Trade and Technological Explanations for Changes in Sectoral Labour Demand in OECD Economies

By

Gerry Boyle and Pauline McCormack[1]

Department of Economics,

National University of Ireland, Maynooth.

Paper Presented to the Irish Economic Association Annual Conference,

Limavady, Co. Derry, Northern Ireland

April 24-26, 1998.

[1] **The authors would like to acknowledge the help of Maurice Roche, Donal O'Neill and Ide Kearney in the preparation of this paper. Any errors are our responsibility.**

Trade and Technological Explanations for Changes in Sectoral Labour Demand in OECD Economies

1. Introduction

The goal of this paper is to identify the main determinants of shifts in the demand for aggregate labour in manufacturing and service sectors for a cross-section of OECD countries. In our empirical analysis we employ a relatively new panel data set (the *International Sectoral Data Base (ISDB) (OECD),(1996)*[2]), for 14 countries and up to 22 two-digit sectors and extending over 35 years from 1960. Apart from the consistent country and sectoral coverage of this database it has a number of unique features which facilitate our empirical inquiry. The provision of *Total Factor Productivity (TFP)* indices by sector is a particularly attractive aspect of the database and these measures will serve as an excellent proxy for technological change which will be a key building block of our analysis. This data set also contains data on the input levels of labour and capital, output (value-added), wage rates and output prices. Data are also available on exports and imports by sector. Unfortunately only the aggregate level of labour input is available and no disaggregation by skill level or by production-non-production worker is possible. While our central interest is the labour aggregate we make an attempt, within the data constraints, to assess whether there are differential skill-based effects.

In the paper we touch on a number of themes that have preoccupied economists in recent years. Foremost among these is the search for a consensus explanation of developments in wage inequality between workers of different skills in OECD countries. While there is a fairly widespread view that labour-demand factors are more important in explaining the widening wage gap between "high skill" and "low skill" workers than labour-supply factors (Johnson (1997) and Gottschalk and Smeeding (1997)), there is not agreement as to the nature of the demand-based explanations. While our paper does not address the issue of wage inequality directly, because we focus on the demand for aggregate labour, we believe we can nonetheless shed light on the relative importance of the variables that affect labour demand,

[2] We opted not to use the full set of sectors available in the *ISDB* and limited our inquiry to private manufacturing and services. Full details of the data set used in the paper are given in Annexe 1.

regardless of type. The cross-country emphasis in our study also assists in identifying common experiences affecting labour demand and thus helps to underpin the robustness and generality of the conclusions that we draw.

The plan of the paper is as follows. Section 2 outlines the arguments for trade and technological explanations of variations in labour demand. Section 3 presents estimates of the contribution of “within” and “between” sector variations to the overall variation in labour demand for a number of time periods for the 14 countries in our panel data set. Section 4 sets up a simple model to test the contribution of trade and technological factors to explaining the “within” sector variation in labour demand. Section 5 sets out some descriptive statistics for the variables used in the regression analysis. Section 6 presents and discusses the econometric findings. Finally, Section 7 concludes the paper.

2. Trade and Technological Sources of Variation in Labour Demand

Much of the debate on the relative importance of demand-side factors has centred on trade versus technological explanations of shifts in labour demand (see for example Berman, Bound and Griliches (1994), Bound and Johnson (1992), Bound and Johnson (1995), Brauer and Hickok (1995) and Johnson (1997)). Following Berman’s, Bound’s and Griliches’ (1994) lead these respective sources have been attributed to “between” sector and “within” sector explanatory factors. Given this classification a simple shorthand procedure for a first-pass determination of the relative importance of trade and technological shift factors has been to conduct a “shift and share” analysis (see, for example, Berman, Bound and Griliches (1994), Machin, Ryan and Van Reenen (1996) and Kearney (1998)). The “shift and share” analysis can be conducted for either wage or employment shares. The wage share analysis is preferred theoretically as the application of Shephard’s Lemma to a logarithmic cost function yields the cost-minimising labour-demand equations where the dependent variable is the wage share.

Box 1 demonstrates both a rationale for this “shift and share” methodology and suggests in addition why such an exercise cannot provide conclusive evidence of the relative importance of trade and technological factors in explaining labour demand shifts.

Suppose one’s objective is to model the demand for labour within a country by sector. The problem has to be embedded within a supply-side modelling framework. Box 1 outlines one tractable method of proceeding. It suggests a two-stage approach to the modelling problem. In Stage 1 the objective is seen to be one of maximising country-wide GDP (q). The arguments of this function are the prices of value-added by sector (the p_i's), and the *economy's* productive capacity which is determined by its primary resources (labour (*l*), capital (*k*), and the rate of *Total Factor Productivity* (*tfp*)). Partial differentiation of this function with respect to the p_i's yields the sectoral supply functions (q_i) whose arguments will be the same variables. This could be interpreted as the "between" sector allocation problem.

The second stage addresses the "within" sector dimension. The sectoral output prices in Stage 1 can be modelled as functions of "within" sector input prices (the w_{ij}, where i = sector and j = input), the *sectoral* level of output (q_i) and the *sectoral* rate of technological change (tfp_i). In other words output prices are set through a simple cost minimising rule. Partial differentiation of the sectoral cost functions with respect to the sectoral wage rate yields the sectoral labour-demand functions (the l_i's) as functions of sectoral input prices, the *sectoral* level of output and the *sectoral* rate of technological change.

If logarithmic functions are assumed then the application of Shephard's Lemma produces "between" sector value-added shares as the dependent variable in the Stage 1 output-supply functions and "within" sector wage share dependent variables in the Stage 2 labour-demand functions. It should be noted that variations in the "between" sector shares sector shares will be dependent on the level of *national* output if the underlying national production function is non-homothetic; and on the *national* rate of technological change if technological change is sectorally biased. Similarly, the "within" sector cost shares will depend on *sectoral* output if the sectoral-level production function is non-homothetic and will be affected by the rate of *sectoral* technological change if technological change is input biased.

An important point to note therefore is that "within" and "between" sector variations are both affected by the rate of technological change and by changes in output.

We can also use the schema in Box 1 to pick our way through the various channels whereby increased trade might impinge on the demand for labour. Trade enters in the classic *Heckscher-Ohlin* sense through imports of labour-intensive products leading to reductions in corresponding relative product prices in the importing country. These relative price falls will in turn affect the sectoral allocation of output. Thus far trade is seen to affect Stage 1 of our modelling schema.

This reallocation of output will work through sectoral output shocks to labour demand and thence to relative input prices. In this sense trade works to influence the "within" sector variations in wage shares. The connection between relative product price and relative input price changes is of a complex general equilibrium nature and may be very difficult to simulate, if at all, with simple empirical models. The direction of causality, for instance, between relative input prices and relative factor demand does not appear clearcut.

It appears at least possible also that trade could operate independently of either product or input prices simply by shifting the demand for labour directly as firms adjust their cost base in the face of incipient competition.

In a recent paper Slaughter (1997) argues that trade variables can also affect the elasticity of labour demand at firm level and thus provides us with another channel of influence, independent of relative input or output prices, through which trade can impact on the "within" sector variation in labour demand. Slaughter bases his argument on the Allen-Hicks (1938) derivation of the labour-demand elasticity:

$$\eta_{ll} = -(1-s)\sigma_{ll} - s\eta \tag{1}$$

where,

η_{ll} = firm own-price labour-demand elasticity,
s = wage share,
σ_{ll} = firm Allen elasticity of substitution,
η = product demand elasticity.

If increased trade raises the product demand elasticity through enhancing competition and providing more consumer choice then the labour-demand elasticity will increase. Trade can also permit greater substitution possibilities (that is, increase the Allen elasticity of substitution) by, for example, allowing firms to out-source some of their production activities to other countries and from (1) this will lead to an increase in the elasticity of demand for labour. Thus changes in h_{ll} and s_{ll} affect the labour demand elasticity in an unambiguous way.

But trade can also affect the wage share and hence the elasticity of demand for labour. Unfortunately, as Slaughter emphasises, neither the direction of impact of trade on the wage share or of the wage share on the elasticity can be signed with any confidence. As trade affects relative input prices the extent to which this affects the wage share will depend on the elasticity of substitution. Moreover the impact of any given change in the wage share on the labour-demand elasticity depends on the relative magnitude of h and s_{ll}.

To summarise our discussion so far: it seems to us that it cannot be inferred from the majority of findings which report that “within” sector variations dominate “between” sector variations in relative labour demand that (a) trade factors are unimportant in explaining labour-demand shifts and (b) technological change of the input-biased type is the dominant source of variation. The latter point is the crux of the debate between Krugman (1995) and Leamer (1996). The issue to us is not whether trade or technological factors are more or less important in explaining the variation in labour demand but the nature of these trade and technological effects, that is, do trade and technological biases enter through a weighted average of the *Heckscher-Ohlin* or Slaughter effect or at all. The direction of causality is also important. As noted earlier, short of employing a fully specified general equilibrium model it is unlikely that definitive answers can be had to these questions. What we hope to do in this paper is to narrow in as far as is possible the areas of contention.

