An investigation of Oliver Williamson's analysis of the division of labour

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In 2009 Oliver Williamson was jointly awarded the Nobel Prize in Economics for his analysis of economic governance. Williamson was central to the emergence of the transaction cost framework as an important aspect of social scientific analysis. Part of this approach makes important efficiency predictions and prescriptions regarding the division of labour within firms in contemporary capitalist economies. This discounts issues of power and privileges 'firm-specific human assets' as the key organisational driver. Indeed, Williamson's approach intentionally conflates the employment relation with exchanges for 'intermediate' goods. This article seeks to investigate Williamson's explanatory claims through a UK-based panel dataset using a dynamic logit modelling approach. The findings question Williamson's central argument. The results, instead, are more consistent with the idea of the industry-specificity of labour and highlight the importance of firm size.

Key words: Division of labour; Employment relation; Williamson's transaction cost economics
JEL classifications: J01, L23, B29

1. Introduction

In 2009 Oliver E. Williamson was jointly awarded the Bank of Sweden's Nobel Memorial Prize for his analysis of organisational governance. His approach was praised for its emphasis on the importance of institutions in economic activity. Williamson (1985, 2000, 2009) is among those arguing that institutions matter because they are vehicles of efficiency (see also, for example, the work of fellow Nobel laureates Ronald Coase and Douglass North). In short, according to Williamson, the efficiency rubric of transaction cost minimisation determines the appropriate institutional framework, or governance structure, for a given exchange or transaction, including the employment relation (Williamson, 1985, p. 241).

Crucially, Williamson's efficient contracting schema is driven by 'asset specificity'; where assets are dedicated to and *in extremis* have no alternative use beyond a specific 'transaction'. Asset specificity generates informational asymmetries and uncertainty, fostering the conditions for adverse selection and moral hazard. Any disruption carries

efficiency consequences; hence the requirement for careful institutional design. In essence, Williamson's transaction cost framework's default position is some form of market arrangement; ranging from simple discrete transactions to co-operative bilateral joint ventures. Hierarchy is seen as an organisational 'last resort' (Williamson, 1993, p. 131).

Williamson considers the employment relation to resemble that of any 'intermediate good' transaction—a central thesis of the transaction cost approach is the ubiquity of the 'theory of contract' (Williamson, 1985, p. 241). Nonetheless, in the context of the division or organisation of labour, Williamson identifies continuity of the relationship between employer and employee as being primarily the outcome of *firm*-specific 'human assets' and subsequently the degree of team production. For Williamson, the conjunction of the two factors generates a matrix from which efficient contracting schema can be drawn.

Williamson's organisation of labour approach demonstrates some complementarities with human capital and personnel economics literatures (see, for example, Gibbons, 2010; Lazear and Shaw, 2007). His approach is worthy of scrutiny because it makes predictions which augment efficiency-based views of the division and organisation of labour in production activities, thereby informing firms' employment relations strategies and management, and makes policy contentions that resonate with the trajectory of de-regulation in recent employment policy in many economies. The transaction cost model is highly influential in informing the strategic approaches of many firms (Cooke *et al.*, 2005) and governments. For instance, Williamson's framework 'demonstrates' the efficiency properties of de-regulated flexible labour markets in situations where work is of a temporary or seasonal nature, and accordingly trade unions have little or no justifiable efficiency role (see also, for example, Spencer, 2009, 2011; Knox, 2010).

Any empirical analysis of this area of the transaction cost approach is beset with complications and significant challenges. Indeed, Williamson (1985, p. 389) grants that the transaction cost framework is not readily amenable to 'conventional' empirical techniques. He considers the framework to be empirically 'crude' and recognises that 'measurement problems are severe' and models are 'primitive' (see also David and Han, 2004; North and Wallis, 1994). Nonetheless, Williamson has claimed on several occasions that transaction cost economics (TCE) 'is an empirical success story' (for example, 1999, p. 1092, and 2000, p. 605). There have been a host of empirical examinations of TCE's governance predictions, with prominent authors, such as Carroll and Teece (1999, p. 3) arguing that TCE is, 'perhaps the single most influential theory in the social sciences'. However, in important survey articles, Carter and Hodgson (2006) and David and Han (2004) convincingly argue that the empirical evidence is not as clear-cut as Williamson (and others) suggest. Much of this literature concentrates on Williamson's central governance claims—the make or buy decision—with little explicit scrutiny of his predictions for the division of labour (for exceptions, see Barton *et al.*, 1999; Battu *et al.*, 2002). This article seeks to contribute to addressing this shortfall in empirical scrutiny, although it is recognised that the analysis is only partial and, due to data limitations and measurability issues, proxy measures are applied, which can never be entirely precise (indeed, this is a feature of the literature, see for example, David and Han, 2004; Carter and Hodgson, 2006). Much of the literature relating to the organisation and division of labour obtains data centred on the firm, or samples of firms (see for example, Baker *et al.*, 1994; Bloom and van Reenen, 2007; Slaughter *et al.*, 2007). By contrast, the approach adopted here utilises a household panel data set—the British Household Panel Survey (BHPS). This

approach, we believe, enhances the scope of the type of organisational arrangements that can be incorporated into the study. Williamson's analysis is cross-sectional, and to the best of our knowledge, this is reflected in the empirical literature. However, although Williamson (2000) readily acknowledges that TCE is static, in the context of the employment relation he recognises a dynamic dimension to the acquisition of 'specific' skills (for example, Williamson, 1985, pp. 242–43 and p. 246). Accordingly, we develop a dynamic model that traces the sensitivity of firm-specific labour skills to 'on-the-job training'. This, we feel, is the first time that Williamson's analysis of the division of labour has been subject to such an examination.[1] Thus, our study is an attempt to augment those firm/industry-based qualitative and quantitative approaches by offering an additional source of evidence.

