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A Comparison Of Two Ways Of Applying Transaction Costs Approach(I): Methodological Debates

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Summary

Whilst the importance of transaction costs in construction has been accorded pervasive recognition, the methodologies used to apply this concept to the analysis of the construction process have been divergent. One way starts from searching for quantifiable items of transaction costs and explores the link between these costs and procurement routes. This paper claims that the attempt to provide explanatory foundation for construction procurement behaviour by quantitatively measuring each important element *of transaction costs in the construction process is highly unlikely to succeed, since the majority of costs with comparative importance are fairly difficult, if not impossible, to estimate. A possible way to avoid this pitfall is to follow Williamson's methodology of comparative institutional analysis. In this context, we take this to involve operationalising the theory by predicting , for transactions with defined attributes, ordinal differences in transaction costs between institutions (procurement routes), and thus, under a 'weak' profit maximising assumption, to derive and test refutable hypotheses concerning the probability or relative frequency of use of each route .*

Keywords: transaction costs, asset specificity, measurement costs, operationalisation

Introduction

In the last two decades, a significant development in the economic theory of organisations has occurred, involving the application of transaction cost economics (TCE) to diverse issues of economic organisation, such as vertical integration, marketing, franchising, multinational corporations, and so on [Shelanski and Klein, 1995]. Against this backdrop, it is no exception to find that this approach is permeating into the analysis of construction organisations. However, we argue, some implicit propositions in TCE are not applicable in dealing with construction cases [Chang and Ive, 2000], so it is necessary to make some modifications to square the basic methodology of TCE with the characteristics of construction.

Prior to 1970s, because the identification of transaction costs is very sensitive to the subject matter of the study, the charge of tautology always overshadowed the value of the insights that the concept of transaction costs can help generate[1]. Fisher's critique was that '*[i]nasmuch as virtually any outcome could be explained by appeal to transaction cost reasoning, recourse to transaction costs gradually acquired "a well-deserved bad name"'[Fisher,1977]'* The prospect of advancing transaction cost research didn't improve until two break-through contributions appeared: Alchian and Demsetz (1972) and Williamson (1975), both of which are devoted to making transaction-cost-based theories refutable. Since then, the framework mainly founded on Williamson's works has gained something of the status of orthodoxy in the economic theory of organisations [Knudsen,1993].

The most direct reason for this success of TCE comes from its research strategy of operationalisation [Coase,1991]. In this strategy the comparative institutional approach became dominant. In other words, the attempt to directly measure the magnitude of transaction costs of running a governance structure is replaced with the effort to determine the factors that are predicted to be responsible for comparative difference in transaction costs across governance structures, for transactions of given attributes. For ease of exposition, the former is called direct measurement approach (DMA) and the latter indirect measurement approach (IMA). The IMA represented a breakthrough in methodology, revolutionising the basic thinking on the way transaction costs should be employed in the economic analysis of organisations. The IMA approach, however, depends upon use of an assumption that 'whatever is, is efficient', i.e. that whenever transactions of given attributes are found most frequently to be organised under a particular governance structure, this constitutes proof that the aforesaid governance structure is indeed the most efficient solution available for those transactions. It also requires that possible relative differences in production (as opposed to transaction) costs between governance structures be controlled for in any research.

In the analysis of construction procurement behaviour, there is a growing interest in the application of TCE. Yet, the methodology of operationalisation is not fully agreed. The purpose of this paper is to present an impartial assessment of the merits and demerits of two approaches.

Introductory remarks aside, the other five sections are organised as follows. The second section contrasts two approaches of transaction costs reasoning: the direct-

[1] Williamson's account of Fisher's critique is pertinent here that '. [Williamson,1985]

measurement transaction cost approach (DMA); and the indirect or frequency-measurement transaction cost approach (IMA). The argument is that the applicability of the DMA depends on whether the magnitude of the *elements* of transaction costs that have comparative significance can be reasonably estimated. To answer this question, we first need to know what elements of transaction costs need to be considered. Thus, section three aims to expound the key issue of why some elements of transaction costs are relevant to some problems of organisational choice. Which (elements or categories of) transaction costs are relevant depends upon what governance alternatives are under comparison. We develop the case for a comparison of procurement routes. In section four, we analyse the contractual context of the choice of construction procurement systems (incomplete contracting), and explain which elements of TC we think are and are not relevant for this purpose, and why. In section five we show that, and explain why, those transaction costs with comparative importance in this context are in fact particularly hard to measure, thereby affecting the applicability of the DMA in the analysis of construction procurement. The concluding remarks are in section six.

To keep it within a reasonable length, the whole paper is separated into two parts: the first part, including section one to section three, focuses on the exploration of methodological issues crucial for us to clear away the conceptual confusions about the nature of different types of transaction costs and the conditions suitable for the IMA and DMA; the second part tries, including section four to section six, to apply the analysis results obtained in the first part to the analysis of construction procurement behaviour.