3. “Within” and “Between” Sector Variations in the Wage Share

The focus of this study is to examine the factors responsible for changes in the sectoral demand for aggregate labour. As noted earlier it is theoretically preferable to specify the demand for labour in wage share form. Thus if we define the aggregate wage share by country for all sectors[3] as:

---

[3] It should be recalled that our focus in this paper is only on private manufacturing and services.

$$\sum_i S_i s_i \qquad \textbf{(2)}$$

where,

S_i = the share of sector i output (value) in total sector output (value),

s_i = the wage share of aggregate labour in sector i output (value).

Thus S_i is the “between” sector share and s_i is the “within” sector share.

By totally differentiating this expression we can decompose the total variation in the wage share into the contribution of “within” and “between” sector variations (see Berman, Bound and Griliches (1994), Machin, Ryan and Van Reenen (1996) and Kearney (1998)):

$$\sum_i d(S_i s_i) = \sum_i ds_i \overline{S_i} + \sum_i dS_i \overline{s_i} \qquad \textbf{(3)}$$

The first expression on the right-hand-side of (3) is the annual average “within” sector variation defined over a given period: $\overline{S_i}$ is the mean “between” sector share defined over the same period. The second expression on the right-hand side is the corresponding “between” sector variation and $\overline{s_i}$ is the mean “within” share.

Based on the OECD’s *ISDB* we present estimates of this decomposition in Table 1.
In about two-thirds of the time periods examined the “within” sector variation dominates the “between” sector variation. Only in the case of two countries, Canada and Sweden, does the “between” sector variation exceed the “within” sector variation. A noteworthy feature of these results is the fact that in almost all time periods the “between” variation is negatively signed in contrast with the outcomes for the “within” sector variation. This result confirms numerous other studies which have focused on non-production labour. We conclude therefore that in so far as technological change and trade factors are important sources of labour-demand shifts, the former is more likely to be manifest as a labour-saving bias while trade is more likely to be influential through some weighted average of relative input price and Slaughter-elasticity effects or simply through shifts in employment in the trade sensitive sectors.

We would not want to overstate this finding. Despite the dominance of “within” sector variation it is nonetheless apparent that “between” sector factors are still quite important. Afterall in about a third of the time periods analysed they dominate the “within” sector variation. Moreover in a large number of the remaining cases the absolute level of the “between” sector variation is quite large. It is also worth noting, for instance, that in the case of the USA, the “between” sector variation dominates the “within” sector variation in the 1980s and early 1990s. This period coincides of course with the widening of trade deficits.

In principle it is possible to model both the “between” and “within” sector variation using the schema outlined in Box 1. However, there is a single major difficulty that renders the modelling of the “between” sector variation impractical. As we have argued earlier, for theoretical consistency the regressors should include all sector prices in addition to national output and technical change. Estimation of such a framework would quickly prove intractable[4]. This consideration combined with the result that “within” sector variations in wage shares are of a greater magnitude than the “between” sector variations provide our justification for focusing on the determinants of the “within” sector variation in wage shares.

[4] We are, however, currently experimenting with a more parsimonious parameterisation of the “between” sector model that requires us to generate *inter alia* aggregate-sector output and technological change indices that may resolve this difficulty.

4. Modelling the "Within" Sector Variation in the Wage Share

Model Specification

In line with a number of other studies (Berman, Bound and Griliches (1994), Machin, Ryan and Van Reenen (1996) and Kearney (1998)) we model the variation in the "within" sector wage share using the following semi-logarithmic specification:

$$\Delta s_{i0} = \sum_{t=-1}^{-2} a_t \Delta s_{it} + \sum_{t=0}^{-2} b_t \Delta w_{it} + \sum_{t=0}^{-2} c_t \Delta k_{it} + \sum_{t=0}^{-2} d_t \Delta q_{it} + \sum_{t=0}^{-2} e_t \Delta m_{it} + \sum_{t=0}^{-2} f_t \Delta tfp_{it} + \Delta u_{i0} \quad \textbf{(4)}$$

where,

Δ = first-difference operator;
i = sector;
t = time period (years);
w = log wage rate deflated by the price of sectoral output (value-added);
k = log capital stock;
q = log sector output (value added);
m = imports as a proportion of value-added;
tfp = log total factor productivity;
a-f = parameters to be estimated;
u = error term.

The set up of the model implies that coefficients are assumed to be constant across sectors. Also it should be noted that while it would have been possible to pool all the country data we opted instead to present separate estimates for each country. It was felt that this procedure would provide more useful information.

As is well known this equation can be rationalised as the dynamic version of the partial derivative with respect to the wage rate of a translog restricted cost function. In our empirical application this theoretical justification will only be approximately correct as we employ a real wage variable defined as the sectoral nominal wage deflated by the corresponding price of value added. It would have been theoretically more consistent with cost-minimising behaviour if we had employed the rental price of capital as deflator and thus omitted the capital stock from the equation but data for such a deflator were not available. In any event it was felt unreasonable to assume full adjustment of capital to variations in rental values over a three year period.

Our measure of technological change is based on the sectoral measures of *Total Factor Productivity* that is provided in the *ISDB*. Considerable ingenuity has been expended in devising appropriate indices of technological change in recent analyses of the sources of wage inequality. At the crudest a simple time trend has been employed. More sophisticated measures have involved using as proxies particular components of the capital stock, such as computers, or measures of the R&D input (see Berman, Bound and Griliches (1994), Machin, Ryan and Van Reenen (1996) and Krueger (1993)). The TFP index seems a natural measure to use in this context which perhaps accounts for why it is used by analysts in discussing the impact of technological change on labour shifts (see, for example, Krugman (1995), Leamer (1996), Steiner and Wagner (1997)).

With the *ISDB* a number of simple measures of trade pressure can be constructed given that both export and import data are available. We opted to use imports relative to value-added as being the closest reflection of how trade pressure might impinge on labour demand.

Given the dynamic structure of our basic equation the long-run partial derivatives will be of most interest. These are defined as:

$$(\partial s / \partial x_j) = \lambda_j = \sum_{t=0}^{t=-2} \varphi_{jt} / (1 - \alpha_{-1} - \alpha_{-2}) \qquad \textbf{(5)}$$

where,

∂ = partial derivative operator;

x_j = regressors in (4) such that j=w,k,q,m and tfp;

φ_j = estimated coefficient such that j=b,c,d,e and f.

If equation (4) is interpreted as the partial derivative of a translog cost function it is well known that expressions for elasticities can be readily derived. Of most interest is the long-run own-price elasticity of demand for labour given by:

$$\varepsilon_{ll} = s_i - 1 + \frac{\lambda_b}{s_i} \qquad \textbf{(6)}$$

It should be noted that it is not necessary for this expression to have the correct sign that the long-run estimated parameter (λ_b) be negative but, if it is positive, the lower will be the corresponding elasticity value for any given sectoral share (s_i).

The bias of technoligical change is given by the magnitude and sign of λ_f. Hicks-neutral technical change implies $\lambda_f = 0$; Hicks-factor using technical change implies $\lambda_f \rangle 0$; and Hicks-factor-saving technical change implies $\lambda_f \langle 0$.

We noted earlier that a drawback of the *ISDB* is that labour is not disaggregated by skill or by category of worker, for example, production versus non-production worker. If we are prepared, however, to make the assumption that the greater the skill intensity of a sector the greater will be the average wage rate in that sector[5], one way of picking up skill effects would be to add the following set of interactive terms to equation (4):

$$\sum_{j=w}^{tfp} \sum_{t=0}^{-2} \theta_{jt} x_{jt} * w_{it} \qquad \textbf{(7)}$$

where,
θ_{jt} = parameters of the interactive terms;
x_{jt} = as defined in equation (5);
w_i = level of wages (real) by sector *i*.

With the lagged terms included these interactive terms terms would require the estimation of 15 extra parameters on top of the 17 set out in (4). Accordingly we imposed the following

[5] Slaughter (1997), for instance, allows that this could be a possibility.

simple parameterisation which restricted the additional parameters to be estimated to only five:

$$\sum_{j=w}^{tfp} q_j \left(\sum_{t=0}^{-2} x_{jt} * w_{it} \right) \qquad \textbf{(8)}$$

In other words we restrict the coefficients for each value of *t* to be equal in value. While this is a limiting specification it is felt that if the interactive terms are important their role should emerge from this specification.