The next section concisely sets out Williamson's analysis of the division of labour and notes some general criticisms of his approach. Following this, the difficulties in testing Williamson's propositions are detailed, the empirical approach and findings are then presented. Conclusions follow.

2. Dividing and organising labour according to Williamson

The concept of asset specificity within the context of the labour market is clearly not new—arguably dating back at least to Adam Smith's study of the division of labour. Asset specificity may be a particular manifestation of specialisation—in the case of the division of labour, leading to specific skills. The division of labour was, in Smith's view, a significant development in socio-economic progress through its uplift of labour productivity. Following Smith, Karl Marx argued the division of labour was both a source of material benefit and a disciplinary mechanism. As political economy gave way to 'economic science', prompting the demarcation between economics and sociology in the mid- to late twentieth century, the efficiency rationale for the division of labour almost completely crowded out the power argument, certainly in economics. Moreover, the underpinning philosophy changed from a eudaemonic orientation—where well-being is conceived of as an active process of flourishing that crucially involves social interaction—to the hedonic, centred on preference fulfilment (Lopes, 2011). In other words, the notion of 'work' and flourishing gave way to 'labour' and disutility (see also Spencer, 2000, 2009, 2011; Fleetwood, 2011)

Indeed, the standard economic emphasis is evident in Williamson's work. In *Economic Institutions of Capitalism* (1985) he privileges the efficiency argument by devoting a chapter to critiquing what he calls the 'radical economic' (1985, p. 207) arguments of, for example, Stephen Marglin. Williamson assumes the social embeddedness, or institutional environment and hence the eudaemonic, of the employment relation is of limited importance. He treats it as a 'set of shift parameters' presumed to be constant and subservient to transaction cost economising (Williamson, 1993, 2000, 2009).

2.1 Williamson's three pillars

Williamson employs two major behavioural assumptions: bounded rationality and opportunism. The former is drawn from Herbert Simon's (1997 [1947]) *Administrative Behavior* and is taken to mean that agents are intendedly rational, but limitedly so

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[1] We are extremely grateful to an anonymous referee who effectively prompted us to further interrogate the dynamic properties of Williamson's analysis of the division of labour.

(Williamson, 1985, p. 45). In other words, agents are cognitively limited and therefore not always capable of making optimal decisions. Simon's original usage related to knowledge limitations in their various dimensions, so that, for example, even if an individual is in possession of all the relevant information he or she may lack the capability and skill to make an appropriate decision due to, for instance, a lack of experience. Williamson's approach is closer to the information asymmetries emphasis of standard economics.

For Williamson (1985, p. 47), opportunism is 'self-interest seeking with guile'. This embodies an extensive range of behaviours, including: fraud, deceit, cheating, stealing and other forms of dishonesty. It is also, at least, captured in standard economic references to adverse selection and moral hazard. In his TCE framework opportunism and bounded rationality only become problematic, in efficiency terms, following the specificity of human and capital assets.

In the employment relation, Williamson's approach emphasises the incompleteness of contracts, because bounded rationality precludes the *ex ante* specification of potential contingencies. Consequently, the risk of transaction-disrupting opportunism is increased. This opportunistic potential is determined by the degree of 'asset specificity'. More sophisticated governance arrangements are required to attenuate the threat of opportunism, and, hence, maintain contractual continuity and efficiency. In the employment relation authority discretion (power) is ceded by employees in return for a reduction in uncertainty over job property rights, such as wages and conditions (Williamson, 1975; Williamson *et al.*, 1975). This, for Williamson, is the essence of governance—the extent of embedded job property rights and the continuity of the employment relation is determined by the degree of *firm*-specific human capital.

According to Williamson (1985, pp. 242–43) this provides explanatory advantages:

Whereas neoclassical reasoning links skills to productivity and compensation, transaction cost reasoning introduces organizational considerations. Specifically, skills that are acquired in a learning-by-doing fashion and that are imperfectly transferable across employers have to be *embedded in a protective governance* structure lest productive values be sacrificed if the employment relation is unwittingly severed. (emphasis in original)

However, Williamson is not always consistently clear on asset specificity (see also David and Han, 2004). It is frequently portrayed as exogenous to the transaction in his analysis; yet whilst he argues for the ubiquity of his framework in comparing employment contracts with those for intermediate goods, he also appears to recognise that firm-specific employment can be facilitated and induced by the contract, that is, it is endogenous, as his allusion to 'learning-by-doing' seems to indicate. He also notes the 'deepening' of skills, such as those of a physician or a typist, can occur with experience (and tenure) but may be transferable and therefore pose little risk to transaction cost inflation. However, 'knowledge of a particular firm's filing system . . . may be highly specific' and therefore does pose a governance issue. Yet this knowledge is surely acquired over time and fostered by a particular employment relation. Indeed, as the examples demonstrate, Williamson's use of the rather ponderous phrase 'human asset specificity' lacks definitional precision. The term may refer to specific investment or skills, but also particular knowledge—tacit and overt. Yet Williamson does not identify 'knowledge' as an important concept; there is sparse, if any, explicit discussion of the complexities of knowledge, and the notion is conspicuous by its absence from the index of *Economic Institutions of Capitalism*.

2.2 The efficient contract matrix

Williamson (1985, p. 242) does, however, concede that the employment relation differs in one aspect from 'other' intermediate transactions; the former occurs on an ongoing basis. The main implication of this is that governance choice in non-labour 'intermediate goods transactions' is primarily driven by the degree of asset specificity and subsequently by the frequency with which transactions occur. For the employment relation, again the efficient division of labour is primarily driven by 'human asset specificity' and secondarily by the separability of working relations, which keys into the measurability of a particular worker's effort, productivity and performance. Nonetheless, the clear driver remains asset specificity, which forms the centrepiece of Williamson's ubiquity claim for his framework.

