Labour-Market Effects of Intra-Industry Trade: Evidence for the United Kingdom

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Abstract

According to the "smooth adjustment hypothesis", the labour-market adjustment costs entailed by trade liberalisation are lower if trade expansion is intra-industry rather than inter-industry in nature. In this paper, we study the link between trade and labour market changes in UK manufacturing industries during the 1980s. We use industry-level measures of unemployment duration and wage variability as proxies for adjustment costs, and we relate them to various measures of intra-industry trade. Our evidence offers some support for the smooth adjustment hypothesis.

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I. Introduction

The ongoing reduction of trade barriers in the global economy has resulted in a burgeoning literature that examines the welfare effects of product market integration. One strand of this literature has attempted to quantify transitional adjustment costs that result from trade-induced changes in specialisation. It is often suggested that the severity of the adjustment costs experienced by a country or industry depends on the type of change in trade patterns. The claim is that distinguishing between the degree of *intra*-industry trade (IIT) and *inter*-industry trade permits inferences on the magnitude of factor-market adjustment costs.

In recent decades, IIT has been a pervasive and steadily growing empirical phenomenon, and a range of theoretical models have been developed to explain its existence. These models associate IIT with welfare gains from trade that arise through the exploitation of scale economies, an increase in product variety and the intensification of competitive pressures (see Helpman and Krugman, 1985). In addition to those gains, it is also widely believed that trade-expansion of the intra-industry type entails relatively smooth resource reallocation and hence low transitional adjustment costs, a proposition that has become known as the “smooth adjustment hypothesis” (SAH). This widely invoked hypothesis has until recently been subjected to relatively little theoretical and empirical scrutiny.

Empirical work has concentrated principally on the pattern of change in trade flows, and on the homogeneity of factor requirements within and between industries. Lundberg and Hansson (1986, p. 129) in a study of Swedish trade and factor homogeneity concluded that IIT “poses different and generally less serious problems of adjustment than the ‘traditional’ inter-industry trade and specialisation.” However, in an analysis for the EU, Greenaway and Hine (1991) cautioned that the evidence on the link between IIT and adjustment costs could not be supported with conclusive empirical evidence.

In this paper we estimate directly the relationship between IIT and adjustment indicators. Specifically, we suggest that too little emphasis has been given to what is in effect the manifestation of adjustment pressures, the labour market. The concept of labour market adjustment revolves primarily around job gains and losses and the subsequent need for workers to relocate and/or retrain. Economists often treat unemployment and the issue of under-employed resources as a macroeconomic cyclical problem that should be addressed with macroeconomic policy measures. This assumption is the foundation for the majority of simulation estimates of trade liberalisation effects. However, such a view abstracts from the microeconomic costs faced by individuals when industries grow, shrink, restructure or relocate. These costs are important and well documented in the labour literature (see, e.g., Shin, 1997; Jacobson *et al.*, 1993; Haynes, Upward and Wright, 1999; ~~surveyed by~~ Hamermesh, 1989; and Kletzer, 1998). The difficulty facing empirical research arises from the need to capture and quantify adjustment costs and to characterise the relationship between adjustment and changing trade patterns, with the specific aim of providing support for or against the SAH.

This paper furthers the literature in two main ways. First, we develop and compare three proxy measures of adjustment costs, namely mean durations of unemployment spells, unconditional wage variability and an industry-level measure of conditional wage variability. Second, we separately consider the relevance of different conceptions of IIT, concentrating on measures of vertical IIT and marginal IIT (MIIT). We find that, given a certain level of trade exposure, a higher degree of IIT is associated with relatively lower industry-level wage variability. The strongest estimation results are found when we use measures of MIIT, although unemployment durations do not appear to be significantly affected.

The paper is organised as follows. Section II provides a theoretical background to the SAH. In Section III we develop our proxy measures of adjustment costs and describe the various measures of intra-industry trade. We estimate the relationship between these variables, constructed on data for UK manufacturing industries, in Section IV. Section V concludes.

II. Theoretical Background

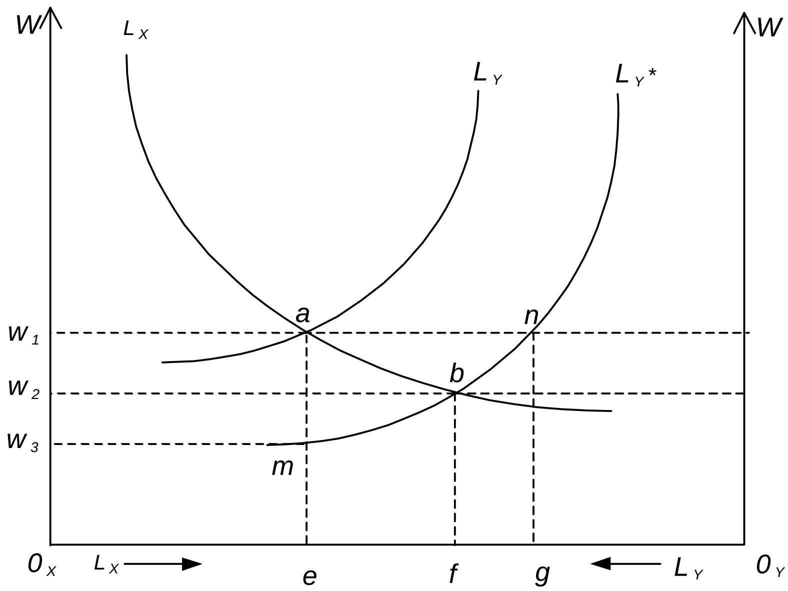
The intuition behind the SAH is straightforward. Consider a small open economy subject to a demand shock induced by the removal of some instrument of trade protection.[1] This alters relative goods prices, which acts as a signal for resources to move from one activity to another. If the shock is an increase in import competition to a particular industry, there will be a decrease in the demand for that industry's production factors. It is assumed that, labour, which we suppose to be the most reactive factor in the short run, will tend to feel the first