Two Ways Of Applying Transaction Costs Reasoning

A General Illumination

The overriding themes for organizational studies are to rationalize the organization selection at the individual level and frequency dominance of organizational forms at the population level. A rational model based on transaction costs entails showing there is a clear link between costs of organization and organization selection behaviour. Intuitively, a good reason for explaining why GS1 (governance structure 1) is chosen instead of GS2 lies in lower costs of using GS1. Thus, whether a reliable comparison of transaction costs between GSs can be made becomes a critical part of the transaction cost theory. To see the possible ways of doing this, a simple mathematical example will be helpful. We are comparing two variables each capturing transaction costs: A and B. Variable A captures the transaction costs associated with GS1, and variable B the TCs of GS2. Their relative magnitude can be demonstrated by: (1) getting the real value of each of the two variables; or (2) assessing the sign of A-B though logical inference and testing to see if GS1 dominates GS2 in frequency of use wherever the sign of this inferred difference is negative, and vice versa whenever the sign is positive, i.e. Williamson's approach; or (3) presenting A and B in a common non-monetary numeraire (e.g. 'number of disputes') and comparing their respective coefficients.

Certainly, as we change the method to be used, the data requirements will vary. For IMA data is required on measurable *transaction attributes* and on relative frequencies with which governance structures are used, for transactions with different attributes. For DMA data is required on measurable transaction attributes, the relative sums of all transaction costs for transactions with similar attributes under different governance structures, and the absolute values of the comparatively significant elements of total TCs. Data require-

ment can be thought of in two dimensions: the number of transactions on which data is required; and the number of dependent variables to be measured per transaction. In terms of the latter, the data requirement of the direct measurement approach (DMA) is, normally, higher. However, the number of transactions on which data is required will depend upon the number of transaction attributes deemed relevant. If, for instance, only one attribute is judged relevant, then both the number of transactions on which data is required and the number of elements of TC needing to be measured per transaction wil be less than in an analysis where multiple attributes are judged relevant, potentially varying independently and offsetting one another.

It might intuitively appear that the number of transactions required for a DMA study to yield statistically significant results would be smaller than in the case of an IMA study. However, once it is recognised that some of the more comparatively important TCs (e.g. cost of disputes) have low probability of occurrence but high impact when they do occur, on the one hand, and on the other that in IMA it is possible to conduct the analysis of the effect of each attribute independently in terms of *ex ante* probabilities using software such as LIMDEP, it follows that this is not in fact the case.

One further distinction is that the DMA approach is potentially pragmatic. It is not *essential*, in this approach, to generate *ex ante* predictions of the sign of the difference in TCs between GSs. It is enough to observe such difference *ex post*. Transaction attributes still have to be measured, but simply to ensure that like is being compared with like. Whereas, it is essential, in the IMA, to theorise the *expected* sign of difference on the basis of observed transaction attributes. Moreover, whilst the IMA has both normative (advice-giving) and positive (explanatory) objectives, it is fair to say that the DMA *can* (but need not) have mainly normative (advice-giving) ones. Any resulting explanation of why the difference in TCs has the sign it is found, empirically, to have, can be constructed retrospectively.

The benefit of making this distinction is to provoke thought about how to choose a better research strategy for applying transaction costs. The next subsection will give a brief description of how the reasoning of these two approaches will run. The discussion about their merits and demerits will be left to the end of this chapter.

A Methodological Comparison Of The DMA And IMA

The first, and intuitively appealing, way of applying transaction cost reasoning is called direct measurement approach (DMA), requiring the identification and direct measurement of the magnitude of elements of transaction costs and the linking up of the sum of these costs with the governance structure used (eg. hierarchy or market). In contrast, the indirect measurement approach is devised to seek the key determinants that *explain* the relative efficacy of governance structures in terms of transaction costs. We can compare these two approaches in a somewhat formal way.

Assume that using a governance structure, say the market, is attendant with $\boldsymbol{n}$ categories of transaction costs, $TC_i \quad i = 1 \cdots n$. According to the DMA, TC_i needs to be identified first. Then, whether those costs are to be used as explanatory variables for organisation selection or simply used in empirical comparison of TCs across governance structures, they need to be quantified. Summing up all the quantified items of transaction costs can yield the total costs of running a governance structure. Of alternative choices, the one with

minimum $\sum_{i=1}^{n} TC_i$ is regarded as most efficient. This means that in using DMA, the absolute level of elements of transaction costs, and the relative or ordinal level of total transaction costs, must be known in order to determine the efficient organisation in most cases[2]. Because there are several, perhaps many, elements of transaction cost, and because the relative magnitude or 'weight' of each element of transaction cost is not known in advance, DMA requires absolute or cardinal measurement of such elements, even though it requires only ordinal ranking of total TCs.
At this point it is important to note that, although there may be many categories or elements of TCs (e.g legal fees for contract writing, court costs, quantity surveyor fees, inspection costs, contractor selection costs, insurances, performance bonds, etc.) mainly these can be traced to just two ultimate sources. Most TCs arise either as costs of collecting information and measuring outcomes or as costs of opportunism. This will be significant later in the argument.

