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Valuing the Cost of an Economic Price Adjustment Clause to the Government

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An Economic Price Adjustment (EPA) clause in a contract allows for adjustment of contract price if certain conditions are met. The Department of Defense (DoD) often uses an EPA clause in contracts where there is an increased risk that the costs of inputs used by the contractor will diverge from the forecasts used in the original pricing of the contract. EPA clauses transfer risk from the contractor to the government; thus, they are of economic value to the contractor. This article reviews EPA clauses, analyzes the value of risk transfer, and discusses how DoD could account for this value in negotiating fees for contracts that contain EPA clauses. Other government costs and risks associated with EPA clauses are also discussed.

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An Economic Price Adjustment (EPA) clause in a contract allows for adjustment of contract price if certain conditions are met. The Federal Acquisition Regulation (FAR) (2005) permits use of an EPA clause when "there is serious doubt concerning the stability of market or labor conditions that will exist during an extended period of contract performance."[1] The DoD uses EPA clauses in areas like multiyear procurement (MYP) contracts; for example, recent C-17, F/A-18 E/F, and AH-64D Apache Longbow MYP contracts all contained EPA clauses covering certain labor costs and contracts for highly volatile commodities, e.g., fuel.

EPA clauses transfer risk from the contractor to the government; thus, they are of economic value to the contractor. For example, a contractor may be able to get better financing terms for a project, given the contractor's lower risk exposure. In other areas of government contracting, hedging a contractor's risk is grounds for adjusting the target fee used in establishing contract price. For example, the Defense Federal Acquisition Regulation Supplement (DFARS) recommends using a higher target fee in a Firm Fixed Price (FFP) contract than in a Fixed Price Incentive Firm (FPIF) contract, where more risk is shared with the government. But, the weighted guidelines method contained in the DFARS does not clearly address how to adjust target fee[2] when an EPA clause is used.[3] After a brief review on the background of EPA clauses, this article analyzes the potential value of EPA clauses and discusses how this value could be taken into account in negotiating a contract.

Background

A fixed price contract commits the contractor to absorb the cost risk associated with providing the agreed-upon product or service. Cost risk can result from unexpected changes in input prices, unfavorable changes in a manufacturing process, labor strikes that shut down production, or other unforeseen events. This works both ways for contractors. If they are not able to control costs, they are exposed to losses; if they are able to control and reduce costs, they retain the higher profit.

Different types of contracts distribute risk between contracting parties in various ways. An FPIF requires the contractor to share cost changes from a negotiated target while an FFP contract puts all of the cost risk on the contractor. EPA clauses place the inflation risk for certain elements of cost—e.g., steel, titanium, labor, or a combination of cost elements—with the government.

The typical EPA clause specifies "[a]djustments based on cost indexes of labor or material" (FAR, 2005). The indexes chosen should be correlated with the cost elements at risk, but should also be broad enough to be outside of the contractor's control (DFARS Procedures, Guidance, and Information, 2012). Most EPAs are written with symmetry between upward and downward price adjustments. However, contractors who have the greatest exposure to upward pressure on input costs will more likely prefer an EPA clause. An EPA clause would be disadvantageous to those expecting a decrease in input prices (which would normally lead to higher profits); to the degree that contractors can influence whether an EPA clause is included, this would result in a higher incidence of upward price adjustments.[4]

In addition to the intended transfer of risk for particular labor or material inputs, EPA clauses can entail unintended risks from such things as poorly chosen indexes and strategic behavior driven by the existence of the EPA clause. The choice of the price index is important. Researchers of past studies have found difficulties in the application of EPA clauses. In some cases, the EPA clause was linked to price changes that were not sufficiently coupled to the actual underlying inputs to the contract that established the need for the clause. We refer to this as "basis risk." For example, Keating, Murphy, Schank, and Birkler (2008) found that the Steel Vessel Index, constructed in the 1950s to track the prices of common materials used in ships, was not representative of modern naval vessels and had been substantially more volatile than the prices of common input materials for modern naval ships. To overcome this inaccuracy, several ship program managers have created their own materials cost indexes.

The DFARS directs that the costs subject to the EPA be fixed at contract start, including the proportions of labor and material, and their allocation across time. This is intended to limit the contractor's ability to shift resources and "game" the EPA clause once a contract has started. Choice of index is also important in limiting gaming of an EPA clause, as some indexes that have been used could allow the contractors' actions to affect index values. For example, in the first F/A-18E/F MYP contract, an index based on the contractor's actual labor rates was used.[5] The Department of Defense Inspector General (DoDIG, 2008) found that Boeing's prefunding of pension liabilities directly affected the Bureau of Labor Statistics' aircraft industry labor compensation index, which was used in calculating EPAs for three Boeing contracts. These unintended risks may result in payments to the contractors that otherwise would not have occurred. Updates to the DFARS and improvements in government/industry practice have better regulated these issues; the F-22 MYP contract includes a good example of a well-written EPA clause. In this case, the portions of contract cost affected were narrowly defined, and the labor indexes specified used a broad formulation for fringe benefits. However, given imperfect information and the limitations of available indexes, the possibility of using an inappropriate index remains.