[1] Labour mobility and adjustment tends to be treated differently by trade and labour economists. In this paper we outline a simple trade model, as we are primarily interested in a multi-sector approach. Slaughter (1999) summarises the methodological differences between the trade and labour economists in a study of wage inequality.

effects of adjustment pressure. The exact impact depends on the structure of the labour market but will usually be a combination of a change in wages and a change in employment. Under our definition of the SAH this means that if offsetting contemporaneous import and export shocks occur within a sector, adjustment costs will be lower than if those shocks affect separate industries.

This issue can be explored using the Jones-Samuelson specific-factors version of a neoclassical trade model. Assume that a country produces two goods, *X* and *Y*, taking world prices as given. Consider Figure 1, where the production of both goods uses a common factor and a range of factors specific to each good. The law of diminishing returns implies that as more of the variable factor, which we may think of as unskilled labour, is applied to the specific factors its marginal product falls. The curves L_x and L_y illustrate the marginal value product of unskilled labour and therefore the demand for such labour in sectors *X* and *Y*. Point *a* represents the initial competitive equilibrium in the economy. At this point, the aggregate demand for unskilled labour, $0_x e$ from sector *X*, plus $0_y e$ from sector *Y*, is equal to the fixed total supply, $0_x 0_y$. The equilibrium real wage is w_1.

Figure 1 Short-Run Labour Market Disequilibrium in a Specific Factors Model



Imagine a (trade-induced) fall in the relative price good *Y* and take *X* as the numéraire (implying that price changes have no effect on the location of the L_x curve and that the vertical axis measures the wage rate in terms of *X*). A reduction in the price of *Y* leads to an downward shift in that sector's labour demand schedule from L_y to L_y* to give a new equilibrium at *b*. The restoration of labour market equilibrium requires the wage rate to fall in terms of *X*, causing the *X* sector to expand its output and employment and sector *Y* to contract. The central issue concerns the dynamics of a move between equilibria *a* and *b*. Two extreme scenarios can be envisaged.

In the first case, we assume that unskilled labour can move costlessly between *X* and *Y* even in the short run, but that the wage rate is sticky downwards (due to the existence of some sort of institutional constraint). Following a fall in the relative price of *Y*, entrepreneurs in that sector will be unable to lower the real wage. This results in the *Y* sector laying off workers given by the interval *eg* who become unemployed. Over time, the real wage rate will be bargained down to re-establish a full-employment equilibrium at *b*. Under such a configuration, adjustment costs take the form of temporary unemployment. It has been shown that such adjustment costs might outweigh the gains from trade, hence trade liberalisation might be Pareto inferior.[2] The cost-benefit balance depends on the magnitude of adjustment costs (and the time frame over which they persist) and trade gains as well as on the social discount rate.

The second possibility is that wages are perfectly flexible and ensure full employment at all times; but the transfer of low-skill labour between *X* and *Y* costs real resources in the form of matching costs and/or "adjustment services" such as retraining and geographical relocation costs. Due to these costs, the market for unskilled labour can become segmented in the short term, and thus wages may differ temporarily between the *X* and the *Y* sector. In terms of Figure 1, this scenario would result in a short-run shift of the market equilibrium to point *m*. The *Y* wage falls from w_1 to w_3 to maintain full employment at $0_y e$ and the wage of *X* workers will remain at w_1. Over time workers in the *Y* sector will be tempted to retrain and move to the high-wage *X* sector. Wage levels will gradually converge towards the long-run equilibrium level w_2. Temporary factor-price disparities are thus needed to induce resource use on the adaptation of factors to changed production requirements. This is why intersectoral wage differentials can be taken as an indicator for labour specificity. Adjustment costs of this nature never result in net aggregate discounted welfare losses, i.e. they do not fully offset the gains from trade and their impact is purely distributional.[3] In theory, lump-sum transfers can be

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[2] see Baldwin *et al*. (1980, p. 408ff.). Brecher and Choudhri (1994) have formalised this proposition in an efficiency-wage model, and Takacs and Winters (1992) have used it for an empirical assessment of British trade policy in the footwear industry.
[3] see Baldwin *et al*. (1980, p. 408) and Davidson and Matusz (2001).

designed so as to compensate all individuals for transitional income losses.[4] In practice, however, transitional wage and income disparities often go uncompensated, thus producing net losers and potentially feeding protectionist pressures.

The specific-factors model, therefore, suggests two sources of adjustment costs (or adjustment *resistance*), factor specificity and factor-price rigidity. Their respective empirical manifestations are factor-price disparities and unemployment. In reality, one is of course likely to find the two phenomena appearing jointly.