In contrast to DMA, the IMA stresses comparative difference. Provided there are two alternative governance under review, their running costs can be expressed as $TC^1 = \sum_{i=1}^{n} TC_i^1$ and $TC^2 = \sum_{i=1}^{m} TC_i^2$. The transaction costs difference between them is

$$\Delta TC = TC^1 - TC^2 = \sum_{i=1}^{n} TC_i^1 - \sum_{i=1}^{n} TC_i^2$$

$$= \sum_{i=1}^{n} \Delta TC_i \qquad (\Delta TC_i = TC_i^1 - TC_i^2)$$

Now, we are not concerned either with the magnitude of each component of TC_i^1 and TC_i^2 or $\sum_{i=1}^{n} \Delta TC_i$, but with what factors will contribute to their difference. Put another way, we attempt to find out the following relation:

$$\sum_{i=1}^{n} \Delta TC_i = f(X_k) \qquad k = 1 \cdots l$$

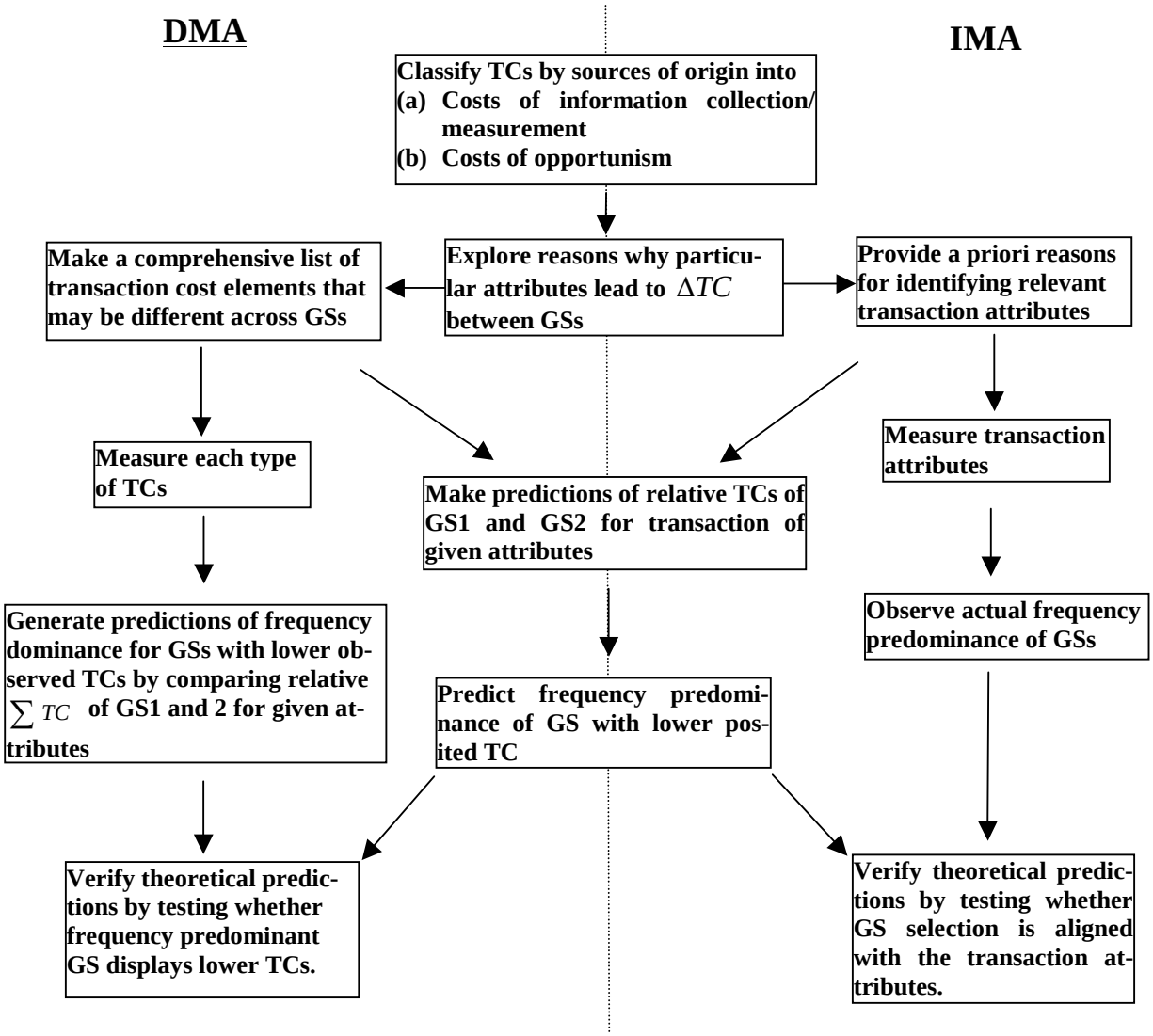
X_k is often called transaction attributes in the TCE literature. In this way, we can get over the difficulties in measuring the absolute level of transaction costs, while it is still possible to derive refutable hypotheses