Estimation Issues

Application of OLS will lead to inconsistent estimates of a_{-1} since $(s_{i-1} - s_{i-2})$ is likely to be correlated with the error term $(u_{i0} - u_{i-1})$. This is a well-known problem with dynamic panel-data models (see Baltagi (1995)) but our specification also presents us with an additional endogeneity problem since the dependent variable (wage share) and hence the error term is correlated by construction with the two of the wage terms, namely, $(w_{i0} - w_{i-1})$ and $(w_{i-1} - w_{i-2})$ [6]. This particular problem has led some researchers to drop the wage term altogether (Berman, Bound and Griliches (1994)) or to downplay the role of wages (Machin, Ryan and Van Reenan (1996)). This appears to us to be an extreme response in that, while the coefficient may be inconsistent unless a satisfactory estimation procedure is utilised, wage effects are extremely important to the debate on the source of changes in labour demand.
The most appealing resolution of this estimation difficulty is to use the *Instrumental Variable* (IV) estimator, provided suitable instruments can be found, that is, variables which are highly correlated with Δs_{i-1} and Δw_{i0} and Δw_{i-1} but uncorrelated with the error term Δu_{i0}.

[6] This is an issue separate from the identification problem. The presumption we make in the latter respect, as in most other studies, is that intertemporal labour supply shifts trace out the labour demand curve. We can of course hope that a suitable estimation procedure will, in a sense, "kill two birds with one stone".

Baltagi (1995, p.126) suggests a number of approaches to obtaining suitable instruments. One is to use s_{i-2} as an instrument for $(s_{i-1} - s_{i-2})$. This could be highly correlated with $(s_{i-1} - s_{i-2})$ and uncorrelated with $(u_{i0} - u_{i-1})$ as long as the u_i's are not themselves serially correlated. By extension possible instruments for the wage terms might be w_{i-2} and w_{i-3}. Baltagi also points out that additional instruments can be obtained by utilising the so-called orthogonality conditions that exist in panel data between the s_{it} and the u_{it}.

To see how these conditions work consider the following simple case where we have four years of data for a single industrial sector and our model is a simple autoregressive relationship:

$$y_{it} = \mathrm{w} y_{i,t-1} + u_{it} \tag{9}$$

Taking first differences we have the model:

$$y_{it} - y_{i,t-1} = \mathrm{w}(y_{i,t-1} - y_{i,t-2}) + (u_{it} - u_{i,t-1}) \tag{10}$$

Supposing now we had the following data:

Year	y_{it}	$y_{i,t-1}$	Δy_{it}	$\Delta y_{i,t-1}$	Δu_{it}
1990	Y90				
1991	Y91	Y90	Y91-Y90		
1992	Y92	Y91	Y92-Y91	Y91-Y90	U92-U91
1993	Y93	Y92	Y93-Y92	Y92-Y91	U93-U92

The orthogonality conditions imply the following instruments for $\Delta y_{i,t-1}$:

Year	IV1	IV2	IV3
1992	Y90	0	0
1993	0	Y90	Y91

The difficulty with this method of determining the instruments is to decide on some way of limiting the number to be employed in the empirical analysis. We adopted a simple procedure. We first defined year dummies as D_{it} (i=sector, t (year)=1,…,T) which take on the value 1 in year t for sector i and 0 for all other years and sectors. Then we simply multiplied these dummies by $y_{i,t-2}$, providing a set of instruments, $D_{it} * y_{i,t-2}$, for Δs_{i-1}, and by $w_{i,t-2}$, providing a set of instruments, $D_{it} * w_{i,t-2}$, for Δw_{i0} and Δw_{i-1} respectively. We also employed the set of year dummies as additional instruments. The actual IV procedure we implemented involved running OLS regressions of Δs_{i-1} on the set of instruments D_{it} and $D_{it} * y_{i,t-2}$ and Δw_{i0} and Δw_{i-1} separately on the set of instruments D_{it} and $D_{it} * w_{i,t-2}$. The fitted values from these subsidiary regressions were then substituted into equation (4) and estimation then proceeded by OLS.

A crucial requirement for the validity of our IV estimation procedure is that the error term in (4) does not display autocorrelation. For the IV estimates we thus employed a Lagrange-multiplier test for second order autocorrelation which involved regressing the residuals from the IV estimates on the residuals lagged once and twice and the full set of variables. Autocorrelation is tested by the t-values on the lagged residual terms in this equation.

A final point to note about our estimation procedure is that following Berman, Bound and Griliches (1994) we premultiplied each variable in equation (4) by $(S_{i0} + S_{i-1})/2$, where S_i is the "between" sector share of aggregate sector value-added. Essentially this procedure is a weighted regression procedure which is a appropriate for the panel data employed in our study because it reduces the variation to be explained and is thus likely to yield more efficient estimates. It also has the advantage that the dependent variable in the estimation corresponds to the measure of "within" sector variation given in equation (3).

5. Some Descriptive Statistics for the Regression Sample

The full complement of observations which were used for the "shift and share" analysis were not available for the regression procedure since not all right hand side variables were available for every year or sector. This was especially true for the trade pressure and technological change variables. In the case of the latter variable no data were available for any country prior to 1970. Severe data gaps meant that it was not possible to estimate the model in (4) for Australia or the Netherlands.

In Table 2 we furnish the means of the actual country data used in the regression analysis. These data are the pooled mean changes defined over all the sectors and years employed in the regression analysis. If we look within countries first it is apparent that a clear pattern emerges with the most important variables in terms of the magnitude of change being real wages and the capital stock. These variables are followed in order of magnitude by the change in output and productivity with the import penetration ratio taking up the rear.

There are some significant variations across countries. Canada and Norway followed by the US exhibit the lowest rate of change in real wages[7]. There is much greater similarity evident in the mean growth of the capital stock with Canada and Denmark experiencing, by admittedly only a small margin, the lowest rate of change. Japan has the highest growth rate. A broadly similar congruence is apparent for the output variable but here Norway is a notable outlier at the bottom end with Japan and Finland taking up pole position. As would be expected there is substantially greater variation apparent for the import variable. Denmark and Sweden and Finland actually experienced a decline in the rate of import penetration on average. Substantial cross-country variability is also to be observed for the rate of *TFP* growth with Norway being a clear outlier at the bottom end and Belgium, Italy, Finland and Japan turning in impressive performances at the top end.

5. Econometric Estimates of the "Within" Sector Variation in the Wage Share

The detailed regression findings are documented in Annex 2. Given the large number of results which are obtained we will focus here on the long-run coefficient estimates (the λ_j's). However, some comments on econometric aspects of the results are appropriate.

It is apparent that our model explains a substantial proportion of the variation in the wage share. There is no evidence of autocorrelation for either the OLS or IV estimates although,

[7] The relatively small number of observations for Norway may invalidate this comparison.

somewhat curiously, the (IV) estimates containing the interaction terms produce some evidence of the problem. There are also some predictable differences between the OLS and IV estimates. In particular, it is evident that that there is a significant upward bias in the OLS estimates of the wage coefficients. On the other hand, the bias for the Δs_{i-1} terms appears to be less pervasive. In most countries all of the variables are statistically significant for at least one value of lag t. The variables which emerge with the strongest statistical effect are the real wage and technological change. We also find a number of high t-ratios among the set of interactive terms for most countries.

Table 3 presents our estimates of the long-run coefficients for each variable in the model. These values bring out very clearly the impact of the estimator used, especially, but not exclusively, on the wage terms. For a large number of countries the IV estimates of the wage impact are lower than the OLS estimates. However, the IV estimator also affects the values of some other coefficients in a few important cases, for example, the output term for Belgium, the trade term for the USA and Norway and the productivity term for Canada, Italy and Belgium.

It is worth drawing attention to the remarkable similarity in results for most countries, certainly as far as the direction of impact is concerned. This gives us greater confidence that the findings we are uncovering may truly reflect fundamental underlying causal factors. The most important findings that emerge are that wage and productivity shocks have the greatest impact on the wage share.

All the country regressions produced a positively-signed wage coefficient. As noted earlier, given that these wage share equations imply a translog cost function, the greater the value of the long-run wage coefficient the greater the risk of “wrong” signs on the wage elasticity. The IV estimates are thus seen to lessen this risk. Nonetheless the IV coefficient estimates are quite large for many countries, most notably in the case of France and the USA. It would appear therefore that the wage coefficients remain contaminated by simultaneity bias. Based on the findings of Machin, Ryan and Van Reenen (1996) there is nonetheless no reason to believe that this problem will affect inferences regarding the other key parameters.

With the intriguing exception of the UK, all the regressions yielded a negative coefficient for the productivity term. The latter result indicates that technological change is predominantly labour-saving in the Hicksian sense.

The capital stock variable in most cases implies substitutability with aggregate labour while the output coefficient implies that expansions in output are not neutral with respect to inputs but tend in general to exhibit a small and mainly positive bias with respect to labour.

The trade pressure coefficient displays the most variability in terms of sign with about half the countries being positive. It is clear that given the relatively small magnitude of the coefficients and when taken in conjunction with the actual variation in the import penetration ratios given in Table 2, trade effects have only played a marginal direct role in explaining labour demand shifts. Nonetheless it is important to record that trade effects significantly influence labour demand in most countries. Moreover, trade effects could operate indirectly through the wage terms in the *Heckscher-Ohlin* sense and given the importance of the wage coefficients we cannot rule out this channel as a potentially important route of influence.