Williamson is interested in the process by which a 'large numbers' situation is transferred into a 'small numbers' one, that is, where many potential transacting parties diminish to a few, ultimately a bilateral monopoly. He argues that when workers possess firm-specific skills, and the task is non-separable, a small numbers situation arises because those skills are not transferable. This implies potentially significant uncertainty for the firm. In the event of contract termination, the firm would experience difficulty in replacing the worker. Hence, workers may exploit their position opportunistically by appropriating an 'undue share' of benefits in efficiency terms. However, because workers' skills are non-tradable they face considerable uncertainty and immobility. Williamson maintains that transactions of this type can only occur under protective governance structures, which ensure job property rights, and a highly structured internal labour market with promotion opportunities, low entry ports, and on-the-job training. Moreover, such governance arrangements bond the parties together through credible commitments and provide a focus for mutual orientation.

Furthermore, the TCE framework ascribes a transaction cost economising role to trade unions in two ways. First, collective bargaining avoids the potentially transaction costly method of bargaining on an individual basis. In this way, Williamson *et al.* (1975, p. 270) claim individual opportunistic bargaining is avoided, and more general organisational objectives are elevated above individual ones. Second, by providing a voice mechanism unions avoid the transaction-disrupting potential of disgruntled workers leaving the firm. Given this, the framework predicts that efficiency-enhancing unions will arise early in those industries and firms where human capital is durable, such as 'railroads', and late, if at all, in occupations with non-specific assets (Williamson, 1985, p. 256).

According to his matrix, determined by the binary interaction of firm specific labour and separable work relations, four simplified classes of the efficient division of labour may be articulated as in Table 1.

As noted, the internal spot market is typified by a lack of 'efficiency interest' in maintaining the employment relation when either party is dissatisfied with the prospect of continuing their association. Workers can exercise mobility without any productive loss and firms find it easy to find replacements without incurring any significant costs. A large numbers situation pertains in such cases, and the firm can easily measure worker productivity to ensure the absence of 'shirking'. Williamson portrays a scenario of equal empowerment, but this critically assumes at least a reasonably buoyant labour market with plentiful alternative sources of employment, inferring the efficiency requirement for unsophisticated safeguards or governance arrangements. A relatively

Table 1. *Williamson's efficient division of labour*

	Low asset specificity	High asset specificity
Separable work relations	Internal spot market (possible examples: migrant farm workers; custodial employees; some professionals—certain draftsmen and engineers; cleaners)	Obligational market (possible examples: administrative support staff; some professions—such as some types of legal practice)
Non-separable work relations	Primitive team (possible examples: some forms of labouring, such as manual freight loading; construction work)	Relational team (possible examples: information technology; high-technology activities)

Notes: Possible examples are not drawn from Williamson directly; he offers little if any direct examples in those categories. Rather, 'possible examples' are inferred from his rationale.
   Source: Adapted from Williamson (1985, p. 247).

high turnover of staff may be seen as insignificant. In general, many unskilled or generically skilled positions would resonate.

The 'obligational market' is typified by the ease of monitoring and, '*firm-specific learning . . .* [and] idiosyncratic organizational experience' (1985, p. 246, emphasis added), such as procedural conventions, complex rules and data processing. Here both firms and workers make an investment in specific skills and consequently have a vested interest in maintaining their relationship. Hence Williamson alludes to safeguards, such as severance pay and other benefits to employees to diminish the possibility of departure. This type of arrangement would then be apposite for skilled and highly skilled occupations.

For Williamson, the 'primitive team' arrangement is efficient in circumstances where individual remuneration cannot be easily determined by virtue of team-based production arrangements. Efficient governance arrangements call for some supervisory arrangement, such as the Indian *jamadar*, who enlists and supervises construction workers for firms (Williamson, 1985, p. 246). More generally, 'the coupling of employment with an oversight assignment is involved' (ibid.). Again, due to the lack of firm-specific skills (and knowledge) and skills generally, a high staff turnover could be tolerated, and relatively high absenteeism rates would presumably not be considered significantly problematic in transaction cost terms (see also Knox's 2010 study of the Australian hotel industry).

The 'relational team' represents the greatest form of investment in firm-specific skills coupled with extensive difficulties in assessing the contribution of each individual employee. Here, as noted, both employer and employee have considerable interest in maintaining the continuity of their association. Accordingly, Williamson considers that firms should engage in processes of aligning interests and incentives between the firm and this type of workforce. Here he predicts high degrees of 'social conditioning' coupled with considerable job security and other benefits, such as medical insurance, which may be 'fiercely egalitarian', to encourage a high degree of employee loyalty. Importantly, this suggests that employees in such positions will perceive extensive job security. Williamson draws on Ouchi's (1980) 'clan' organisation to invoke

the co-operation and team spirit associated with the relational team. Also, as a result, Williamson anticipates lower resistance to technological innovations and lower absenteeism rates than other forms of labour division.

To elaborate on the logic of Williamson's argument, imagine that if a worker is an important part of a team, such that team performance would be adversely affected (at least in the short term) by the worker's absence or under-performance, then it would be expected that the worker would perceive his or her position to be relatively secure. This argument has an important bearing in the development of the empirical approach, which is elaborated later.

2.3 Some conceptual criticisms

Williamson's model has been subject to some sustained criticism (see, for example, Dow, 1987; Ghoshal and Moran, 1996; Hodgson, 2004; Kay, 1992).[2] Of particular significance is Dow's (1987) criticism. He contests that Williamson applies opportunism between employer and employee asymmetrically: Williamson tends to focus on the potential opportunistic traits in the latter to the exclusion of the former. This echoes a more general criticism of mainstream labour economics regarding its relegation of power (see, for example, Spencer, 2009), and its disutility of work assumption. Simon (1991), for example, poses the question: if work is such a source of disutility, then why are more instances of free-riding and shirking not observed? He contests that workers demonstrate docility and acceptance of authority (see also, for example, Spencer, 2009; Fleetwood, 2011; Lopes, 2011). Also of some relevance is the sensitivity of Williamson's efficiency predictions to his ubiquity of opportunism assumption. Recent work highlighting social capital in the workplace (for example, Rafael and Zemsky, 2002) acts as a potential platform for a conceptual challenge to the privileging of opportunism.

