150	***
ln X	c,t	0	-1.721	-	c	0	-5.678	***
ln YW	c,t	1	-3.125	**	c	0	-4.696	***
ln Ex	c	0	-2.258	**	c	0	-5.559	***
ln Px/Pm	c	1	-3.278	***	c	0	-5.529	***
ln M	c,t	0	-1.632	-	c	0	-6.150	***
ln P/Pm	c	0	-1.027	-	c	0	-5.126	***
NX/Y	c	0	-2.512	**	c	1	-5.927	***
RULC	c	1	-0.040	-	c	0	-4.571	***
ln Px	c,t	1	-0.820	-	c	0	-3.182	***
ln Pm	c,t	1	-1.059	-	c	0	-4.081	***
ln P	c,t	1	-1.855	-	c	0	-0.937	-
ln ULC	c,t	1	-1.083	-	c	0	-1.533	*

Note: Critical values according to Charemza and Deadman (1997). *** = statistically significant at 1%, ** = statistically significant at 5%, * = statistically significant at 10%.

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