We report on the role of the wage interaction terms in Table 4. If it is accepted that industries with higher average wages are also more skill intensive then a positively (negatively)-signed coefficient would suggest that the greater the level of skill the greater (lower) the magnitude of the partial derivatives. A first point to note about the reported results is that there are a large number of significant coefficients. It is evident that for a majority of countries, in four out of five of the terms, the coefficients are positively signed while 10 countries produce a positive and significant coefficient for the wage-wage[8]variable and six yield a significantly positive parameter estimate for the capital-wage variable.

In the case of the trade term the majority of countries provide a negative coefficient implying that trade impacts negatively on labour demand the higher the skill-intensity of the sector.

In general the findings would appear to confirm a good deal of the results that have emerged from the wage inequality literature. The positive sign for the capital-wage term gives support to the capital-skill complementarity hypothesis (Welch (1970), Griliches (1969)). In the case

[8] The partial derivative of the wage variable will depend on all the coefficients of the interaction terms.

of the TFP-wage variable we also find that technological change tends to complement skill. A similar finding in the case of the output-wage variable may reflect the fact that high growth sectors tend to be concentrated in the high-skill/high-tech sectors.

6. Concluding Remarks

In this paper we have used a relatively new cross-country panel data set (*ISDB* (OECD (1996))) to examine the factors which are responsible for shifting labour demand in recent decades in large and diverse number of countries. We contend that the main strength of our analysis is a simple but important feature, namely, the application of a similar methodology to a consistently generated set of data. Given this feature we believe that any conclusions that are drawn are more likely to be robust.

Our principal findings are in broad agreement with many recent studies that have focused on the determinants of shifts in the employment of skilled labour. The main debate has centred on the respective roles and importance of trade versus technological shift factors. We find that, for the sample of the countries as a whole, “within” sector variations in the wage share dominate the “between” sector variations. We interpret this result as suggesting that input-biased technological change rather than sectoral-biased technological change could potentially be an important explanation for shifts in the wage share. However, trade factors cannot be ruled out because of this finding since trade can impinge indirectly on the “within” sector wage share through relative wages or the labour demand elasticity or directly by affecting employment shifts.

To explore these issues more explicitly we then estimated for each country a dynamic model of the “within” sector wage share which contained five main right-hand-side variables, namely, real wages, capital, output, import ratios and technological change as proxied by the rate of growth in *Total Factor Productivity*. We also added a number of interactive terms designed to capture very simply if there were skill effects to be unearthed.

Our regression analysis confirmed that technological change and real wages were the most important factors driving the wage share, both in terms of magnitude and statistical significance. We uncovered evidence that the wage effect was subject to statistical bias and despite use of an instrumental variable estimator it is not clear that this bias was entirely eliminated. We also found small but statistically significant effects for our trade variable.

The interactive terms proved to be statistically significant in a large number of cases. These terms tentatively confirmed important skill effects. In particular we found evidence of: lower elasticities for higher-skilled labour; capital skill complementarity; labour-using technological change for more skill-intensive sectors workers.

Overall we find broad agreement across countries which differ in many ways but especially in their labour-market institutions. In many respects this is a striking and comforting finding. Nonetheless we find sizeable cross-country differences in the intensity through shocks to labour demand are experienced. This may have implications, for instance, for the testing of Krugman's (1993) *Euroscelerosis* hypothesis.

References

Allen, R.G.D. (1938), *Mathematical Analysis for Economists*, Macmillan, London.

Baltagi, B. H. (1995), *Econometric Analysis of Panel Data*, Wiley, New York.

Berman, E., J. Bound and Z. Griliches (1994), "Changes in the demand for skilled labor within U.S. manufacturing: evidence from the annual survey of earnings", *Quarterly Journal of Economics*, May: 367-395.

Bound, J. and G. Johnson (1995), "What are the causes of rising inequality in the United States?", Federal Reserve Bank of New York, *Economic Policy Review*, January: 9-17.

Bound, J. and G. Johnson (1992), "Changes in the structure of wages in the 1980s: an evaluation of alternative explanations", *American Economic Review*, June, 82(3): 371-392.

Brauer, D.A. and S. Hickok (1995), "Explaining the growing inequality in wages across skill levels", Federal Reserve Bank of New York, *Economic Policy Review*, January: 61-75.

Gottschalk, P. and T.M. Smeeding (1997), "Cross-national comparisons of earnings and income inequality", *Journal of Economic Literature*, XXXV, June: 633-687.

Griliches, Z. (1969), "Capital-skill complementarity", *Review of Economics and Statistics*, November, 51: 465-68.

Johnson, G.E. (1997), "The changes in earnings inequality: the role of demand shifts", *Journal of Economic Perspectives*, 11(2), Spring: 41-54.

Kearney, I. (1998), "Estimating the demand for skilled labour, unskilled labour and clerical workers: a dynamic framework", ESRI *mimeo*, Dublin.

Krueger, A. (1993), "How computers have changed the wage structure: evidence from microdata, 1984-1989", *Quarterly Journal of Economics*, February, 108: 33-60.

Krugman, P. (1993), "Inequality and the political economy of *Eurosclerosis*", CEPR Discussion Paper.

Krugman, P. (1995), "Technology, trade and factor prices", NBER Working Paper 5355, Cambridge (Mass).

Leamer, E.E. (1996), "Wage inequality from international competition and technological change: theory and country experience", *American Economic Review*, May: 309-314.

Machin, S., A. Ryan and J. Van Reenen (1996), "Technology and changes in skill structure: evidence from an international panel of industries", CEP, LSE Discussion Paper No. 4, May.

OECD (1996), *International Sectoral Data Base* 1960-1995, Paris.

Slaughter, M. (1997), "International trade and labor-demand elasticities", NBER Working Paper 6262, Cambridge (Mass.).

Steiner, V. and K. Wagner (1997), “Relative earnings and the demand for unskilled labor in West German manufacturing”, ZEW Discussion Paper No. 97-17, June.

Welch, F. (1970), “Education in production”, *Journal of Political Economy*, January/February, 78: 35-59.

Figure 1: A Two-Stage Approach to Modelling the Sectoral Demand for Labour Within a Country

Stage 1: "Between" Sector Allocation of Output

$$Max\ pq = \sum p_i q_i = f(p_1,\ldots,p_n; l, k, tfp)$$
$$\left(\frac{\mathrm{d}(pq)}{\mathrm{d}p_i}\right) = q_i = f_i^1(p_1,\ldots,p_n; l, k, tfp) \qquad \textbf{(i)}$$

Stage 2: "Within" Sector Allocation of Inputs

$$Min\ p_i q_i = g_i(w_{i1},\ldots,w_{im}; q_i, tfp_i)$$
$$\left(\frac{\mathrm{d}(p_i q_i)}{\mathrm{d}w_{i1}}\right) = l_i = g_i^1(w_{i1},\ldots,w_{im}; q_i, tfp_i) \qquad \textbf{(ii)}$$

Table 1: “Within” and “Between” sector contribution to the overall variation in labour demand in OECD countries[a]

Country	Period	“Within”	“Between”
CAN	70-80	0.126	–0.264
	81-92	0.135	–1.911
	70-92	0.156	–0.936
DEU	60-70	0.789	0.054
	71-81	0.691	–0.172
	82-93	0.127	–0.178
	60-93	0.722	–0.150
FRA	70-80	0.689	–0.107
	81-91	–0.572	–0.205
	70-91	0.099	–0.160
GBR	70-80	0.688	–0.255
	81-92	–0.583	–0.290
	70-92	–0.068	–0.249
ITA	60-70	0.167	0.150
	71-82	–0.292	–0.018
	83-94	–0.212	–0.171
	60-94	–0.040	–0.029
JPN	60-70	–0.002	0.110
	71-82	0.610	–0.037
	83-94	0.123	–0.108
	60-94	0.352	–0.036
USA	60-70	0.258	–0.073
	71-81	0.325	–0.182
	82-93	–0.033	–0.183
	60-93	0.110	–0.232
AUS	69-81	0.305	–0.159
	82-94	–0.606	–0.143
	69-94	–0.301	–0.066
BEL	70-81	1.427	–0.067
	82-93	–0.536	–0.085
	70-93	0.268	–0.065
DNK	70-80	0.385	–0.230
	81-92	–0.112	–0.312
	70-92	0.131	–0.291
FIN	60-70	0.303	–2.342
	71-82	–0.052	2.276
	83-94	0.450	–0.045
	60-94	1.469	1.774

Table 1 cont'd.

Country	Period	"Within"	"Between"
NLD	69-80	0.807	–0.256
	81-92	–0.559	–0.223
	69-92	0.071	–0.216
NOR	62-76	1.004	0.057
	77-91	–0.362	–0.367
	62-91	0.373	–0.148
SWE	70-81	0.160	–0.240
	82-94	–0.284	–0.322
	70-94	–0.244	–0.252

[a]: Based on the decomposition in (5) x100. Note the changes are defined as the annual average over the indicated period.