The procedures for implementing DMA and IMA can be summarized in Fig.1. It is clear that the step of identifying categories of transaction costs that may occur in the course of transactions is their common point of departure. After identifying the sources of transaction costs, we have to interpret why transaction costs will change as transactions are organized in a different way, leading to predicted frequency dominance of one GS over another. These two approaches branch out here. If the DMA is adopted, transaction costs have to be broken down into a comprehensive list of elements for which we have no adequate *a priori* reasons to rule out their comparative significance (i.e. reasons to reject in advance the proposition that they may vary significantly between one GS and another). We can make a prediction purely on theoretical grounds, such as: ***for the transactions***

[2] There are some special cases where without the absolute value of the elements of transaction costs, the costs of governance can still be compared (see Sec.5)

with attributes set A, total TCs will be lower in GS1 than in GS2. A corollary is that GS1 is predicted to be more widely used than GS2, so GS1 will occupy a larger proportion in the population. We thus have two predictions. Provided the first hypothesis is to be tested empirically, first of all, all identified elements of transaction costs or their difference between GSs have to be measured in the same unit. If the unit is money, we can obtain the estimate of the real value of costs. If the unit is an arbitrarily chosen numeraire whose ratios with each element of transaction costs can be relatively easily estimated, we can obtain the estimate of costs in a different unit. With these data in hand, it is easy for us to generate statements about the sign of $\sum \Delta TC$ between GS1 and GS2. Meanwhile, to test the second hypothesis, the actual frequency distribution of GSs for transactions of given attributes has to be investigated. At the last node, theoretical predictions are to be verified by examining whether the dominant GS has lower average transaction costs.

Fig. 1 The flow char of implementing DMA and IMA



However, if the IMA is adopted, we have to use theory to point out transaction attributes that will make governance structures perform differently and then predict the predominance of a governance structure according to these attributes. Take the standard example of TCE. When hierarchy (GS 1) is compared with market (GS 2), their relative advan-

tage will be changing as the degree of asset specificity. The refutability of this theory is built on the following prediction:

$$\begin{cases} \textbf{\textit{If}}\ k \le \bar{k}\ \textbf{\textit{, then}}\ \Delta TC \ge 0\textbf{\textit{, so GS2 will be dominant over GS1.}} \\ \textbf{\textit{If}}\ k \ge \bar{k}\textbf{\textit{, then}}\ \Delta TC \le 0\textbf{\textit{, so GS1 will be dominant over GS2.}} \end{cases}$$

In other words, we focus on the conditions in which hierarchy (or market) is desirable. To prove the validity of this sort of theoretical inference, transaction attributes and the actual selection of GSs have to be recorded so as to generate statistical regularities. From the direction of attributes acting on the selection of GSs, given the assumption that behaviour is transaction cost minimising (profit maximising), the theoretical prediction of effect of attribute on difference in TCs between one GS and another can be indirectly verified.

It is clear that the success of DMA is dependent on two factors: (1) completeness of the list of elements of transaction costs; (2) accuracy of measurement of each element in that list of transaction costs. First of all, it will be ideal to draw up an exhaustive list of transaction costs for every governance structure. Of course, if it can be justified, the items of minor significance can be ignored. Second, there may appear some practical problems in measurement. Using Eq.1 to demonstrate GS 1 is advantageous over GS 2 entails

$$\Delta \boldsymbol{TC} = \boldsymbol{TC}^{\mathbf{1}} - \boldsymbol{TC}^{\mathbf{2}} = \sum_{i=1}^{n} [TC_i^1 - TC_i^2] > 0$$

This inequality can be determined by relative magnitude of aggregate transaction costs of TC^1 and TC^2. In fact, not all categories of transaction costs need to be estimated. Only the categories with a first-order difference need to be computed. The success of DMA is conditional on whether the precise estimate of these costs can be obtained empirically.

In contrast, IMA is, in essence, a deductive method, by which we mean the explained phenomena are rationalized by its logic system, inferring from the first principle – behavioural assumptions. Thus, the validity of theory relies on that of assumptions. According to the mainstream economic methodology [Friedman,1953], the touchstone for a scientific economic theory is not in the realism of its assumptions, assessed directly, but in the predictive power of the theory incorporating those assumptions. Thus, to what extent the theoretical prediction can fit the data is the main concern.