Strictly speaking, the specific-factors model represents inter-industry trade. If we accept a definition of an "industry" that allows some heterogeneity in the production functions of constituent goods, however, then we could reinterpret the model in the sense that X and Y denote two single-product firms that use some firm-specific factors as well as mobile (unskilled) labour. The SAH is about the relative adjustment paths in the scenario where X and Y represent goods from distinct industries (inter-industry adjustment) and in the scenario where X and Y represent goods that pertain to the same industry (intra-industry adjustment). According to the SAH, adjustment costs in the form of unemployed resources and of adjustment services will be lower in the latter scenario. This is what we attempt to evaluate empirically.

III. Measuring Adjustment Costs and Intra-Industry Trade

For an empirical test of the SAH, we require appropriate measures of adjustment costs and IIT. We construct three adjustment proxies that are derived from the theoretical analysis in Section II: unemployment duration and two wage variables, unconditional and conditional wage variability. This complements previous work in which labour market adjustment is modelled on the basis of net sectoral employment changes (Brülhart and Hine, 1999) and of job turnover rates (Andersson, Gustafsson and Lundberg, 2000; Brülhart, 2000). For IIT we have a choice from a range of measures that have been suggested in the literature.

III.1 *Adjustment Costs*

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[4] see Feenstra and Lewis (1994, p. 202). Dixit and Norman (1986) have proposed an incentive-compatible taxation scheme that ensures Pareto gains.

In a regime with inertia in relative wages, adjustment to demand shocks that are asymmetric across sectors will occur via temporary unemployment. Traditionally, studies such as Bale (1976), Mutti (1978) and Baldwin, Mutti and Richardson (1980) have thus defined adjustment costs as the period of unemployment suffered by displaced workers.

In this paper, we employ data on unemployment duration to assess the validity of the SAH. Based on the British Labour Force Survey, we have sectoral data on **average unemployment duration** (*DURATION*) for 1984, 1988 and 1991 at the four-digit level of the UK SIC(80) classification (149 industries), which we aggregate to the three-digit level (73 industries) for comparability with the other variables. Individuals are attributed to the industry in which they were employed prior to their unemployment spell. The durations reported are uncompleted durations, i.e. average duration of those still unemployed. Appendix Table 1 reports those durations, averaged over three sample years.[5] When looking at the annual data (not reported), we find that the average duration of unemployment fell significantly over the 1980s. However, positive and significant rank correlation coefficients across years, suggests that cross-industry differences tend to persist.[6]

In the specific-factors model, adjustment costs can also arise without unemployment, if workers are imperfectly mobile but wages are flexible. In that case adjustment will be reflected by temporary wage disparities. It is thus important to consider both unemployment, which is a direct source of welfare losses, and factor-price variability, which is an indirect indicator of costs through the required use of “adjustment services”.

We use two measures of wage variability. First, we simply compute the **standard deviation of industry-level real wage rates** (*WAGEVAR*) across the 12 years contained in our sample period 1979-1991 at the three-digit sectoral level. This yields a measure of the gross intertemporal variability of industry-level wages. This measure is included, in part, as a benchmark for our more important measures ~~and is not the focus of this paper~~.[7]

The second measure is more sophisticated and draws on Campbell (1989). Here we define **conditional wage variability** (*CWAGEVAR*) as the responsiveness of sectoral nominal

[5] See Haynes, Upward and Wright (2000) for a discussion of non-employment duration censoring. Ideally we would have used LFS data for 1979, 1991 and a selection of mid 1980s data, but due to the quality of the early LFS data, 1984 was the earliest year for which the data were of sufficient quality to be usable.
[6] As expected, heavy industries such as mining and steel making tend to have the largest durations while technology and food manufactures tend to be lower on average. Causes of persistent differences might include skill specificity and geographical clustering.
[7] We acknowledge that ideally we should be measuring *WAGEVAR* across comparable workers. However, we make the simplifying assumption that the occupational mix in each industry is similar. Detrending the data made little difference to the findings, but these results are available from the authors upon request.

wages to changes in the aggregate unemployment rate and to sectoral demand shocks. We use this conditional measure as an alternative representation of the temporary wage dispersion that accompanies asymmetric demand shocks in the model described in Section II when labour reallocation requires “adjustment services”. *CWAGEVAR* is not an indicator of the incidence of adjustment costs, but of the intensity of wage responses to given demand shocks, and hence of the degree of sector-level factor specificity: the greater the costs of moving labour from one sector to another, the larger will be the temporary variation of relative sectoral wages to a given sectoral demand shock.

The first step in the construction of *CWAGEVAR* is to estimate disaggregated Phillips curves at the three-digit level of the UK SIC(80) classification. The dependent variable of the Phillips-curve equation is the change in the log of nominal hourly wages ($\dot{w}_i$) for each industry. The independent variables are a constant, the current and lagged values of the change in the log of the sectoral price level ($\dot{p}_i$) measured with the producer price index, the current and lagged values of a measure of the aggregate unemployment rate (u), and the current and lagged values of a measure of sector demand changes ($\dot{d}_i$) defined as first-differenced log gross value added at factor cost. Thus, we have the following wage equation:

$$\dot{w}_{it} = c_i + \sum_{j=0}^{n} \alpha_{ij} \dot{p}_{i,t-j} + \sum_{j=0}^{n} \beta_{ij} u_{t-j} + \sum_{j=0}^{n} \gamma_{ij} \dot{d}_{i,t-j} + \varepsilon_{it} \tag{1}$$