Table 2: Pooled Means[a] by Country of the Variables Used in the Regression Analysis of "Within" Sector Wage Shares

Country	Δs_{i0}	Δw_{i0}	Δk_{i0}	Δq_{i0}	Δm_{i0}	Δp_{i0}	N[b]
CAN	-.0055	.0214	.0741	.0474	.0181	.0356	159(143)
DEU	.0233	.1095	.1176	.0403	.0871	.0392	316(286)
FRA	-.0034	.0884	.1276	.0719	.0476	.0544	199(179)
GBR	.0015	.1833	.1029	.0503	.0059	.0798	111(97)
ITA	-.0014	.1610	.1453	.1460	.1038	.1159	242(209)
JPN	-.0378	.2387	.3315	.2035	.3048	.1077	187(171)
USA	-.0042	.0625	.0929	.0671	.0439	.0438	334(292)
BEL	.0460	.2736	.0891	.1353	.1189	.1550	66(48)
DNK	-.0113	.2326	.0709	.0680	-.0063	.0548	95(80)
FIN	-.0307	.0898	.0930	.3479	-.0579	.1041	150(138)
NOR	-.0102	.0218	.1438	.0140	.0249	-.0045	60(54)
SWE	-.0308	.0663	.0856	.0590	-.0245	.0721	97(87)

[a]:These data are the means (x100) obtained over all sectors and years employed in the regression analysis for each country. It should be recalled that each variable is pre-multiplied by the "between" sector share of total value added.

[b]: The numbers in parentheses are the actual number of observations used in the regression analysis. Because of lags the number of observations used in the regession analysis is less than the numbers of observations available to calculate the means in this table.

Table 3: Long-run Coefficient Estimates (λ_j) by Country of "Within" Wage Share Regressions[a]

Country	Estimator	λ_b	λ_c	λ_d	λ_e	λ_f
CAN	**OLS**	.40	.05	-.22	.13	-.27
	IV	.30	.03	-.39	.25	-.05
DEU	**OLS**	.59	-.11	.08	.01	-.64
	IV	.45	-.01	.05	-.01	-.49
FRA	**OLS**	.68	-.26	.33	.02	-.99
	IV	.70	-.34	.40	-.02	-.88
GBR	**OLS**	.15	-.61	.14	.38	.57
	IV	.14	-.74	.01	.44	.62
ITA	**OLS**	.48	-.25	.25	-.01	-.75
	IV	.33	-.51	.17	.04	-.17
JPN	**OLS**	.12	.04	.14	.33	-.35
	IV	.21	-.01	.21	.36	-.44
USA	**OLS**	.73	-.30	.33	-.00	-1.04
	IV	.55	-.32	.33	.15	-.84
BEL	**OLS**	.65	-.57	-.66	-.06	-1.18
	IV	.47	-.42	.11	-.05	-.12
DNK	**OLS**	.02	-.03	-.01	.13	-.23
	IV	.02	-.12	.19	.16	-.41
FIN	**OLS**	.59	-.19	.02	.01	-.64
	IV	.39	-.17	.06	.05	-.63
NOR	**OLS**	.68	.04	-.26	.07	-.35
	IV	.47	-.05	-.02	.24	-.35
SWE	**OLS**	.64	-.24	.28	.04	-.92
	IV	.51	-.18	.11	.11	-.54

[a]: **Standard errors have not been computed for these coefficients but the significance of the coefficients may be roughly inferred from Annex 2.**

Table 4: Signs and Statistical Significance of "Skill" Interaction Terms by Country

Country	$\sum \Delta w_{it} w_{it}$	$\sum \Delta k_{it} w_{it}$	$\sum \Delta q_{it} w_{it}$	$\sum \Delta m_{it} w_{it}$	$\sum \Delta p_{it} w_{it}$
CAN	Pos & Sig	Pos & Sig	Pos & N-Sig	Pos & Sig	Neg & N-Sig
DEU	Pos & Sig	Pos & Sig	Neg & N-Sig	Neg & N-Sig	Pos & N-Sig
FRA	Pos & Sig	Neg & N-Sig	Pos & Sig	Pos & N-Sig	Neg & Sig
GBR	Pos & Sig	Pos & Sig	Neg & Sig	Pos & N-Sig	Pos & Sig
ITA	Pos & Sig	Pos & Sig	Neg & Sig	Neg & Sig	Pos & Sig
JPN	Neg & N-Sig	Pos & Sig	Neg & N-Sig	Pos & N-Sig	Pos & N-Sig
USA	Pos & Sig	Pos & Sig	Neg & N-Sig	Neg & Sig	Pos & Sig
BEL	Pos & Sig	Pos & N-Sig	Pos & N-Sig	Pos & N-Sig	Neg & N-Sig
DNK	Pos & N-Sig	Pos & N-Sig	Neg & N-Sig	Neg & N-Sig	Pos & N-Sig
FIN	Pos & Sig	Neg & Sig	Pos & Sig	Neg & N-Sig	Pos & N-Sig
NOR	Pos & Sig	Neg & N-Sig	Pos & N-Sig	Pos & Sig	Pos & N-Sig
SWE	Pos & Sig	Neg & N-Sig	Pos & Sig	Neg & Sig	Neg & N-Sig

Annex 1: Sector and time period coverage of the empirical analysis

Sectors / Countries and time periods	Canada 1970 -1992	France 1970 - 1991	Germany 1970 - 1993	Italy 1970 - 1994(1)	Japan 1970 – 1994	UK 1970 - 1994(1)	USA 1970 – 1993
Food, beverages and tobacco	X, R	X, R	X, R	X, R	X, R	X, R	X, R
Textiles, wearing apparel and leather industries	X, R	X, R	X, R	X, R	X, R	X, R	X, R
Wood, and wood products, including furniture	X, R	X, R	X, R	X		X	X, R
Paper, and paper products, printing and publishing	X, R	X, R	X, R	X	X, R	X, R	X, R
Chemicals and chemical petroleum, coal, rubber and plastic products	X, R	X, R	X, R	X	X, R	X, R	X, R
Non-metallic mineral products except products of petroleum and coal	X, R	X, R	X, R	X, R	X, R	X, R	X, R
Basic metal industries	X, R	X, R	X, R	X, R	X, R	X	X, R
Fabricated metal products, machinery and equipment	X, R	X, R	X, R	X, R	X, R	X, R	X, R
Metal products, except machinery and transport equipment		X, R	X, R	X, R			X, R
Agricultural and industrial machinery		X, R	X, R	X, R		X	X, R
Office and data processing machines, precision and optical instruments		X, R	X, R	X, R			X, R
Electrical goods		X, R	X, R	X, R		X	X, R
Transport equipment		X, R	X, R	X, R		X	X, R
Other manufacturing industries	X, R	X, R	X	X	X, R	X, R	X, R
Electricity, gas and water	X	X, R	X, R	X, R	X	X, R	X
Construction	X	X	X	X	X	X	X
Wholesale and retail trade, restaurants and hotels						X	
Wholesale trade and retail trade	X	X	X	X	X		X
Restaurants and hotels	X	X		X			X
Transport, storage and communication	X	X	X		X	X	X
Finance, insurance, real estate and business services		X	X	X	X	X	
Financial institutions and insurance	X						X
Real estate and business services	X						X

NOTE: X = Sectors included in the shift and share analysis.
R = Sectors included in the regression sample.
Numbers in parentheses refer to years used in the regression sample.

Annex 1 cont'd.

Sectors / Countries and time periods	Australia 1969(70)-1994	Belgium 1970 -1993(2)	Denmark 1970 -1993(2)	Finland 1970 - 1994	Netherlands 1969 - 1992	Norway 1970 - 1991	Sweden 1970 – 1994
Food, beverages and tobacco		X, R	X, R	X, R	X	X, R	X, R
Textiles, wearing apparel and leather industries		X, R	X, R	X, R	X	X, R	X, R
Wood, and wood products, including furniture			X, R	X, R	X	X, R	X, R
Paper, and paper products, printing and publishing		X, R	X, R	X, R	X	X, R	X, R
Chemicals and chemical petroleum, coal, rubber and plastic products		X, R	X, R	X, R	X	X, R	X, R
Non-metallic mineral products except products of petroleum and coal		X, R	X, R	X, R	X	X	X, R
Basic metal industries		X, R	X, R	X, R	X	X, R	X, R
Fabricated metal products, machinery and equipment		X, R	X, R	X, R	X	X	X, R
Metal products, except machinery and transport equipment		X, R	X		X		
Agricultural and industrial machinery		X, R	X		X		
Office and data processing machines, precision and optical instruments		X, R	X		X		
Electrical goods		X, R	X		X		
Transport equipment		X, R	X		X		
Other manufacturing industries		X, R	X, R	X, R	X	X	X, R
Electricity, gas and water	X	X, R	X, R	X	X	X	X
Construction	X	X	X	X	X	X	X
Wholesale and retail trade, restaurants and hotels							
Wholesale trade and retail trade	X	X	X	X	X	X	X
Restaurants and hotels	X	X	X	X	X	X	X
Transport, storage and communication	X	X	X	X	X	X	X
Finance, insurance, real estate and business services	X						
Financial institutions and insurance		X	X	X	X	X	X
Real estate and business services			X	X	X	X	X