At the end of this chapter, we will come back to discuss which approach is more suitable for the case of this study. Before that, we first have to know what are the categories of transaction costs that may really matter and why.

This inequality can be determined by relative magnitude of aggregate transaction costs of TC^1 and TC^2. In fact, not all categories of transaction costs need to be estimated. Only the category with first-order difference should be computed. As a result, the success of DMA is completely conditional on whether the precise estimate of the categories of first-order difference can be obtained empirically. Before answering this question, we first have to know what are categories of transaction costs that may really matter.

What Are Transaction Costs?

The concept of transaction costs

Transaction costs arises when goods and service are transferred across technologically separable phases of production or distribution [Williamson, 1985]. How costly is the process of transferring is bearing on governance structure being used, ie. the way this process is organized. What reasons make trade incur costs? An intuitive guide is given in Coase(1960):

> *In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on.*

Taking Coase's lead, Dahlman(1979) summarises the key items of transaction costs according to the different phases of transacting as shown in Table 1:

Table 1 Items of transaction costs in the different stages of transacting

Stage of Transacting	Pre-contracting Stage	Contracting Stage	Post-contracting stage
Items of transaction costs	Search and information costs	Bargaining and decision costs	Policing and enforcement costs

As a result, according to Dahlman, transaction costs are rooted in lack of information. For getting over the incompleteness of information, both sides of buyers and sellers have got to locate suitable trading counterparts, formulate acceptable decision criteria, negotiate for better terms and ensure the realisation of ex ante promises. All these efforts involve not only real resource consumption, like telephone bills, information subscription fees, transportation fees, but also the opportunity costs of time spent. In principle, the costs of increasing the available information would turn out to be worthwhile if the quality of decision can be sufficiently improved. And the extent of these costs will affect the efficiency of market relative to hierarchy. This line of definition gives an intuitive understanding to transaction costs, whereas the actual potential sources of transaction costs are beyond the above-mentioned costs caused by, we can call, **the first round** of information problems. The consequences of incomplete information are more than the necessity of overcoming information gap, since the strategic manipulation of information by the informed party can be more devastating to the transaction relation. The later problem, in terms of TCE, results from the interaction between bounded rationality and opportunism. The rationality of decision makers is bounded due to both the incompleteness of the current available information and some extent of ignorance on the future as well as the neurophysiological and language limits. If the extent of incomplete information facing transactors is different, the opportunistic motives for taking advantage of other's vulnerability can be triggered to wrought **the second round** of information problems – the informed party tries to reap a larger share of gain from trade than agreed upon ex ante by disclosing dis-

torted information to mislead his/her trading party. Providing all the opportunistic strategies can be implemented with no cost, the efficiency of carrying out this transaction won't be altered[3] except for redistribution of income. In the general case, the story doesn't wind up here because few people are willing to give up the expected gains without struggling. If the situation goes into disarray, the consequence will be far-reaching. First of all, renegotiation before the expiry of contract will be a direct effect of opportunistic behaviour and how costly it would be depends on the efficacy of dispute resolution mechanism. Second, the lagged effect of a bitter experience will be reflected in the next transaction, leading to two costly outcomes: (1) For reducing the occurrence of renegotiation, more resources will be devoted to formulating the contract in more detail, preventive actions will be taken, such as bonds, and an efficient mechanism for settling disputes will be required to set up. They all entail costs. (2) A possible welfare loss may happen due to less productive technology being employed for avoiding the vulnerable position. According to the above analysis, transaction costs should consist of two parts:

$$TC = TC_I + TC_{II}$$

The first category is caused by the first round of information problems, excluding the intervention of opportunism, while the second category indicates the consequential costs arising from the strategic exercise of information asymmetry by the informed party. As will be clear in the next subsection, this is a key to understand why there is divergent view on transaction costs in the literature.

A Systematic Presentation of information problems of transaction

The major information problems in the transaction is described in

Fig. 2, from which four outcomes may result. First of all, the producer has to make a decision between (1) inefficient but less vulnerable technology (or GS) as well as (2) efficient but vulnerable technology or GS. If the producer goes for the upper branch at Node I with the probability of π_1, the well-documented problem of under-investment of efficient technology (or GS) becomes the issue of interest [Grout (1984), Hart & Moore (1988) , Hart(1995)]. The productivity shortfall arising from the adoption of less efficient technology (or GS) is tantamount to be a social welfare loss, $\triangle W$. If the vulnerable path is taken, two possibilities may happen at note II: opportunistic behaviour will occur or not, with the probability of π_2 and 1- π_2. If the vulnerability is not exploited by the trading party, the TC_{II} will vanish. However, if it takes place, the vulnerable party may either accept the hold-up offer to bear the extra payment ΔP and/or value loss due to inferior quality $v(\Delta Q)$ relative to the condition of perfect competition, or reject the threat of hold-up, thus causing a series of disputes, renegotiation and third-party arbitration. Except for legal costs, the opportunity cost of delay is also important. The consequential costs due to tussling for rent is labeled as $\boldsymbol{TC_c}$. In the worst situation, the vulnerable party may be forced to accept hold-up offer after struggling, so quasi-rent is still expropriated in the form of ΔP and/or $v(\Delta Q)$.