There are also theoretical questions over Williamson's allusion to specificity. The transaction cost framework tacitly assumes asset specificity is exogenously determined; yet Williamson explicitly recognises this is not the case with ongoing employment contracts. Nonetheless, his emphasis remains on asset specificity's 'locomotive role' in determining governance arrangements. As noted, this is problematic: experiential knowledge idiosyncrasies develop with duration, and skill enhancement would tend to result in more sophisticated contractual relations (for example, Slaughter *et al.*, 2007). Reward structures, fringe benefits, pension rights and promotion prospects may all be associated with skill progression and, indeed, may exhibit important feedback properties. For example, generous reward structures and promotion prospects may encourage employee lock-in with a firm, and thereby foster the development of firm-specific skills—the opposite causal flow predicted by Williamson. Indeed, he states nothing overtly about wages; predictions are inferred. Herein lies a tension in Williamson's analysis. As noted, his TCE framework is explicitly static (for example, Williamson, 2000), but the admission of the acquisition of specific skills over time suggests endogeneity

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[2] Williamson has been accused of lacking clarity in a host of significant concepts within transaction cost theory, ranging from 'contract', 'transaction', 'institution', 'economising on bounded rationality' and 'opportunism' (see, for example, Dow, 1987; Kay, 1992; Ghoshal and Moran, 1996; Hodgson, 2004). Some concepts—such as 'institutions'—are not defined by Williamson; others are only very loosely defined and lack conceptual clarity.

and a dynamic model. This represents a particular empirical challenge, which we out-line in Section 3.

Second, communication and informal group idiosyncrasies are to be found in most jobs, but many procedures tend not to be firm-specific but *industry*-specific (Jacoby, 1990, p. 323). There are numerous examples of industry standards and professional associations that seek to both establish and disseminate best practices and common practices, procedures and protocols in a particular industry or professional activity rather than a specific organisation. Thus, for example, the rise of evidence-based medicine has introduced particular practices and protocols in medical practise that is not specific to any particular firm or organisation, but is to medicine (see for example, McMaster, 2008). According to Jacoby's perspective, workers—even those with highly specialised skills—will be more mobile than Williamson's model predicts. Therefore, industry-specific skills may be of more significance than Williamson's framework suggests, as more sophisticated contractual arrangements may also arise through the potential of employee exit threats to other firms in an industry where skills are industry-specific. Thus, using Williamson's schema (Table 1), *pace* Williamson, relational team type contracts may appeal to firms wishing to commit their employees who possess *industry*-specific skills. The importance of this is that there is an alternative narrative account to that presented by Williamson.

Williamson's analysis does not consider any potential impact on 'efficient governance' that may arise from firm size. *Prima facie*, this may be unproblematic, but if size has any bearing on the 'separability of work relations' and factors influencing the degree of firm-specific labour, then this may be an oversight in Williamson's approach. We analyse this in Section 3.

3. Empirical analysis

Williamson offers a blueprint for the efficient division of labour that complements important aspects of the standard economic approach to this issue; it also resonates with important policy initiatives relating to, for instance, attempts to increase the flexibility of labour markets, by, say, constraining the influence of trade unions. According to Williamson's rubric, unions offer limited efficiency advantages in those activities where workers do not possess firm-specific skills, and such activities should not be subject to what he views as unnecessary 'protective governance structures', arguably what may be perceived as workers' rights. More generally, as noted, Williamson's default position is for arrangements that ensure that 'resources are allocated to their highest value as the marvel of the market works its wonders' (2000, p. 598), unless asset specificity prompts some other organisational arrangements. Moreover, for Williamson (1985), the labour market is equivalent to that of any 'intermediate good'.

The model we present next endeavours to explore the extent to which Williamson's explanation resembles the structure of employment practices in a developed Western economy, the United Kingdom. Our modelling approach reflects Williamson's explicit acknowledgement of the dynamic (and endogenous) sources of firm-specific labour, noted earlier. To the best of our knowledge, this is by no means a standard approach to empirically testing TCE, in general, and his division of labour analysis, in particular. For instance, Carter and Hodgson's (2006) and David and Han's (2004) meta-analyses indicate that almost all prominent empirical studies in this area appear to be cross-sectional. Our approach is founded on a dynamic procedure that relates firm-specific labour

skills (as proxied by tenure) to on-the-job training. Specifically, we interact the relevant variables in a logit regression over the time period of the entire data set (from 1991 to 2006) controlling for all other characteristics (i.e., all other variables in our model).

3.1 Data

The BHPS panel dataset was used. This tracks household and individual histories over time. Its first wave occurred in 1991, and the survey has been updated each year. The sample, for various reasons, changes over time. The panel, however, permits an examination of labour market changes over time, career progression, unemployment propensity, and skill acquisition, all of which are relevant to this study. We discontinued our analysis at 2006 as a means of obviating the potential impact of the 2007 (and ongoing) financial crisis.

The dataset offers the advantages of large sample size: 63,420 in this study. As noted, much of the literature examining the organisation of labour tends to be firm-based, and as such the BHPS offers less detailed coverage of employment activities. However, due to its panel nature it offers an enhanced coverage of organisational arrangements and an extensive range of occupations that can be incorporated into the study. Moreover, it enables individuals and employment arrangements to be tracked over time, affording a dynamic dimension. Thus, the data offer the opportunity to obtain a richer milieu of organisational structures and their development than single firm/industry studies.