NOTE: X = Sectors included in the share analysis.
R = Sectors included in the regressions.
Years in parenthesis apply to regression sample

Annex 2: Detailed Regression Results by Country for the "Within" Sector Wage Shares

CAN	OLS		IV		IV+Interaction Terms	
Variable[a]	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Δs_{i-1}	-0.258331	0.092443	-0.225661	0.143958	-0.190018	0.101804
Δs_{i-2}	-0.122195	0.090505	-0.150531	0.128748	-0.053553	0.091423
Δw_{io}	0.408037	0.031475	0.277124	0.096915	0.024793	0.07966
Δw_{i-1}	0.149076	0.051205	0.21761	0.091582	0.179077	0.066169
Δw_{i-2}	-2.05E-03	0.051382	-0.086611	0.070578	-0.089389	0.049359
Δk_{i0}	0.178387	0.166459	-0.11911	0.219129	-0.930494	0.446265
Δk_{i-1}	-0.032719	0.229509	0.618643	0.31744	-1.2555	0.526885
Δk_{i-2}	-0.07569	0.154057	-0.45516	0.226285	-1.28561	0.485554
Δq_{i0}	-0.250864	0.057798	-0.423409	0.078591	-0.818271	0.504245
Δq_{i-1}	9.82E-03	0.062176	0.020024	0.087916	-0.548838	0.510685
Δq_{i-2}	-0.065834	0.062507	-0.138758	0.096765	-0.705228	0.519826
Δm_{i0}	0.093126	0.031437	0.219583	0.045602	-3.06392	1.1741
Δm_{i-1}	0.01598	0.032926	0.087329	0.04604	-3.19319	1.18049
Δm_{i-2}	0.075265	0.035603	0.037092	0.051211	-3.12712	1.17756
Δp_{i0}	-0.206486	0.057561	0.040938	0.078033	0.110434	0.508791
Δp_{i-1}	-0.172637	0.0545	-0.160234	0.073823	0.17748	0.518351
Δp_{i-2}	7.00E-03	0.054521	0.043942	0.077189	0.39441	0.519998
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.032078	3.86E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.111678	0.04198
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					0.059446	0.048505
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					-0.030067	0.049127
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					0.308625	0.113579
$\overline{\Re}^2$	.81		.59		.79	
$\overline{\Delta u_{i-1}}$[b]			.21		–1.94	
$\overline{\Delta u_{i-2}}$[b]			–.38		.78	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

DEU	OLS		IV		IV+Interaction Terms	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	0.036451	0.069542	0.131689	0.076854	-0.01219	0.03699
Δs_{i-2}	-0.183842	0.063103	-0.210152	0.136383	-0.09371	0.067192
Δw_{io}	0.603422	0.015371	0.598885	0.052654	0.122879	0.030442
Δw_{i-1}	1.25E-03	0.045315	-0.061655	0.056841	-0.076538	0.027947
Δw_{i-2}	0.072069	0.042766	-0.050153	0.092361	-0.025007	0.045033
Δk_{i0}	0.07986	0.072305	-0.264325	0.15144	-0.535083	0.214085
Δk_{i-1}	-0.094599	0.119645	0.60462	0.253529	-0.621713	0.238466
Δk_{i-2}	-0.107938	0.070621	-0.351459	0.150788	-0.835191	0.220358
Δq_{i0}	0.037536	8.89E-03	0.028799	0.020017	0.291733	0.163529
Δq_{i-1}	0.034747	9.14E-03	6.68E-03	0.019305	0.310328	0.161922
Δq_{i-2}	0.017036	8.34E-03	0.013073	0.01846	0.298252	0.158849
Δm_{i0}	-6.18E-04	0.010351	4.77E-03	0.022385	0.110865	0.241606
Δm_{i-1}	-9.50E-03	0.010169	-0.057795	0.022115	0.096478	0.241705
Δm_{i-2}	0.018429	9.40E-03	0.042047	0.02002	0.141421	0.241531
Δp_{i0}	-0.640979	0.01368	-0.542042	0.027077	-0.662322	0.16732
Δp_{i-1}	0.020015	0.047443	0.099726	0.03664	5.46E-03	0.165665
Δp_{i-2}	-0.108576	0.044426	-0.085633	0.09584	-0.074245	0.177381
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.050327	1.76E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.057628	0.019017
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.024844	0.014842
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					2.66E-03	0.01514
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-0.011107	0.022001
$\overline{\Re}^2$	.94		.74		.94	
$\overline{\Delta u}_{i-1}$ [b]			–.40		.06	
$\overline{\Delta u}_{i-2}$ [b]			–1.68		–3.21	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

FRA	OLS		IV		IV+Interaction Terms	
Variable[a]	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Δs_{i-1}	-0.02884	0.11259	3.63E-03	0.116516	-0.021452	0.04755
Δs_{i-2}	0.114339	0.108554	0.259693	0.283396	0.169556	0.113544
Δw_{io}	0.648039	0.016037	0.727609	0.071026	0.018989	0.040843
Δw_{i-1}	-0.018294	0.077292	-0.075114	0.098648	-0.047338	0.042139
Δw_{i-2}	-9.35E-03	0.074317	-0.136734	0.195307	-0.089564	0.079476
Δk_{i0}	0.201023	0.106892	0.63373	0.27286	0.666753	0.311506
Δk_{i-1}	-0.104426	0.141924	-0.580214	0.35407	-0.096216	0.348259
Δk_{i-2}	-0.333308	0.098474	-0.302678	0.252254	0.059076	0.280546
Δq_{i0}	0.019504	0.042942	-0.2208	0.110862	-2.03823	0.623195
Δq_{i-1}	0.145124	0.073035	0.472418	0.16496	-1.75211	0.632123
Δq_{i-2}	0.14059	0.063801	0.046254	0.173036	-1.9314	0.6291
Δm_{i0}	-0.020059	8.43E-03	-9.86E-03	0.023759	-0.36142	0.263448
Δm_{i-1}	0.018423	9.01E-03	-0.035119	0.024694	-0.332701	0.263359
Δm_{i-2}	0.020084	7.52E-03	0.027606	0.01974	-0.31504	0.264588
Δp_{i0}	-0.7135	0.048516	-0.35671	0.124382	1.28306	0.647054
Δp_{i-1}	-0.124454	0.131287	-0.453722	0.178872	1.69449	0.656206
Δp_{i-2}	-0.067272	0.120995	0.165349	0.324131	1.95201	0.669424
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.053323	2.06E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					-0.023765	0.022944
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					0.165479	0.051065
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					-0.159728	0.053348
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					0.028481	0.021733
$\overline{\Re}^2$	.95		.70		.95	
$\overline{\Delta u}_{i-1}$ [b]			–.92		–.35	
$\overline{\Delta u}_{i-2}$ [b]			.41		–.07	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

GBR	OLS		IV		IV+Interactions	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	0.321764	0.105477	0.499477	0.12276	0.037481	0.131839
Δs_{i-2}	-0.109741	0.099404	-0.149368	0.097121	-0.074425	0.08511
Δw_{io}	0.08928	0.030253	0.084999	0.031111	-0.142678	0.060646
Δw_{i-1}	0.051605	0.036318	0.049983	0.037558	0.082699	0.031733
Δw_{i-2}	-0.022305	0.033995	-0.041901	0.032705	-0.040534	0.027553
Δk_{i0}	-0.294164	0.719436	0.088929	0.715543	-3.90907	1.18773
Δk_{i-1}	-0.602374	0.976657	-1.05388	0.975695	-2.81082	1.62125
Δk_{i-2}	0.413128	0.672949	0.484098	0.656792	-4.23957	1.34996
Δq_{i0}	-0.553517	0.179325	-0.559925	0.177121	3.51397	1.55562
Δq_{i-1}	0.369647	0.214881	0.438772	0.206587	4.2492	1.58909
Δq_{i-2}	0.294742	0.172515	0.130521	0.17527	4.48255	1.56819
Δm_{i0}	0.179196	0.03236	0.172669	0.032358	-1.26012	1.02363
Δm_{i-1}	0.050881	0.037186	0.043702	0.035207	-1.34856	1.01508
Δm_{i-2}	0.070451	0.02848	0.071529	0.027406	-1.28873	1.01912
Δp_{i0}	0.549957	0.207624	0.52239	0.205572	-3.79479	1.45458
Δp_{i-1}	0.022098	0.224735	-0.117599	0.221506	-4.07663	1.50249
Δp_{i-2}	-0.119998	0.166827	-4.08E-03	0.167637	-4.34957	1.49563
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.02199	6.12E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.36569	0.125099
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.415028	0.159332
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.42191	0.150645
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					0.141334	0.108312
$\overline{\Re}^2$	.70		.71		.72	
$\overline{\Delta u}_{i-1}$ [b]			.48		−.48	
$\overline{\Delta u}_{i-2}$ [b]			1.62		.44	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