A rise in prices should lead to an equiproportionate rise in nominal wages with no long-run money illusion and n-period adaptive expectations. Furthermore, theory predicts a negative coefficient on unemployment and a positive coefficient on industry-level demand changes. We estimated equation (1) for each of the 73 three-digit industries i on annual data for 1979-1991. The number of lags n is essentially arbitrary. Campbell (1989) has found that seven quarterly lags were sufficient to measure the relevant dynamic effects, hence we opted for two annual lags.[8]

In a second step, we can calculate *CWAGEVAR*:

$$WAGEFLEX = \left(\sum \gamma_{ij}\right)\left(std.\,of\ \dot{D}\right) - \left(\sum \beta_{ij}\right)\left(std.\,of\ u\right) \tag{2}$$

where $\dot{D}$ represents demand changes for manufacturing as a whole. The *CWAGEVAR* variable is calculated as follows. First, the sum of the coefficients on the unemployment rate

[8] We have undertaken extensive tests for alternative specifications with respect to the number of lags on the regressors and found that the results are qualitatively unaffected by the inclusion of additional lag terms.

(current and lagged) is multiplied by the standard deviation of the unemployment rate. Then, the sum of the coefficients on the demand variable (current and lagged) is multiplied by the standard deviation of the demand variable for all industries, so as to ensure the same shock is applied to all industries. Finally, the first value is subtracted from the second, since positive demand shocks and negative unemployment shocks both tend to exert upward pressure on wages. Hence, *CWAGEVAR* should be positive. Reassuringly, 65 of our 73 three-digit estimates of *CWAGEVAR* have a positive sign (Appendix Table 1).

III.2 *Intra-Industry Trade*

For an empirical assessment of the SAH we must make the distinction between inter- and intra-industry trade and develop a measure that captures the relevant aspects of trade dynamics.

The most widely employed measure of IIT is the **Grubel-Lloyd index** (*GL*), where the share of IIT in industry *i* for a given country is:

$$GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \tag{3}$$

where X_i and M_i are the exports and imports of industry *i* during a particular time period, usually one year. The index can take any value between 0 and 1 where the upper bound represents all trade being intra-industry in nature.[9]

One recent development has concentrated on how IIT can be disentangled into its **vertical and horizontal** components (Abd-el-Rahman, 1991, and Greenaway *et al*., 1994a, 1995). The motivation for making this distinction in the context of the SAH is that factors might be relatively less mobile within vertically differentiated industries than in horizontally differentiated ones. This is because the labour skill requirements are more likely to be greater between vertically rather then horizontally differentiated sectors hence more retraining would be required and adjustment costs would be greater. Horizontal product differentiation is defined as the simultaneous export and import of goods whose unit values are within a specified range, commonly defined as ±15 percent.[10] Following the logic of the SAH we would expect vertical IIT to imply more severe adjustment implications than horizontal IIT.

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[9] The properties of this index are discussed extensively in Greenaway and Milner (1986).

[10] The width of the wedge that is used to define horizontal IIT has been the subject of some controversy. However, Greenaway *et al*. (1994) undertook an extensive sensitivity analysis and found that the main results were not sensitive to the choice of interval bounds. Specifically, a widening of the wedge tends to increase the

We define horizontal and vertical IIT for three-digit SIC industries *i*, based on data for four-digit SIC industries *l*.[11] Each four-digit sector is attributed to the horizontal or vertical class of IIT depending on the relative values of import and export unit values. A four-digit sector is defined as horizontally differentiated if:

$$1-\alpha \leq \frac{UV_{lik}^{X}}{UV_{lik}^{M}} \leq 1+\alpha , \tag{4}$$

where *k* stands for a particular trading partner and α is set to 0.15.

Thus, IIT is measured as

$$IIT_{ik}^{p} = \frac{\sum_{l}\left(X_{lik}^{p} + M_{lik}^{p}\right) - \sum_{l}\left|X_{lik}^{p} - M_{lik}^{p}\right|}{\sum_{l}\left(X_{lik} + M_{lik}\right)} , \tag{5}$$

where *p* denotes horizontally (H) or vertically (V) differentiated four-digit products. This index can be aggregated across trade partners. Vertical and horizontal IIT add up to total IIT as measured by the GL index: $GL_i = IIT_i^H + IIT_i^V$.

It has been argued that the conventional indices of IIT are static in nature, because they relate to trade flows in one year only, whilst adjustment is a dynamic phenomenon that might span a longer time period (Hamilton and Kniest, 1991). To address this issue, measures of **marginal IIT** (MIIT) have been developed to describe the dynamics of trade patterns. We use the measure proposed in Brülhart (1994), which is a transposition of the GL formula to first-differenced trade flows:

$$MIIT_i = 1 - \frac{\left|\Delta X_i - \Delta M_i\right|}{\left|\Delta X_i\right| + \left|\Delta M_i\right|} , \tag{6}$$

where Δ is the difference operator. This index, like the GL index, is always defined and varies between 0 and 1, where 0 indicates marginal trade in the particular industry to be completely of the inter-industry type, and 1 represents marginal trade to be entirely of the intra-industry type.[12] The intuition underlying MIIT is that parallel increases or decreases of imports and exports in an industry will have a neutral effect on employment. For example, if exports

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average share of horizontal IIT, but it was found to have only a weak effect on relative shares across industries and over time.