3.2 Measurement and other empirical approaches

As noted, there are extensive measurement challenges in this area (Williamson, 1985; David and Han, 2004). In their surveys of the empirical analysis of TCE, Carter and Hodgson (2006) and David and Han (2004) note the lack of consensus in defining variables. Earlier, Farber (1999, p. 2468) argued, 'specific capital is not generally directly measurable or even observable', hence the use of proxies is common. Indeed, David and Han refer to nine potential ways of capturing labour asset specificity, including specialised skills, training needs and buyer loyalty. In this study two key areas are highlighted: asset specificity and employment contract features. Here labour specificity is proxied by tenure. Tenure is given by the time (in months) that the respondent has been employed in his or her current job. The use of tenure as a proxy for labour specificity has precedence in the human resource management and labour economics literatures (for example, Cavanagh and Garen, 1997; Farber, 1999; Bingley and Westergaard-Nielsen, 2003). Farber (1999, p. 2468) considers such arguments to be reasoning by analogy, where 'the idea is that if time in the labor market indexes accumulation of general skills then time with the firm indexes accumulation of firm-specific skills'. This may also resonate with Williamson's (1985, p. 246) references to firm-specific learning in his 'obligational market' category.

In this context the application of the tenure-specificity analogy is subject to three potentially significant constraints (Farber, 1999). First, standard human capital models suggest a non-linear relationship between tenure and earnings. Second, tenure may be influential in wage determination processes, such that long-serving employees may be treated differently from other employees in that tenure premiums may be evident, which implies the following. Third, wage levels do not reflect productivity, and extensive specialisation may engender a bilateral monopoly. Hence, as Farber argues, it is arbitrary to assign wage as a dependent variable with tenure as an explanatory variable.

In this study we believe the latter two of Farber's limitations are avoided, as Williamson's model makes no explicit predictions of earnings in transactions typified by asset specificity; the empirical model is not predicated on any particular pattern in any tenure-earnings profile. The first difficulty (concavity of tenure returns) is of a greater significance, however, but it is not entirely straightforward to address. For instance, the potential for a concave function could just as easily be disputed in terms of the definitions used to measure benefit flows and productivity. Longer tenured employees may have acquired considerable tacit knowledge that contributes to their performance in ways not directly amenable to measurement. Thus, the concavity effect may be of diminished importance in the context of this exercise (Battu *et al.*, 2002).

Other studies, for example, Slaughter *et al.* (2007) measure skills specificity through defining job categories and eliciting the views of a panel of 'experts' on the uniqueness of skills to that category within a firm. This obviously offers a considerable advantage as it escapes some of the deficiencies associated with the use of tenure as a proxy. However, Slaughter *et al.*'s dataset is firm-based and dedicated to a specific industry and location (information technology in Singapore). By employing household panel data, the approach presented here is more amenable to accommodating Williamson's matrix, which obviously extends beyond a single industry.

3.3 The model

Given the ambiguities of aspects of Williamson's approach and the problems identified earlier in articulating empirical analysis, a model based on, but not replicating, the matrix identified in Table 1 is developed. Independent variables relate to job security; contractual characteristics, including the status of the job (full-time, permanent, part-time, temporary), period of notice, pension and wage arrangements, holiday entitlements; worker characteristics, including education and marital status; industry categories; wage levels; and job characteristics, including trade union membership. We also note firm size as measured by the number of employees (where a small firm is defined as: 1–24 employees; medium is 25–99, and large is equal to or greater than 100 employees). Drawing from Williamson, we set the dependent variables as tenure and perceptions of job security. The latter acts as a proxy in reflecting his argument that both parties will be bound by their relationship the greater the extent of specific investment involved. The dataset did not possess a variable matching Williamson's allusion to work separability, and potential proxies, revolving around job autonomy, such as 'being your own boss' and 'greater initiative' could not be applied because there were too few responses to these questions making the sample size for those who responded (less than 0.3% of the total sample), insufficient for statistical analysis. Interestingly, most who did answer said this had attracted them to the job in question. Moreover, there are no variables in BHPS that relate to remuneration being partly based on a collective or team effort/performance. The use of job security is thus based on, as noted earlier, what we believe to be an intuitively appealing argument that resonates strongly with the tenor of Williamson's TCE analysis. Those individual workers who constitute an important part of a team, by virtue of their absence or under-performance having a potentially deleterious impact on the overall performance of the team, would perceive themselves to be relatively secure in their position. This is not an entirely satisfactory assumption, especially as such perceptions would be affected by the macro-performance of the economy, but given the nature of the data we are not aware of variables that offer an enhanced

representation. Nonetheless, as noted, we have endeavoured to address the potential impact of recent economic events by using data up to and including 2006.

A simultaneous equations model where both dependent variables are binary was employed. This permits a direct test of whether simultaneity exists between variables (Greene, 2000), in this case between job security and asset specificity. The binary variables are formally expressed:

$$y_1 = 1 \text{ if } y_1^* > 0, \ 0 \text{ otherwise}$$

$$y_2 = 1 \text{ if } y_2^* > 0, \ 0 \text{ otherwise} \tag{1}$$

The variable y_1 reflects aspects of job security captured via a dummy variable that takes a value of 1 if an individual perceives his or her job is secure. Asset specificity (y_2) is captured by tenure in a specific employment, also a dummy variable taking a value of 0 if tenure is less than or equal to 48 months and 1 if tenure is greater than 48 months.[3] This is no random figure. Williamson (1985, p. 270) uses this as a distinction between long-term and sequential short-term contracts in his discussion of franchising. As emphasised, Williamson assumes that labour contracting and the exchange of intermediate outputs are substantially the same. Given this, we see no reason, stemming from his analysis, to preclude the use of this measure. In his discussion of employment, Williamson does not refer to any specific measures, he merely stresses contractual continuity. It seems to us that the specification of four years as a proxy measure of specificity is within the spirit of Williamson's use of the term 'continuity'.