Therefore, a more complete expression of expected type-II transaction cost (TC_{II}) consists of three items as follows:

[3] This is because the total gain from this transaction is still the same if we ignore the effect of wealth.

$$L = \pi_1 \Delta W + (1-\pi_1)\pi_2 \left\{ \pi_3 [\Delta P + v(\Delta Q)] + (1-\pi_3)\left[\pi_4 TC_c + (1-\pi_4)[TC_c + \Delta P + v(\Delta Q)] \right] \right\}$$

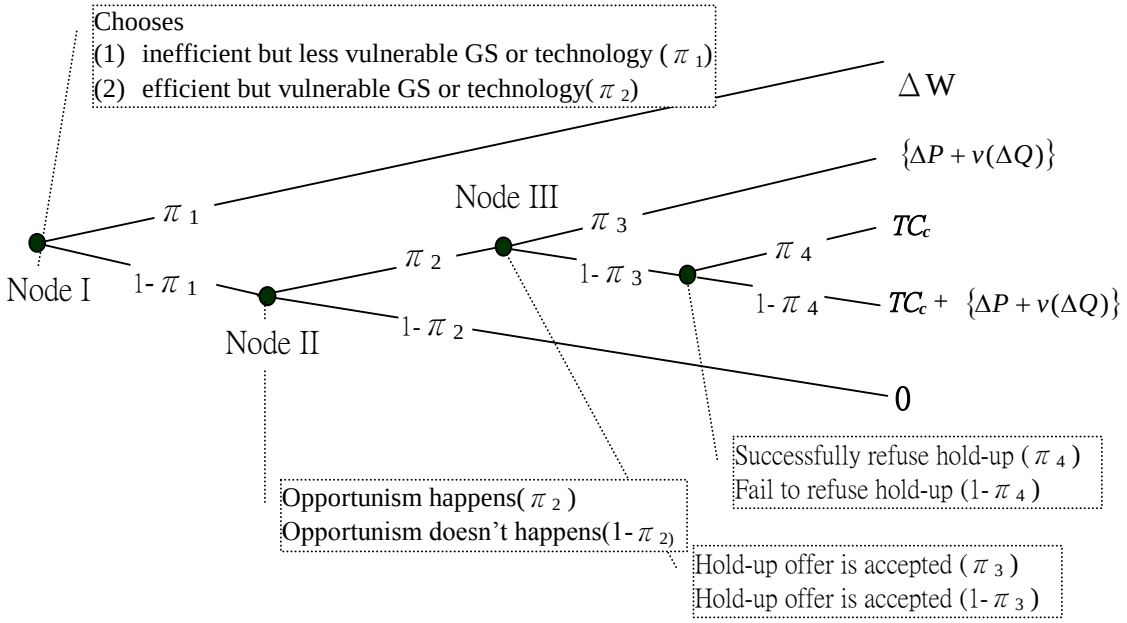
Welfare loss due to inefficient production

Loss due to acceptance of hold-up offer

Loss due to refusal of hold-up offer

Eq. 1

Fig. 2 A structural presentation of information problems in a transaction



The nature of TC_I and TC_{II}

From overall perspective, the TCs that matter are real resource-incurring TCs, which reduce the total economic gain from transaction. However, from the perspective of a single transaction, trying to optimize their profit, behavioural uncertainty (especially opportunism) gives rise to another kind of cost – the negative difference between the promise (on the basis of which the transaction are agreed) and the delivery or outturn. We call this rent-transferring TCs. This is admittedly an appropriation or transfer of economic rent from one transactor to another , rather than a resource-cost. This type of TCs may either be anticipated or not. Where they are anticipated, they result in loss from refusal to engage in a potentially efficient transaction. This loss (the opportunity cost) is measured by the difference between the total economic net benefit that would have accrued from the aborted transaction, in the absence of opportunism, and the economic net benefit of the best alternative arrangement or transaction chosen instead. Where they are not anticipated, they result in a loss of expected return to the transactor, which may reduce return below opportunity costs.