ITA	OLS		IV		IV+Interactions	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	0.121928	0.072113	-0.015973	0.101598	0.039975	0.047301
Δs_{i-2}	-0.046797	0.071361	0.057493	0.159967	-0.164723	0.077776
Δw_{io}	0.478514	0.015148	0.395729	0.057691	0.069	0.031326
Δw_{i-1}	-0.042287	0.036018	0.044861	0.062564	5.12E-03	0.036391
Δw_{i-2}	9.02E-03	0.035961	-0.120024	0.080917	0.038269	0.040159
Δk_{i0}	-0.35755	0.117902	-1.16105	0.292612	-1.86547	0.397468
Δk_{i-1}	0.411068	0.152347	0.811079	0.355882	-0.842066	0.448782
Δk_{i-2}	-0.289101	0.099675	-0.135275	0.236586	-1.36888	0.357913
Δq_{i0}	0.125458	0.034628	-0.093179	0.07478	2.06575	0.476159
Δq_{i-1}	0.020017	0.035924	0.180213	0.075692	1.92963	0.47157
Δq_{i-2}	0.088393	0.035027	0.077427	0.08055	1.94713	0.47039
Δm_{i0}	-0.018199	0.01193	-9.16E-03	0.028172	0.487313	0.285223
Δm_{i-1}	0.010452	0.012768	0.015239	0.028449	0.537076	0.283771
Δm_{i-2}	-5.91E-03	0.012751	0.029	0.029155	0.522448	0.284553
Δp_{i0}	-0.636761	0.039589	-0.164133	0.081087	-2.55813	0.475005
Δp_{i-1}	0.057694	0.062071	-0.045639	0.082658	-1.83432	0.469071
Δp_{i-2}	-0.113171	0.063794	0.042779	0.143848	-1.98744	0.479639
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.026632	1.04E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.070751	0.021416
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.106699	0.026825
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.104101	0.026699
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-0.029765	0.016195
$\overline{\Re}^2$	.89		.44		.90	
$\overline{\Delta u}_{i-1}$ [b]			–1.40		–3.51	
$\overline{\Delta u}_{i-2}$ [b]			–.74		–.17	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

JPN	OLS		IV		IV+Interaction Terms	
Variable[a]	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Δs_{i-1}	0.173031	0.078743	0.242765	0.114226	-0.069153	0.124654
Δs_{i-2}	0.026555	0.076453	0.023324	0.075717	-0.109862	0.079469
Δw_{io}	0.022945	0.022978	0.061039	0.030035	0.152653	0.052925
Δw_{i-1}	-0.015267	0.024215	4.40E-03	0.034889	-0.045191	0.03743
Δw_{i-2}	0.088995	0.022745	0.092021	0.022752	0.039292	0.02528
Δk_{i0}	-0.103772	0.145364	-0.118796	0.146845	-0.871137	0.365733
Δk_{i-1}	-0.067406	0.16952	0.027028	0.165585	-0.963937	0.376167
Δk_{i-2}	0.203048	0.11769	0.086136	0.12172	-0.388152	0.319432
Δq_{i0}	-0.060919	0.083527	-0.038152	0.084375	0.527867	0.713371
Δq_{i-1}	0.127738	0.080646	0.150054	0.080849	0.654049	0.699828
Δq_{i-2}	0.04476	0.072681	0.04185	0.071601	0.512309	0.69125
Δm_{i0}	0.363513	0.076119	0.347856	0.07409	0.047691	1.91249
Δm_{i-1}	-0.244823	0.09437	-0.184856	0.084881	-0.341198	1.89032
Δm_{i-2}	0.146154	0.094797	0.097812	0.090796	0.088708	1.87862
Δp_{i0}	-0.152998	0.082081	-0.178084	0.082387	-0.625705	0.673814
Δp_{i-1}	-0.042572	0.080325	-0.074304	0.080336	-0.483903	0.662493
Δp_{i-2}	-0.072719	0.074884	-0.073996	0.073678	-0.43551	0.660529
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					-1.96E-04	2.58E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.049673	0.020706
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.036064	0.046101
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.028282	0.043675
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					2.96E-03	0.125129
$\overline{\Re}^2$	.64		.65		.70	
$\overline{\Delta u}_{i-1}$			-.88		-2.5	
$\overline{\Delta u}_{i-2}$			-.68		-1.64	

[a]: Variables are defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation – test regressions.

USA	OLS		IV		IV+Interactions	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	-0.160755	0.054617	0.091821	0.084834	-0.035176	0.024876
Δs_{i-2}	-0.077335	0.053131	-0.325546	0.198583	-0.134285	0.057962
Δw_{io}	0.724604	0.010509	0.576977	0.058472	0.056924	0.019448
Δw_{i-1}	0.126517	0.04129	-0.1153	0.067247	-9.31E-03	0.020158
Δw_{i-2}	0.054197	0.040508	0.211848	0.151806	0.030679	0.044161
Δk_{i0}	-0.181997	0.046732	-0.11024	0.173875	-0.604276	0.149361
Δk_{i-1}	-0.214193	0.066297	0.07625	0.238369	-0.344111	0.161765
Δk_{i-2}	0.021772	0.052503	-0.358938	0.19202	-0.404321	0.166919
Δq_{i0}	0.304176	0.014725	0.18366	0.056828	0.562007	0.109044
Δq_{i-1}	0.075418	0.024046	0.123413	0.067647	0.287534	0.113435
Δq_{i-2}	0.023899	0.021567	0.103319	0.088905	0.296347	0.114656
Δm_{i0}	-0.013606	0.012813	0.19315	0.046197	0.763947	0.271103
Δm_{i-1}	-0.011888	0.012723	-0.086904	0.045659	0.758792	0.271923
Δm_{i-2}	0.023514	0.012537	0.077958	0.048032	0.764703	0.270988
Δp_{i0}	-1.01927	0.020373	-0.630573	0.074124	-1.41986	0.155226
Δp_{i-1}	-0.207206	0.059521	-0.124076	0.088001	-0.459456	0.157036
Δp_{i-2}	-0.057079	0.058327	-0.279408	0.225949	-0.530616	0.171864
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.0653	1.29E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.030415	0.014274
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.022439	0.010337
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.036979	0.01487
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-0.073236	0.026157
$\overline{\Re}^2$	.98		.68		.97	
$\overline{\Delta u}_{i-1}$ [b]			1.11		–1.41	
$\overline{\Delta u}_{i-2}$ [b]			.66		–2.32	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

BEL	OLS		IV		IV+Interaction Terms	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	0.04725	0.129364	0.173167	0.36113	-0.017512	0.158579
Δs_{i-2}	0.115912	0.103326	-0.041264	0.442797	-0.107611	0.232414
Δw_{io}	0.622631	0.024795	0.381028	0.165981	0.103023	0.06259
Δw_{i-1}	-0.051235	0.079926	3.67E-03	0.163537	-0.045412	0.073804
Δw_{i-2}	-0.031222	0.066504	0.027323	0.323158	0.088891	0.13508
Δk_{i0}	0.064978	0.150089	0.646579	0.683522	-1.75075	1.48506
Δk_{i-1}	-0.060714	0.202248	-0.92726	0.90764	-1.9194	1.41033
Δk_{i-2}	-0.480317	0.169639	-0.083469	0.760117	-1.88515	1.48884
Δq_{i0}	-0.01568	0.068414	-0.520399	0.332376	-0.677974	1.20535
Δq_{i-1}	0.274042	0.074702	0.567762	0.337637	-0.049728	1.25273
Δq_{i-2}	0.290902	0.095033	0.046752	0.414217	-0.192021	1.1306
Δm_{i0}	-0.026072	0.015607	0.033304	0.071173	-0.415247	1.05957
Δm_{i-1}	-0.052522	0.014247	3.00E-03	0.059762	-0.440148	1.06858
Δm_{i-2}	0.030624	0.013401	-0.078642	0.078008	-0.408279	1.04967
Δp_{i0}	-0.565298	0.072642	0.331118	0.315433	1.23702	1.18471
Δp_{i-1}	-0.195738	0.090563	-0.487105	0.322169	1.21285	1.24437
Δp_{i-2}	-0.226902	0.099013	0.049718	0.479414	1.23694	1.20136
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.032723	.550618E–02
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					0.121867	0.10652
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					0.033053	0.085657
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					-0.1109	0.083635
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					0.029568	0.077121
$\overline{\Re}^2$	.97		.41		.97	
$\overline{\Delta u}_{i-1}$ [b]			–.43			
$\overline{\Delta u}_{i-2}$ [b]			.87			