[11] We reclassified 5-digit SITC trade data to 4-digit SIC80 categories using a concordance constructed by the authors. Unit values at the 4-digit SIC level require a degree of factor homogeneity within industries to make economic sense. Elliott *et al.* (2000) show that to a large extent that the UK SIC satisfies this requirement.

[12] The properties of MIIT index differ in some subtle ways from those of the GL index. For discussion, see Oliveras and Terra (1997).

contract, jobs may be threatened but if imports contract by the same amount, domestic sales may expand so as to offset lost market share in export markets.[13]

We also use an **unscaled measure** of the change in IIT between two time periods, which has been suggested by Greenaway *et. al*. (1994b):

$$\Delta IIT_i = \Delta[(X_i + M_i) - |X_i - M_i|]. \tag{7}$$

This measure may be useful, since it does not express IIT as a share and thus it varies with the size of an industry's trade exposure as well as with the amount of IIT. Note that although this measure compares trade patterns of two years it is not a measure of MIIT in the strict sense. While the MIIT relates to the share of IIT in trade changes, ΔIIT measures the change in IIT, which is a conceptually different dimension.

IV. Empirical Results

We computed all the measures described in Section III on SIC(80) three-digit data for the UK, yielding a cross-section dataset with 73 observations. *WAGEVAR* and *CWAGEVAR* are estimated on the basis of annual data, and the trade variables relate to data for 1979 and 1991. *GL*, IIT^H and IIT^V and *TRADE* are averaged over those two years, where *TRADE* is a measure of trade intensity calculated as a share of imports plus exports in sectoral gross value added. Wage data are based on the UK New Earnings Survey, and trade data are from the OECD, concorded to the SIC classification from the five-digit SITC. Duration data are averaged over 1984, 1988 and 1991, and taken from the UK Labour Force Survey.

This time period and its length were chosen for a number of reasons. First, 1979-1991 covers a period of significant structural change in the UK economy from the large manufacturing sector decline of the early 1980s to the Lawson boom of the latter half of the decade. By taking a time-averaged cross section we hope to smooth out the effects across the business cycle. Second, a number of our adjustment and IIT measures require a reasonable length of time to be confidently measured (for example *CWAGEVAR* and MIIT).

A useful first impression of the relations among our variables can be gleaned from a correlation matrix (Table 1). Three observations stand out. First, our three adjustment proxies

[13] This assumes that industry productivity and world market size remain unchanged. Lovely and Nelson (2000) show that MIIT can be associated with inter-industry factor reallocation if productivity is also allowed to change.

are uncorrelated. Those measures thus capture empirically different aspects of the complex process of labour-market adjustment. Second, whilst most of the six IIT measures are significantly correlated, those correlations are far from perfect. The correlations seem to support the usefulness of the GL index, since this measure is significantly correlated with all other IIT measures. Note, however, that the first-differenced GL index is completely uncorrelated with the MIIT coefficient, which underscores the importance of differentiating empirically as well as conceptually between, on the one hand, changes in IIT (ΔGL) and, on the other hand, IIT in trade changes (*MIIT*). The third noteworthy feature of Table 1 is that the correlations between the adjustment variables and the IIT variables are negative in the majority of cases. This is consistent with the SAH. Yet, except for two cases these correlations are not statistically significant. Hence, bivariate analysis does not allow us to make strong inferences on the link between adjustment and IIT.

In exploring our data beyond bivariate analysis, we face the problem that theory does not equip us with a set of firm priors on what control variables to include in a fully specified model of labour-market adjustment. While labour economists have studied the determinants of individual unemployment spells and unemployment turnover rates extensively (see, e.g., Hildreth and Pudney, 1998), we cannot draw on an established empirical model of what determines average unemployment durations at the industry level. The determinants of industry-level wage variability, is likewise underresearched. Since our aim is not to develop a fully specified model of the determinants of labour-marked adjustment costs, we concentrate on those variables that feature explicitly in the SAH and report test statistics on the null hypothesis that the errors are orthogonal to the regressors. Our regression structure is, therefore, kept deliberately simple and is open to potential omitted variable bias if factors affecting the ease of adjustment are correlated with the included explanatory variables.[14] To address this issue specifically, we compute the RESET test, which estimates the joint significance of the estimated coefficients on the second, third and fourth powers of the OLS predicted values, when those generated regressors are added in an auxiliary regression to the set of regressors of the original model. Failure to reject the statistical significance of those additional regressors would indicate that some variables were omitted that are correlated with the original set of included regressors (or their powers), and hence that OLS coefficient

[14] The inclusion of additional variables such as occupation, qualifications and skills would provide a more comprehensive model. However, ~~this detracts from the simple aims of this paper and~~ in the context of our study this was not possible, due to the limitations of the early annual LFS data. There remains obvious potential for future research.

estimates are biased (Thursby and Schmitt, 1977). Since the RESET test is a general misspecification test, and it for example also performs well as an indicator of incorrect functional form, its use seems particularly appropriate to our context, where the aim is to test the null of the chosen model against an unspecified alternative.