We can classify the elements of **TC_I** and **TC_{II}** according to the nature of those costs, resource-incurring or rent-transferring, into Table 2. By definition, **TC_I** is caused by the first-round information problem in the absence of opportunism. All the costs used to fill up the information gap , as listed in Table 1 are of resource-incurring type. However, this is not the case for **TC_{II}** , which meanwhile contains resource-incurring TCs, such as legal fee

and opportunity cost of delay, and rent-transferring TCs, such as welfare loss due to adoption of inefficient technology or GS ($\triangle W$) ,extra payment (ΔP) and loss due to inferior quality ($v(\Delta Q)$). The purpose of introducing this classification system is to highlight the fundamental distinction of **TC_I** and **TC_{II}** in terms of measurement difficulties.

Table 2 A classification of transaction costs

	TC_I	**TC_{II}**
resource-incurring TCs	1. cost of information collection and search costs 2. cost of bargaining 3. cost of measuring performance of agents or quality of products	legal fee and opportunity cost of delay (TC_c)
rent-transferring TCs		1. welfare loss due to adoption of inefficient technology or GS ($\triangle W$) 2. extra payment ($\triangle P$) or loss due to inferior quality ($v(\Delta Q)$)

The ways of modelling transaction costs

Outside the studies of economic organizations, the most common way of theorizing transaction costs is to treat them as another category of cost, that can be "formalized in a transaction cost function analogous to a production function" [Niehans, 1987]. In the simplest form, the transaction function is often treated as in proportion to the number or volume of transaction. The transaction cost simply plays the same role as a tax, taking away a part of revenue from the receiver [Allen,1991]. This setting can be frequently seen in the works of financial economics and monetary economics, but rarely found in the studies of economic organizations and economic history. Why? The key point lies in whether the trading parties are able to manipulate private information to change counterparty's evaluation of this transaction to this own benefit. If the price cannot be determined independent of the trader's actions, the information problem will not terminate in the first round and its side-effect should not be ignored. Put it other way, if the value of the underlying object of transaction is a stochastic variable, controlled in the hand of God, TC_I is the principal component of transaction costs and its magnitude is generally varying as the number or volume of transaction. Buying shares is a case. For the general cases, the expected return of this investment is not affected by the individual buyer or the seller, so the costs of doing this transaction mainly belongs to the category of TC_I, increasing as the volume of trading. Buying shampoo in the neighbouring store of Boots, Drugstore or Tesco is another example. For finding the best offer, the time and transportation fee spent in every search is quite similar. The transaction costs in this case is proportional to the number of searches. As a result, it is sensible to treat TC_I as a tax-like cost in modelling. However, it is not the case when the second round of problems may be triggered by moral hazard and asset specificity. Difficulties in measuring quality or the performance of the agent as well as the irreversibility and lock-in effect of lump-sum investments are two contributing factors to transaction problems. The transactions subject to these two problems are characterized by (1) the involvement of the agent's efforts to produce goods or

service. Because the attributes of the transaction object, such as quality, can be changed by the trading parties, its value is not only affected by uncontrollable uncertainty by God, but by behavioural uncertainty due to the manipulation of asymmetrical information. Meanwhile, if the transaction elapses a period of time rather than completes on the spot, the influence of post-contractual interaction between trading parties will be growing weighty, making TC_{II} dominate over TC_{I}. When the different types of transaction costs becomes dominant, the principal difference will be made in modelling. For the category of TC_{I} - dominant transactions, transaction costs can be approximately depicted as a tax. However, for the category of TC_{II} -dominant transactions, transaction costs are more than the "fixed costs" per transaction, but governance-dependent. That is, the right way of approaching transaction costs in this case are not from the number or volume of transaction but from the way that the transaction are organized in that the consequential costs arising from behavioural uncertainty are a joint function of attributes of transaction and attributes of governance structures. Only when the chosen governance structure is best suited to the characteristics of the project can the transaction costs be minimized relative to other alternatives. In fact, the role of transaction cost in the first category is quite different from that in the second category. More often than not, the theorists are forced to consider the effect of transaction costs just because the frictionless model fails to explain. Thus, transaction costs are treated as another category of cost like production cost in the marginal analysis. In contrast, the transactions of the second category are generally associated with the organizational issues where involve coordination of trading parties in a certain period of time.

Table 3 A Summary table for the comparison of the IMA and DMA

	TC_I	**TC_{II}**
Alterability of the attributes of the transaction object	No	Yes
Sources of Uncertainty	Parametric uncertainty	Parametric uncertainty Behavioural uncertainty
Way of modelling	Transaction cost as a tax	Transaction cost as the cost of governance
Standard Case	Purchase of shampoo from the neighbouring stores	Comparative institutional analysis

The points of difference between these two approaches are summarized in Table 3. The characterizations of transactions that each approach is analytically advantageous, including period of transacting and alterability of the attributes of the transaction object by trading parties lead to different sources of uncertainty prevailing the transaction. Parametric uncertainty is uncertainty facing all parties and itself will not be affected by individual party's strategy. The expected return of shares in the perfect competition financial market is a case. In contrast, uncertainty may be caused by the possibility that the strategies

taken by the traders may drift out of contract stipulations. Actually, as will be explained in Chapter 4, this is a manifestation of the incomplete contract.