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

DNK	OLS		IV		IV+Interactions	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	-0.914674	0.154766	-0.429847	0.163087	-0.279145	0.193265
Δs_{i-2}	-0.193801	0.122539	0.087844	0.133572	0.144129	0.139678
Δw_{io}	0.151756	0.069742	0.216868	0.109014	0.164363	0.210615
Δw_{i-1}	6.97E-03	0.083663	-0.039602	0.117181	-0.186116	0.128929
Δw_{i-2}	-0.114944	0.074787	-0.153558	0.080956	-0.074337	0.096215
Δk_{i0}	0.268945	0.265138	0.399709	0.323675	-0.044216	1.50012
Δk_{i-1}	-0.310003	0.342644	-0.646429	0.410069	-0.318187	1.39025
Δk_{i-2}	-0.030078	0.257912	0.082513	0.326559	0.16898	1.39162
Δq_{i0}	-0.272318	0.15975	0.078127	0.1609	1.19457	1.23659
Δq_{i-1}	0.246678	0.136612	0.217181	0.169928	1.18967	1.27394
Δq_{i-2}	0.015623	0.110099	-0.042412	0.130794	0.984723	1.26909
Δm_{i0}	0.087814	0.028742	0.070578	0.033363	0.203904	0.803653
Δm_{i-1}	0.110447	0.032314	0.092308	0.039034	0.129758	0.789412
Δm_{i-2}	0.069567	0.030488	0.049356	0.037049	0.144803	0.785541
Δp_{i0}	-0.021704	0.164196	-0.392767	0.176189	-2.29421	1.43471
Δp_{i-1}	-0.478433	0.155102	-0.253878	0.189612	-1.96947	1.44962
Δp_{i-2}	0.014023	0.135456	0.102143	0.161648	-1.71172	1.43425
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					5.50E-03	0.012422
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					3.57E-03	0.118472
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					-0.085268	0.105024
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.156483	0.119742
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-7.16E-03	0.067729
$\overline{\Re}^2$	.77		.66		.69	
$\overline{\Delta u}_{i-1}$[b]			–.92			
$\overline{\Delta u}_{i-2}$[b]			.91			

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

FIN	OLS		IV		IV+Interactions	
Variable[a]	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Δs_{i-1}	-0.183424	0.087321	-0.321601	0.126762	0.053257	0.047694
Δs_{i-2}	-0.254063	0.087526	0.027211	0.269564	-0.183849	0.091798
Δw_{io}	0.612019	0.014772	0.494845	0.055102	-4.50E-03	0.025524
Δw_{i-1}	0.096273	0.061101	0.220546	0.095289	-0.04933	0.03448
Δw_{i-2}	0.152242	0.06098	-0.21415	0.18647	0.066231	0.063032
Δk_{i0}	-0.023003	0.092372	-0.194507	0.285775	1.39865	0.331972
Δk_{i-1}	-0.078639	0.120397	0.49134	0.369273	1.42181	0.326775
Δk_{i-2}	-0.172327	0.09275	-0.52282	0.28643	1.33084	0.318349
Δq_{i0}	8.12E-03	0.036482	-0.093622	0.112381	-0.404234	0.106964
Δq_{i-1}	0.130373	0.050205	0.042465	0.152492	-0.256372	0.11785
Δq_{i-2}	-0.103923	0.040204	0.13272	0.123382	-0.431642	0.114521
Δm_{i0}	0.029121	0.01584	0.020932	0.049725	0.38045	0.318
Δm_{i-1}	-0.014242	0.015062	0.065353	0.04683	0.356593	0.312141
Δm_{i-2}	2.18E-03	8.75E-03	-0.026337	0.027208	0.36403	0.313798
Δp_{i0}	-0.602565	0.025563	-0.728309	0.073883	-0.691795	0.110931
Δp_{i-1}	-0.153613	0.059737	-0.045355	0.092268	-0.102831	0.106443
Δp_{i-2}	-0.168275	0.060905	-0.038491	0.188462	-0.189863	0.133613
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.052147	1.93E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					-0.127372	0.026972
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					0.032359	9.13E-03
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					7.48E-03	9.52E-03
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-0.031136	0.026969
$\overline{\Re}^2$	.98		.80		.98	
$\overline{\Delta u}_{i-1}$ [b]			.21		–3.01	
$\overline{\Delta u}_{i-2}$ [b]			–1.54		–1.26	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

NOR	OLS		IV		IV+Interaction Terms	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	0.491246	0.146599	0.072282	0.278587	-0.042546	0.058768
Δs_{i-2}	-0.254366	0.176171	-1.0982	1.24192	0.064567	0.343824
Δw_{io}	0.701509	0.017687	0.407601	0.189846	-1.65E-04	0.044778
Δw_{i-1}	-0.327925	0.110477	-0.220835	0.254641	0.078333	0.053735
Δw_{i-2}	0.148186	0.128828	0.767716	0.909041	-0.144368	0.243423
Δk_{i0}	-0.160418	0.082729	0.125205	0.599095	0.102782	0.385437
Δk_{i-1}	0.209439	0.086204	0.218625	0.574795	0.49997	0.415492
Δk_{i-2}	-0.021858	0.079243	-0.437753	0.543255	0.354419	0.39886
Δq_{i0}	0.199389	0.077861	-0.375395	0.515656	0.148891	0.556536
Δq_{i-1}	-0.356344	0.087518	0.214313	0.494918	-0.136554	0.581316
Δq_{i-2}	-0.043069	0.100647	0.121283	0.629965	-0.286508	0.601943
Δm_{i0}	0.046143	0.01806	0.371747	0.119408	-1.83795	0.696804
Δm_{i-1}	-0.02049	0.0128	-4.57E-03	0.072361	-1.92449	0.703943
Δm_{i-2}	0.031544	0.014482	0.126553	0.100674	-1.89771	0.710904
Δp_{i0}	-0.90198	0.081458	0.069863	0.529811	-1.11306	0.555904
Δp_{i-1}	0.697384	0.166695	-0.138397	0.553598	-0.15717	0.577854
Δp_{i-2}	-0.061769	0.204321	-0.641167	1.37887	0.153337	0.594497
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.054184	2.39E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					-0.022901	0.034058
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					2.23E-03	0.047388
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					0.018159	0.047423
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					0.15504	0.05802
$\overline{\Re}^2$	.99		.47		.98	
$\overline{\Delta u}_{i-1}$ [b]			.22		−.78	
$\overline{\Delta u}_{i-2}$ [b]			−1.52		−.65	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.

SWE	OLS		IV		IV+Interaction Terms	
Variable[a]	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Δs_{i-1}	-0.338306	0.128669	-0.272473	0.23633	0.019751	0.057451
Δs_{i-2}	-0.393952	0.117953	-0.145679	0.554177	-0.268729	0.134083
Δw_{io}	0.641095	0.010425	0.585904	0.058839	0.045839	0.026216
Δw_{i-1}	0.22322	0.083951	0.20262	0.152818	0.029487	0.041394
Δw_{i-2}	0.245668	0.07847	-0.064406	0.367751	0.128184	0.088711
Δk_{i0}	-0.278466	0.107794	-1.09129	0.538459	-0.272759	0.383932
Δk_{i-1}	-0.066827	0.140165	0.752939	0.671735	0.281548	0.422338
Δk_{i-2}	-0.071202	0.093804	0.089246	0.453623	-0.012408	0.428316
Δq_{i0}	0.316094	0.039921	0.228842	0.195291	-0.078742	0.308746
Δq_{i-1}	0.095843	0.057389	-0.108487	0.244355	-0.467105	0.293806
Δq_{i-2}	0.069366	0.06465	0.036772	0.311169	-0.454049	0.306884
Δm_{i0}	0.01713	0.01316	0.107324	0.063052	0.790361	0.345044
Δm_{i-1}	0.035	8.48E-03	0.031525	0.03785	0.76551	0.344492
Δm_{i-2}	0.022685	7.00E-03	0.019846	0.033394	0.762476	0.344949
Δp_{i0}	-0.970811	0.04342	-0.808638	0.208196	-0.760475	0.422658
Δp_{i-1}	-0.289008	0.122094	0.064855	0.284684	0.257969	0.39515
Δp_{i-2}	-0.336167	0.121955	-0.019193	0.582679	0.078868	0.438713
$\sum_{t=0}^{t=-2} \Delta w_{it} w_{it}$					0.053148	1.63E-03
$\sum_{t=0}^{t=-2} \Delta k_{it} w_{it}$					-0.010909	0.032287
$\sum_{t=0}^{t=-2} \Delta q_{it} w_{it}$					0.035832	0.024033
$\sum_{t=0}^{t=-2} \Delta p_{it} w_{it}$					-0.019799	0.033262
$\sum_{t=0}^{t=-2} \Delta m_{it} w_{it}$					-0.062888	0.028606
$\overline{\Re}^2$	.99		.81		.99	
$\overline{\Delta u}_{i-1}$ [b]			.99		−1.03	
$\overline{\Delta u}_{i-2}$ [b]			−.61		.65	

[a]: Variables are as defined in the text (equation (4)).
[b]: t-ratios for the lagged residuals in the Lagrange multiplier autocorrelation - test regressions.