We proceeded by regressing each of the three adjustment proxies on a constant, a measure of trade intensity (*TRADE*) and each of our six IIT measures in turn. The estimated coefficients of this additive model are reported in Table 2. Misspecification bias does not seem pervasive, since the RESET test statistic is significant in only three of the 18 regressions. We find the expected negative parameter estimates on the IIT variables in 13 out of the 18 runs, but only two of them are statistically significant. The only IIT variable for which we consistently find a negative (but not statistically significant) coefficient is the MIIT index.[15]

We need not be surprised by the weakness of the results on the IIT variables reported in Table 2, since the additive model is unlikely to be the most appropriate representation of the SAH. The importance of the structure of trade flows for labour-market adjustment will vary across industries according to the importance of international trade to each sector. The more open an industry, the more we would expect IIT to matter. We have therefore augmented our specification with an interaction term between *TRADE* and the IIT variables. The estimation results of this interaction model are reported in Table 3.

As expected, we find that the addition of an interaction term improves our estimates. This is particularly true for the two adjustment proxies based on wage variability. In those cases, the interaction term always produces the expected negative coefficient, and statistical significance is found in nine of the 12 runs. The RESET test rejects the hypothesis of misspecification bias in 11 of the 12 runs. The negative estimated interaction coefficients suggest that the more an industry is open to trade, the more strongly a higher share of (M)IIT is associated with lower wage variability. Specifically, we interpret the negative coefficients on the interaction variables in the regressions of *WAGEVAR* as an indication that (M)IIT requires fewer inter-sectoral moves of imperfectly mobile factors than inter-industry trade. The interpretation of the negative coefficients on the interaction term in the regressions of *CWAGEVAR* is subtly different. These results suggest that, the stronger a sector's trade

[15] Where we do find consistent significance is on the trade-exposure variable when *DURATION* is the regressand. This would suggest that workers from industries that are relatively open to trade suffer relatively shorter unemployment spells.

exposure, the more negative is the association of (M)IIT and conditional wage variability. In other words, high-(M)IIT sectors also seem to be ones that require smaller wage changes to adjust to a given shock.

If we use *DURATION* as the measure for adjustment, however, our model is less successful. The interaction of IIT with *TRADE* is never statistically significant, and misspecification problems are indicated in three of the six regressions. It appears that the degree of IIT is most strongly related to *CWAGEVAR*. Hence, our results confirm the SAH in the sense that IIT entails relatively small need for "adjustment services", and physical adjustment costs appear to be a more prominent feature of trade-related structural adjustment in the UK than temporary unemployment due wage rigidities.

The generally significant *TRADE* variable in Tables 2 and 3 for the *DURATION* and *CWAGEVAR* regressions suggests that, as expected, the more open an industry to foreign competition, the more variable its wages but also the lower its average unemployment duration. The latter result is consistent with the view that international competition increases job creation, decreases job destruction and/or weakens the power of domestic unions.[16]

Among the different measures of IIT, we find that the distinction between vertical and horizontal IIT does not seem to impact on results in the way that might have been anticipated. Our results suggest that vertical IIT is more strongly negatively related to adjustment costs than horizontal IIT, which runs against established priors. Of all the IIT measures, only the MIIT index has the expected sign across all specifications. In terms of R^2 the interaction model with *CWAGEVAR* as the adjustment measure and the MIIT index as the IIT measure has the greatest explanatory power. These results lend support to the SAH in the sense of the MIIT literature.

V. Conclusions

This paper employs a number of measures of adjustment costs and of IIT to assess the "smooth adjustment hypothesis" in a dataset for UK manufacturing in the 1980s. We introduce three alternative adjustment indicators: average unemployment duration, gross variability of industry-level wages and conditional variability of industry-level wages. The results offer support for the smooth adjustment hypothesis. In particular we find evidence that, given a certain level of trade exposure, a higher degree of IIT is associated with relatively lower industry-level wage variability. This suggests that IIT tends to entail comparatively smooth adjustment in terms of the costs associated with moving and retraining displaced workers. However, average unemployment durations do not appear to be significantly affected by IIT. This result may indicate that transitional costs of adjustment to structural change in UK manufacturing are due less to inflexibility of wages than to occupational and/or geographical specificity of labour. In other words, the SAH seems to be valid primarily because the heterogeneity of labour inputs is greater between than within industries (hence the greater wage variability of sectors with high inter-industry trade), and not because wages are more flexible within than between sectors (as unemployment durations seem unaffected by the intra- or inter-industry nature of trade changes). Finally, we find that on the whole the strongest support for the SAH is found if IIT is measured with an index of marginal IIT.

[16] Davidson and Matusz (2001) show formally that increased trade exposure can raise the rate of job turnover.

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TABLE 1: Raw Correlations Among Variables
(73 observations)

	DURATION	*WAGEVAR*	*CWAGEVAR*	*TRADE*	*GL*	*DGL*	*VIIT*	*HIIT*	*MIIT*	*ΔIIT*
DURATION	1.00									
WAGEVAR	-0.08	1.00								
CWAGEVAR	-0.15	-0.01	1.00							
TRADE	-0.24**	0.14	0.25**	1.00						
GL	-0.12	0.06	-0.11	-0.08	1.00					
ΔGL	0.06	-0.23**	0.13	0.13	-0.22*	1.00				
VIIT	-0.12	0.11	-0.12	-0.16	0.89***	-0.15	1.00			
HIIT	-0.02	-0.08	-0.01	0.12	0.56***	-0.20*	0.12	1.00		
MIIT	-0.17	-0.02	-0.03	-0.01	0.40***	-0.004	0.37***	0.21*	1.00	
ΔIIT	-0.16	0.22*	-0.12	0.34***	0.42***	0.03	0.29**	0.38***	0.39***	1.00

$^{***}/^{**}/^{*}$ denotes statistical significance at the 99/95/90 percent level.