A two-stage procedure may be used to correct for simultaneity. In the first stage perceptions of job security may be predicted from a reduced-form logit that includes all variables affecting both job security perceptions and asset specificity. Asset specificity is also predicted from a reduced-form logit, which again includes all variables affecting both dependent variables. The reduced forms are expressed as:

$$\begin{aligned} y_1^\star &= \beta_1 X + \varepsilon_1 \\ y_2^\star &= \beta_2 X + \varepsilon_2 \end{aligned} \tag{2}$$

where X is a vector of explanatory variables. In the second stage, the newly created predictor variable for job security is used in place of the original variable in the asset specificity (tenure) regression. Similarly, the variable predicting tenure is employed in the contract characteristics regression. Both the reduced forms and structural equation are estimated using maximum likelihood logits.

Individuals' characteristics were captured by variables such as gender, marital status, age (as a proxy for experience) and the highest educational qualifications attained. Employment features were represented by variables including an individual's promotion prospects, trade union membership, whether they were salaried employees and if their job included managerial duties and had on-the-job training provided by the employer. Firm size and whether the firm is in the private sector were also included.

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[3] We conducted a standard ordinary least-squares regression with a continuous measure for tenure as the dependent variable, but the model's predictability was rendered insignificant as the tenure variable is not normally distributed, and repeated sampling did not produce a normal distribution.

In addition, the potential effects of industrial and occupational grouping on both job security and asset specificity are controlled.

On the basis of the foregoing, we believe that Williamson's framework would predict a strongly positive relationship between human capital characteristics, such as degree of education and experience (age), and perceptions of job security and tenure. A possible rationale being that higher levels of education suggest greater specialisation in a particular field. Of course, this is not necessarily the case, as education may lead to the enhancement of transferable skills and hence mobility. Education combined with experience and/or tenure has some resonance Williamson's argument in that it indicates a degree of lock-in. A strongly positive relationship between particular occupational classifications and perceptions of job security and tenure were anticipated. Also expected, given Williamson's argument, were that 'sales and customer services' and 'administration and secretarial' would have less significant relationships than 'professional', 'skilled trades', 'associated professional and technical', and 'managerial' to perceptions of job security and tenure. This reflects Williamson's distinctions between 'internal spot' and 'relational team' arrangements. With respect to standard industrial classifications, on the basis of Williamson's matrix, 'agriculture, forestry and fishing' and 'construction' would be expected to be negatively associated with perceptions of job security and tenure, given the relatively high seasonal and casual proportion of employment in these sectors. Williamson does not place any significance on firm size in his analysis. Accordingly, firm size should have no bearing on either tenure or perceptions of job security in the model.

3.4 Results

Tables 2 and 3 present the results from the logit models. The structural equations contain predicted values for tenure (in the job security regression) and job security (in the tenure regression).

The individual regressions are identified by the use of exogenous instrumental variables. In the tenure equation, age, age squared and pay incentives are used as instruments. We expect that age and tenure would be related and also that financial rewards may strengthen tenure with a particular employer, *ceteris paribus*, although for reasons set out shortly, we do not emphasise this latter point. In the job security model, the standard occupational classification is employed as instrumental variables. Perceptions of job security may reflect particular occupational characteristics and may vary across occupations.

Estimates for perceived job security are presented in Table 2. Some of the results reflect *a priori* expectations; others require further comment. There is a statistically insignificant relationship between job security and educational attainment at A-level (or equivalent) and degree level. There is an inverse relationship between basic school-leaving qualifications, such as 'O-levels', and perceived job security. This latter result, to some extent, resonates with Williamson's analysis. However, the statistical insignificance of higher educational attainment is not necessarily consistent with his framework, in which there is some expectation of security. Promotion prospects are significantly positively related to job security, as is being a salaried employee. From Williamson's perspective, this is unsurprising and consistent with his analysis.

Having an occupational pension and being a trade union member are significantly inversely related to job security and is inconsistent with Williamson's argument. Interestingly, being employed in the private sector is negatively related to perceived job security, although given Williamson's (1985) references to bureaucracy and the public

Table 2. *Estimates for job security*

Variable	B	S.E.	Wald	Sig.	Exp(B)
Degree is highest educational qualification	0.068	0.086	0.629	0.428	1.070
A-level or equivalent is highest educational qualification	0.046	0.087	0.285	0.593	0.955
O-level or equivalent is highest educational qualification	0.187	0.078	5.765	0.016	0.830
Promotion prospects	0.873	0.471	3.436	0.064	2.395
Pension	1.115	0.105	112.112	0.000	0.328
TU membership	0.751	0.093	65.517	0.000	0.472
Salaried	0.227	0.078	8.467	0.004	0.797
Managerial duties	0.077	0.069	1.242	0.265	1.080
Married	.512	0.066	59.609	0.000	0.9600
Male	0.020	0.065	0.093	0.761	0.980
Private sector	0.545	0.106	26.348	0.000	0.580
Standard occupational classification					
Managerial	0.590	0.130	20.553	0.000	1.804
Professional	0.677	0.137	24.491	0.000	1.969
Assoc. professional & technical	0.695	0.123	31.828	0.000	2.004
Admin & secretarial	0.502	0.127	15.672	0.000	1.653
Skilled trades	0.232	0.136	2.898	0.089	1.261
Personal service occupations	0.917	0.132	48.294	0.000	2.503
Sales & customer services	0.607	0.133	20.872	0.000	1.834
Standard industrial classification					
Agriculture, forestry, fishing	1.138	0.215	27.960	0.000	3.121
Mining & manufacturing	0.864	0.169	26.075	0.000	2.373
Electricity, gas, water supply	0.709	0.198	12.794	0.000	2.032
Construction	1.012	0.167	37.398	0.000	2.750
Distribution	1.546	0.130	141.233	0.000	4.0691
Financial intermediation, business activities	0.820	0.157	27.422	0.000	2.270
Public admin, education	1.422	0.130	119.063	0.000	4.146
Health & social services	1.742	0.129	183.275	0.000	5.710
On-the-job training & medium-sized firm	0.481	0.091	28.096	0.000	1.618
On-the-job training and large firm	0.449	0.089	25.549	0.000	1.567
Predicted tenure	5.675	0.315	325.502	0.000	291.581
Constant	2.467	0.141	306.734	0.000	0.085

