Ex-ante and Ex-post Subcontracting in Highway Procurement Market

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Abstract

Many markets associated with infrastructure procurement have a two-tier structure. In the first tier, the projects are allocated to primary contractors who subsequently subcontract part of the work in the secondary market. The government procurement markets tend to operate under an ex-ante subcontracting rule. That is, every primary contractor proposes a bid that reflects subcontracting decisions, and the prices for subcontracted items. In this paper we study the impact of changing this rule to ex-post subcontracting and measure the magnitudes of associated effects on procurement prices, constructors’ and subcontractors’ profits, and market efficiency.

Our model is designed to capture pertinent features of the infrastructure procurement market that, with a few exceptions, have been ignored in previous work. Specifically, a project in our setting consists of several tasks. Before bidding, the primary contractor makes subcontracting decisions by holding a subcontracting auction on an item-by-item basis. Subcontractors who specialize in the work associated with a given item submit quotes to all primary contractors who are preparing a bid for the main auction. We demonstrate that under this structure subcontractors are incentivized to submit different quotes to different (ex-ante symmetric) bidders. This effect arises because a subcontractor winning an engagement with a given contractor does not necessary result in him working on the project. On the other hand, his probability of working on the project could be increased in discrete non-zero increments. As a result, depending on

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contractors’ own costs, it is possible that a subcontractor is engaged to deliver his services at the price which exceeds his lowest quote. This effect disappears in the setting with ex-post subcontracting, since subcontractors always negotiate with a single contractor and thus submit only one quote.

We develop an identification strategy that demonstrates how available data could be used to identify the underlying distributions of item level private costs for both main constructors and subcontractors. One hurdle that we need to overcome is that we observe a subcontractor’s quote, for a given item and contractor, only when the contractor decides to subcontract the item and the subcontractor submits the lowest quote amongst its rivals. Since oftentimes, for a given item, multiple contractors hire the same subcontractor, we do often observe multiple price quotes from the same subcontractor. This helps us to identify the underlying distribution of subcontractors’ costs. The identification of primary contractors’ costs follows the reasoning similar to that employed in the identification of the Roy model.

We translate our identification strategy into the estimation methodology and apply it to highway procurement data from California to recover the primitives of the model. We use the estimated distributions of private costs to assess the magnitude of the effects associated with switching from ex-ante to ex-post subcontracting requirement.

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