TABLE 2: Adjustment and Trade Exposure: Additive Model

(OLS with heteroskedasticity-consistent standard errors, 73 obs.)

	CONST	***TRADE***	**IIT**	***R2***	***RESET*** *(P values)*
dep. var. = *DURATION*					
IIT = *GL*	10.94^{***}	-0.49^{***}	-3.65	*0.08*	*0.70*
IIT = Δ*GL*	10.18^{***}	-0.45^{***}	-1.15	*0.06*	*0.21*
IIT = IIT^V	10.97^{***}	-0.52^{***}	-4.98	*0.08*	*0.94*
IIT = IIT^H	10.17^{***}	-0.46^{***}	0.22	*0.06*	*0.04*
IIT = *MIIT*	10.64^{***}	-0.46^{***}	-0.99	*0.08*	*0.75*
IIT = Δ*IIT*	10.22^{***}	-0.40^{**}	-0.001	*0.06*	*0.00*
dep. var. = *WAGEVAR*					
IIT = *GL*	0.43^{***}	0.02	0.16	*0.02*	*0.70*
IIT = Δ*GL*	0.47^{***}	0.03^{*}	-0.81^{**}	*0.08*	*0.24*
IIT = IIT^V	0.41^{***}	0.03	0.37	*0.04*	*0.24*
IIT = IIT^H	0.49^{***}	0.03	-0.47	*0.03*	*0.75*
IIT = *MIIT*	0.47^{***}	0.02	-0.01	*0.02*	*0.65*
IIT = Δ*IIT*	0.46^{***}	0.01	0.0002	*0.05*	*0.42*
dep. var. = *CWAGEVAR*					
IIT = *GL*	0.21^{***}	0.03^{*}	-0.16	*0.07*	*0.09*
IIT = Δ*GL*	0.18^{***}	0.03	0.27	*0.07*	*0.13*
IIT = IIT^V	0.21^{***}	0.03^{*}	-0.17	*0.07*	*0.46*
IIT = IIT^H	0.19^{***}	0.03^{*}	-0.17	*0.06*	*0.67*
IIT = *MIIT*	0.19^{***}	0.03^{*}	-0.01	*0.06*	*0.68*
IIT = Δ*IIT*	0.19^{***}	0.05^{***}	-0.0002^{**}	*0.11*	*0.94*

$^{***}/^{**}/^{*}$ denotes statistical significance at the 99/95/90 percent level.

TABLE 3: Adjustment and Trade Exposure: Interaction Model

(OLS with heteroskedasticity-consistent standard errors, 73 obs.)

	CONST	***TRADE***	***IIT***	***TRADE*IIT***	***R2***	***RESET*** *(P values)*
dep. var. = *DURATION*						
IIT = *GL*	11.10^{***}	-0.61^{**}	-4.49	0.64	*0.08*	*0.64*
IIT = Δ*GL*	10.07^{***}	-0.28	1.71	-4.11	*0.07*	*0.04*
IIT = IIT^{V}	10.93^{***}	-0.48^{**}	-4.73	-0.25	*0.08*	*0.90*
IIT = IIT^{H}	10.37^{***}	-0.62^{**}	-3.58	2.70	*0.06*	*0.03*
IIT = *MIIT*	10.60^{***}	-0.43^{*}	-0.92	-0.06	*0.08*	*0.46*
IIT = Δ*IIT*	10.28^{***}	-0.47^{**}	-0.002	0.0003	*0.06*	*0.00*
dep. var. = *WAGEVAR*						
IIT = *GL*	0.36^{***}	0.08^{***}	0.53	-0.29^{***}	*0.07*	*0.27*
IIT = Δ*GL*	0.46^{***}	0.04	-0.66	-0.20	*0.09*	*0.42*
IIT = IIT^{V}	0.34^{***}	0.08^{***}	0.82^{**}	-0.44^{***}	*0.09*	*0.10*
IIT = IIT^{H}	0.46^{***}	0.04^{*}	-0.01	-0.32	*0.09*	*0.62*
IIT = *MIIT*	0.44^{***}	0.05^{*}	0.05	-0.05^{*}	*0.03*	*0.78*
IIT = Δ*IIT*	0.43^{***}	0.04	0.0004^{**}	-0.0001^{**}	*0.09*	*0.44*
dep. var. = *CWAGEVAR*						
IIT = *GL*	0.14^{**}	0.09^{***}	0.23	-0.30^{***}	*0.14*	*0.06*
IIT = Δ*GL*	0.17^{***}	0.03^{**}	0.43	-0.24	*0.08*	*0.29*
IIT = IIT^{V}	0.15^{**}	0.08^{***}	0.23	-0.40^{***}	*0.13*	*0.15*
IIT = IIT^{H}	0.13^{***}	0.08^{***}	0.99^{*}	-0.83^{***}	*0.14*	*0.81*
IIT = *MIIT*	0.13^{***}	0.08^{***}	0.09	-0.09^{***}	*0.15*	*0.36*
IIT = Δ*IIT*	0.17^{***}	0.07^{***}	-0.00004	-0.0001^{**}	*0.14*	*0.72*

$^{***}/^{**}/^{*}$ denotes statistical significance at the 99/95/90 percent level.