Diagnostic Statistics	2 Log likelihood 11504.212	Cox & Snell R Square 0.301	Nagelkerke R Square 0.399
Wald (on instruments)		Chi-square (7) = 27.115	P value = 0.000
Hausman-Wu (on instruments)		Chi-square (7) = 21.289	P value = 0.000

sector possessing less clear-cut incentives and lower penalties for under-performance, this result may not have been unanticipated.

In relation to occupation classifications, most are positively related to perceived job security except for skilled trades classifications, which have insignificant effects.

Again, this is not consistent with Williamson's analysis. With 'sales and customer services' and 'administration and secretarial' categories demonstrating significantly positive results, their coefficients are similar to those recorded for 'managerial positions'. Again, this is not consistent with TCE predictions. Moreover, the insignificance of the 'skilled trades' classification, especially in the context of the significance of the other variables, further questions the robustness of the association of skills and security posited by Williamson. In effect, his delineation of employment arrangements is questioned.

Broad industrial categories have positive effects, although the significance varies, with health and social services demonstrating the strongest association with perceived job security.

Other variables indicate that firm size interacting with on-the-job training demonstrates a significantly positive relationship with job security, and tenure is also positively related to perceived job security. Williamson does not express an explicit view on firm size and perceptions of security (or worker autonomy). In terms of explaining this result we may speculate that workers may perceive that they have more influence in smaller scale production. However, this is *speculation*. By contrast, the tenure result could indicate some association with the acquisition of firm-specific skills, although this may also indicate seniority effects.

The results for the tenure equation are presented in Table 3. Interestingly, higher education exerts a negative influence on tenure. In contrast, the most basic school-leaving qualification (O-levels) has a positive influence on tenure. Again, given the tenor of Williamson's case, this would appear to be rather surprising. Taking his assumption that asset specificity is exogenously determined, given the caveats outlined previously, then education could potentially be a marker for those with specific skills. Yet from the data, there appears to be greater fluidity in graduates' employment. As graduates seem also to possess a greater perception of job security relative to those with basic school-leaving qualifications (Table 2), these results do not indicate *firm* specificity but may be suggestive of employment security and greater mobility, which is more consistent with Jacoby's (1990) *industry* specificity analysis.

Promotion prospects are also negative but insignificant. Having a pension, being a salaried employee, being a trade union member and having managerial duties are all associated with prolonged tenure, as is being married and working in the private sector. Some of those results, excepting the private sector variable, are consistent with Williamson's matrix.

Of far greater significance to the central thrust of Williamson's thesis is the finding that on-the-job training *reduces* tenure. The significance of this result suggests that, *pace* Williamson, on-the-job training enhances workers' general transferable skills as opposed to firm-specific skills, and further indicates that there are no significant lock-in effects. Interestingly, there is a statistically significant difference between the coefficients of medium and large-scaled firms, which may indicate that the extent of the inverse relationship between on-the-job training and tenure is greater the larger the scale of the firm. Again, this result is more consistent with an industry-specific explanation than Williamson's firm-specific analysis.

In terms of the interaction variable between small firms and standard occupational categories: 'professional', 'associated professional and technical', 'administrative and secretarial', 'skilled trades' and 'personal services' have positive and significant relationships with tenure. 'Sales and customer services' is insignificant. Arguably, there is little

Table 3. *Estimates for asset specificity (tenure)*

	B	S.E.	Wald	Sig.	Exp(B)
Degree is highest educational qualification	0.742	0.089	69.150	0.000	0.476
A-level or equivalent is highest educational qualification	0.048	0.081	0.351	0.554	1.049
O-level or equivalent is highest educational qualification	0.357	0.072	24.837	0.000	1.430
Promotion prospects	1.052	0.561	3.511	0.061	0.349
Pension	1.690	0.133	161.776	0.000	5.421
TU membership	0.947	0.092	105.041	0.000	2.577
Salaried	0.623	0.074	69.844	0.000	1.864
Managerial duties	0.643	0.071	82.677	0.000	1.903
Married	0.572	0.065	76.610	0.000	0.861
Male	0.150	0.056	7.231	0.007	0.861
Age	0.044	0.004	148.382	0.000	1.045
Age squared	0.000	0.000	160.061	0.000	1.000
Managerial ⋆ Small firm	0.969	0.447	4.694	0.030	0.379
Professional ⋆ Small firm	1.493	0.560	7.109	0.008	4.449
Assoc. professional & technical ⋆ Small firm	1.475	0.493	8.935	0.003	4.370
Admin & secretarial ⋆ Small firm	1.353	0.373	13.118	0.000	3.867
Skilled trades ⋆ Small firm	0.836	0.428	3.805	0.051	2.306
Personal service occupations ⋆ Small firm	2.215	0.480	21.307	0.000	9.158
Sales & customer services ⋆ Small firm	1.144	0.729	2.460	0.117	3.139
Predicted job security	2.931	0.541	29.390	0.000	0.053
Private sector	1.426	0.071	406.325	0.000	4.163
Agriculture, forestry, fishing	3.815	0.260	216.034	0.000	45.358
Mining & manufacturing	4.021	0.245	270.204	0.000	55.770
Electricity, gas, water supply	4.044	0.258	245.518	0.000	57.067
Construction	3.243	0.203	254.649	0.000	25.607
Distribution	3.610	0.206	299.660	0.000	36.979
Financial intermediation, business activities	3.220	0.198	265.381	0.000	25.024
Public admin, education	3.024	0.179	285.990	0.000	20.569
Health & social services	3.303	0.192	294.664	0.000	27.188
On-the job-training & Medium-sized firm	0.361	0.094	14.890	0.000	0.697
On-the-job-training & large firm	0.854	0.098	76.436	0.000	0.426
Constant	6.506	0.255	650.662	0.000	0.001