Finally, from the above analysis, the best research strategy for modeling transaction costs should be determined by the composition of $\mathbf{TC_I}$ and $\mathbf{TC_{II}}$ of transaction at issue. Transaction cost as a tax is a sensible simplified view of examining the effect of transaction costs if, $\mathbf{TC_I} >> \mathbf{TC_{II}}$, while we have to put the analysis of transaction costs into the context of governance structure if $\mathbf{TC_I} << \mathbf{TC_{II}}$. This provides a basic reason why these two views coexists in the literature.

Which Way To Go: DMA V.S. IMA

With reference to **Table 4**, the DMA and IMA are distinguished from the perspectives of (1) reality of assumptions, and (2) measurability of elements of transaction cost. The DMA has advantage in requiring less demanding behavioural assumption, that is, whether the agent is able to find the optimal solution is not critical to the verification of the theory in that transaction cost itself (absolute level or relative level) has to be measured. In this respect, the IMA seems more vulnerable to critiques from economic methodologists. In a pure deductive model, the result of analysis can be derived from the basic premises, the proof of mathematical theorems being the case at issue. This has been the ultimate goal for natural or social scientists. But the problem is that the reality is so complicated that we can hardly find a premise that is both realistic and tractable. It is obvious that most researchers appreciate the latter more than the former. This view leads to the pervasive acceptance of assessing the theory by way of its predictive power instead of realism of assumptions. Following this mainstream perspective, the question asked of the IMA is whether the more or less unrealistic assumption will bring too many errors so that the validity of the theory is severely affected. Moreover, in interpreting the unexpected results, the reasons may be ascribed either to (1) the mistaken selection of variables, (2) inappropriate measurement of variables or (3) the wrong behavioural assumption(s). However, the test of hypotheses by empirical investigation is actually sensitive to (1), (2) and (3). That is, only when all three premises are valid can we obtain statistically significant results.

Regarding measurability of transaction cost elements, there is no way out of context to make a judgment about which approach is better. Any reasonable comparison has to be made on the basis of the decision context. As enunciated before, modeling transaction cost as a tax is a sensible way to simplify the problem for dealing with the transaction with parametric uncertainty only. This is also where the DMA is relatively more feasible in that the costs in proportion to the number or volume of transactions can more easily to be estimated reliably. In contrast, if the main sources of transaction costs stem from behavioural uncertainty, the potential costs incurred will go beyond resource-incurring transaction costs and include rent-transferring transaction costs such as extra costs paid or downgraded quality forced to accept. To reveal the complete picture of the effects of behavioural uncertainty, both of these two components have to be taken into account. But, this will pose a tremendous obstacle to those who want to undergo the actual measurement. Measurement of quality shortfall is intrinsically difficult, for obvious reasons. Moreover, whilst it may be feasible to measure the difference between renegotiated or outturn price and contract price, it is not legitimate to assume a priori that all of this difference is necessarily a rent-transferring transaction costs arising from opportunism.

Table 4 Comparison of advantage and disadvantage of DMA and IMA

Dimension for Comparison	Direct Measurement Approach		Indirect Measurement Approach	
	Advantage	**Disadvantage**	**Advantage**	**Disadvantage**
Reality of assumptions	No need to assume ex ante efficiency.			The quality of inference heavily relies on the validity of assumptions, at least the correctness of predictions.
Measurability of transaction cost elements		Need to obtain reliable measures for transaction cost elements of first-order importance	The actual choice can be easily observed.	

Regarding TC_c, the difficulty is even greater. First of all, the costs of settling disputes, the principal element of TC_{II}, have to include the opportunity cost of delay, legal bills and so on. Obviously, the magnitude of these costs varies considerably among transactions. Now the problem facing us is how to infer the representative estimate of the population from the limited samples. In other word, what we want to explore is not whether some particular transaction using GS1 has lower transaction costs than those using GS2, but rather the proportion of GS1 transactions with lower costs in the population. However, due to the stochastic nature of TC_{II}, we need to have substantially large samples to eliminate the biases caused by its high variability. Therefore, for the most research topics where TC_{II} is dominant, the costs of meeting this requirement will be too substantial to be practical. And this is where the DMA is least likely to be applicable.

To sum up, since the potential measurement difficulties vary as the nature of transaction cost types, the relative desirability of the DMA and IMA is naturally dependent on what are the principal elements of transaction costs with comparative significance, which in turn is affected by what are the alternative GSs under comparisons. Accordingly, to give a fair assessment of which one of the IMA and DMA is more suitable to the analysis of construction procurement routes, we have to deepen our understanding about the main sources of transaction costs that may occur in the construction project. This is the issue that we will turn to in our sequel paper.

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