APPENDIX TABLE 1: Adjustment Variables

SIC	Description	*DURATION (months)*	*WAGEVAR*	*CWAGEVAR*
222	steel tubes	13.32	0.46	0.38
223	drawing, cold rolling & cold forming of steel	6.75	0.48	0.14
224	non-ferrous metals industry	12.09	0.51	0.41
231	extraction of stone, clay, sand & gravel	11.47	0.42	0.25
241	structural clay products	13.28	0.47	-0.28
242	cement, lime & plaster	12.65	0.89	-0.10
243	building products of concrete, cement or plaster	8.42	0.56	0.15
244	asbestos goods	13.01	0.36	0.01
245	working of stone & other non-metallic minerals n.e.c.	8.63	0.50	0.28
246	abrasive products	12.83	0.39	0.24
247	glass & glassware	10.63	0.39	0.20
248	refractory & ceramic goods	9.92	0.36	0.18
255	paints, varnishes & printing ink	9.68	0.66	0.27
256	specialised chemical products mainly for industrial & agricultural purposes	11.85	0.73	0.28
257	pharmaceutical products	11.35	0.95	0.26
258	soap & toilet preparations	8.12	0.54	0.36
259	specialised chemical products mainly for household & office use	9.92	0.62	0.12
311	foundries	13.02	0.45	-0.03
312	forging, pressing & stamping	12.13	0.39	0.15
313	misc. metal products	10.61	0.42	0.38
316	hand tools & finished metal goods	8.31	0.47	0.24
320	industrial plant & steelwork	8.84	0.53	0.24
321	agricultural machinery & tractors	7.53	0.47	0.33
322	metal-working machine tools & engineer's tools	10.53	0.48	0.02
323	textile machinery	5.61	0.52	0.01
324	machinery for the food, chemical & related industries; process engineering contractors	6.88	0.64	0.14
325	mining machinery, construction & mechanical handling equipment	10.89	0.59	0.21
326	mechanical power transmission equipment	9.92	0.51	0.10
327	machinery for the printing, paper, wood, leather, rubber, glass & related industries; laundry & dry cleaning equipment	9.40	0.70	0.37
330	manufacture of office machinery & data processing equipment	7.68	0.72	-0.06
341	insulated wires & cables	9.25	0.24	0.44
342	basic electrical equipment	10.27	0.42	0.21
343	electrical equipment for industrial use & batteries & accumulators	9.77	0.53	0.25
344	telecommunication equipment, electrical measuring equipment, electronic capital goods & passive electronic components	8.92	0.65	0.26
346	domestic-type electric appliances	9.74	0.32	0.34
347	electric lamps & other electric lighting equipment	11.00	0.44	0.10
352	motor vehicle bodies, trailers & caravans	6.70	0.47	0.13

353	motor vehicle parts	10.56	0.42	0.12
371	measuring, checking & precision instruments & apparatus	5.13	0.58	-0.05
372	medical & surgical equipment & orthopaedic appliances	11.80	0.47	0.38
373	optical precision instruments & photographic equipment	6.83	0.51	0.22
411	organic oils & fats (other than crude animal fats)	7.81	1.25	0.55
412	slaughtering of animals & production of meat & by-products	8.15	0.28	0.32
413	preparation of milk & milk products	9.68	0.43	0.31
414	processing of fruit & vegetables	5.63	0.36	0.27
415	fish processing	10.12	0.22	0.10
416	grain milling	7.77	0.58	0.30
419	bread, biscuits & flour confectionery	8.56	0.43	0.26
421	ice cream, cocoa, chocolate & sugar confectionery	8.97	0.57	-0.03
422	animal feeding stuffs	9.57	0.77	0.21
424	spirit distilling & compounding	9.26	0.68	0.22
426	wines, cider & perry	8.10	0.81	0.53
427	brewing & malting	10.42	0.37	0.29
428	soft drinks	11.66	0.68	-0.01
431	woollen & worsted industry	12.92	0.34	0.29
432	cotton & silk industries	13.21	0.36	0.15
434	spinning & weaving of flax, hemp & ramie	11.53	0.26	0.23
435	jute & polypropylene yarns & fabrics	14.16	0.51	0.05
436	hosiery & other knitted goods	7.62	0.25	0.23
438	carpets & other textile floor coverings	9.81	0.53	-0.02
451	footwear	8.59	0.15	0.02
455	household textiles & other made-up textiles	10.70	0.26	0.36
461	sawmilling, planing, etc of wood	9.48	0.31	0.27
462	manufacture of semi-finished wood products & further processing & treatment of wood	10.83	0.42	0.36
463	builders’ carpentry & joinery	11.58	0.26	0.22
464	wooden containers	12.15	0.23	0.31
466	articles of cork & plaiting materials, brushes & brooms	8.71	0.38	0.27
467	wooden & upholstered furniture and shop & office fittings	9.67	0.23	0.37
471	pulp, paper & board	10.57	0.53	0.22
472	conversion of paper & board	9.21	0.52	0.23
483	processing of plastics	9.55	0.54	0.22
492	musical instruments	5.30	0.30	0.34
494	toys & sports goods	6.06	0.32	0.34