Diagnostic Statistics	2 Log likelihood 10387.571		Cox & Snell *R* Square 0.251		Nagelkerke R *Square* .406
Wald (on instruments)			Chi-square (3) = 11.240		P value = 0.015
Hausman-Wu (on instruments)			Chi-square (3) = 12.302		P value = 0.020

correspondence with TCE predictions. According to Williamson's approach, we may have expected greater significance with 'professional', 'managerial' and 'skilled trades' than the other occupational category variables. However, as Table 3 demonstrates, this pattern was not observed. Indeed, the 'managerial' category was significantly *inversely* related to tenure. Whilst the foregoing is, in our view, not consistent with Williamson's analysis, we do not wish to over-emphasise this given the level of aggregation involved in these variables. In other words, these occupational variables may capture a host of occupations with varying degrees of firm specificities.

Industry effects are positive and significant with the largest effect on tenure being in 'electricity, gas and water', 'mining and manufacturing' and 'agriculture, forestry and fishing' with statistically similar coefficients. 'Construction', 'health and social services' and 'financial intermediation and business activities' share broadly the same level of significance. Again, these patterns are not consistent with TCE.

As a proxy for experience, age has the anticipated sign, *a priori*. Being older increases tenure. Surprisingly, predicted job security has a negative effect on tenure. We can only speculate that this may reflect periodic bouts of optimism in terms of occupational mobility. It does not, in our view, correspond to Williamson's framework and may have greater resonance with an industry-specificity analysis. However, we emphasise that this is a fairly speculative interpretation.

The process of verification of the robustness of the instruments and the empirical model involved two procedures. First, a Wald test of whether the instruments are jointly equal to zero is performed. The general objective is to test the validity of a set of g independent restrictions, expressed as:

$$H\theta = h \qquad (3)$$

where θ is a $(m \times 1)$ vector of parameters.
The Wald test statistic is:

$$W = (H\tilde{\theta} - h)'[HI^{-1}(\tilde{\theta})H']^{-1}(H\tilde{\theta} - h) \qquad (4)$$

This is approximately a chi-square distribution with g degrees of freedom under the null hypothesis expressed in equation (3). This is followed secondly by an exogeneity test (Hausman-Wu) assessing independence of the instruments from the disturbance term. Results are compared against critical values from a chi-square distribution. Results in Tables 2 and 3 suggest that the null of no significance in the Wald test can be rejected. The instruments are also uncorrelated with the error term in the regression model; the model is statistically significant and robust.

4. Conclusions

Although the model generates statistically robust results, caution must obviously be exercised in making informed judgements of the evidence. As noted, this is especially the case in seeking to analyse Williamson's explanation of the division of labour, which is subject to conceptual ambiguities as well as measurability issues. Nonetheless, we believe that the analysis here augments and complements firm and industry based empirical studies, and the analyses articulated by the likes of Fleetwood (2011) and Spencer (2000, 2009, 2011) (see also David and Han, 2004; Carter and Hodgson,

2006), as well as subjecting Williamson's division of labour framework to direct empirical scrutiny—something that is seldom attempted.

Williamson makes a host of efficiency-based predictions based on his rubric of firm-specific labour. His approach also marginalises conceptions of power; it is reduced to a property of his notion of opportunism and hence becomes an issue of transaction cost efficiency. Arguably, Williamson enters this highly contested arena as if his analysis were boldly objective. It clearly is not—it privileges a type of analytical approach that seeks to conflate labour with exchanges for intermediate goods.

The results appear to demonstrate limited support for some of Williamson's predictions—not least the impact of trade union membership and tenure, and the association of tenure with relatively stable employment arrangements in that there is evidence of what Williamson would call 'protective governance arrangements', such as the provision of pensions. There is also an association with managerial duties and employment stability. Nonetheless, causation is not necessarily always linear, and feedback effects cannot be ruled out. Furthermore, such results are relatively uncontroversial and have been found elsewhere. Of greater significance is the lack of support of—and indeed, direct challenge to—key aspects of Williamson's analysis. Most prominently the relationships between on-the-job training and tenure are contrary to the logic of Williamson's transaction cost analysis. The findings on education are less obvious and more challenging to interpret, but they may be consistent with employment security and occupational mobility and may tentatively suggest some correspondence with Jacoby's (1990) allusions to industry specificity. Also of some significance are the findings for the relationships between firm size and tenure and perceptions of job security. Williamson's framework says nothing about the size of the firm—the matrix is claimed to be ubiquitous. This finding alone calls for further investigation to explain this pattern. Moreover, in both regressions, industry variables appear inconsistent with his TCE explanation, although, as noted, there is a caveat to those results and they should be treated with caution.

Overall, we do not find compelling evidence to support Williamson's explanation for the division of labour in a developed capitalist economy, and therefore we caution against the appeal of Williamson's explanation of, and blueprint for, the 'efficient organisation' of labour. Indeed, the conflation of the employment relation with 'intermediate transactions' for any commodity, in Williamson's analysis, raises concerns that appear to be borne out in this study. Williamson also appears to offer the prospect of a misguided emphasis on labour specificity at the level of the organisation. By contrast, our approach suggests more supportive evidence for specialisation at the industry level. This, we believe, is a more appropriate platform in analysing the influences on the patterns of the division of labour.

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