EPA-like clauses are also used to mitigate risks in commercial, long-term supply agreements in capital-intensive industries (Goldberg & Erickson, 1987). A common objective of these agreements in commercial transactions is to stabilize supply availability; the purpose of the EPA-like component is to transfer pricing risk to the party most able to manage it. Like an EPA clause in a government contract, the private contracts use a price index to adjust the transaction price in the long-term agreement. For example, a supplier of wrought titanium might index processed mill product prices to the cost of titanium sponge. Public firms must estimate the value of these EPA-like clauses for their quarterly and annual financial reporting if the language of the clause implies an embedded risk option. In some cases, the firm can use market prices for similar options for a valuation; in other cases, it must use a model. For estimating the value of an EPA clause in a defense weapons system contract, the same process can be applied. The valuation method is dependent on the type of commodity covered under the clause.

Value of Risk Transfer in Government Contracts

EPAs in government contracting transfer risk from the contractor to the government. In commercial transactions of this sort, the party that "sells" risk is expected to pay a premium to the party that "buys" risk. The financial and insurance industries have developed sophisticated tools for estimating the value of risk, thus the "premiums" that should be paid for various types of risk transfers. In government contracting, the premium would be paid by a downward adjustment to the target fee earned by the contractor, set during determination of the contract price. The DFARS does not clearly address fee adjustments to account for the risk transfer when including an EPA clause.[6] Presently, contracting officers use their own judgment in determining whether to reduce the contract fee to reflect the lower cost-risk exposure, and no guidance is provided to contracting officers as to what might be an appropriate adjustment level.

The DFARS does take into account other forms of risk transfer and provides recommendations on target fee adjustments to account for their value, e.g., moving from an FPIF to an FFP contract. These recommendations can provide rules of thumb for valuing other types of risk transfer. The Table lists the range of fees paid for contract risk based on contract type.

TABLE. DFARS CONTRACT RISK FEE POLICY

Contract Type	Normal Value	Designated Range
Firm-fixed-price (FFP), no financing	5.0%	4 to 6%
FFP, with performance-based payments	4.0%	2.5 to 5.5%
FFP, with progress payments	3.0%	2 to 4%
Fixed-price incentive (FPI), no financing	3.0%	2 to 4%
FPI, with performance-based payments	2.0%	0.5 to 3.5%
FPI, with progress payments	1.0%	0 to 2%
Cost-plus-incentive-fee	1.0%	0 to 2%
Cost-plus-fixed-fee	.5%	0 to 1%

For example, if an FFP contract with progress payments has a 15 percent fee, 3 percentage points are for contract risk. The value of the risk transfer (as indicated by the DFARS "profit" rules) associated with an FPIF contract vice an FFP contract is 1 percent.[7] Note that the rules make no distinction between an FPIF with a high share ratio (e.g., 80 percent of overruns/underruns absorbed by the government) and one with a low share ratio. However, the designated range allows the contracting officer some leeway in accounting for the different levels of risk transfer possible in an FPIF contract.

Valuing EPA Risk Transfers Using Financial Models

The value of an EPA clause is what the finance literature calls the "risk premium"—the minimum price (or fee reduction) that the government might charge for taking the specific risk from a contractor.[8] The financial tools used to determine the market price of risk implied in hedging debt and commodities form the basis for valuing an EPA clause.

Keynes (1930, pp. 142–44) and Hicks (1946, pp. 146–47) were the first to develop theories on the returns associated with commodities futures markets. Their *normal backwardation* theory postulated that the risk premium would accrue, on average, to buyers of futures (analogous to the government for an EPA). This was due to producers (the contractor) selling futures—thereby hedging their profits—to speculators (the government), who required in return a price below the expected spot price at maturity (potential decrease in negotiated fee). This is similar to a hedger buying insurance from an insurance firm that serves as the speculator. The insurer expects that the premium includes compensation for administration and other management expenses associated with the insurance policy. These are all analogous to an EPA.

To apply this to valuing the cost of risk to the government associated with EPA clauses, consider two extremes: a contract that is exposed to general inflationary risks in all elements of cost, e.g., labor and materials, and a contract exposed exclusively to risk in its commodity costs. In the first case, the entire contract is exposed to general inflation and the risk that this inflation deviates from the forecasted inflation used in developing the contract. The risk that, overall, all inflation deviates from forecasted inflation is called the Inflation Risk Premium (IRP). In this case, if the government were to charge a risk premium to hedge the contractor from the entire amount of this risk, it could be estimated directly as the IRP. This premium would be reflected as a reduction of the fee paid to the contractor.

To understand the IRP, begin by examining risk premium generically. A risk premium is the discount required on an investment whose cash flows are subject to fluctuations in value due to its exposure to a particular risk. The price discount is computed as the price relative to the same asset that is free of the risk exposure. For example, the equity risk premium, as used in the capital asset pricing model, is the discount investors require on an investment in the market portfolio of equity securities relative to the risk-free rate. For U.S. stocks, this can be estimated by calculating the rate of return implied by the Standard & Poor's 500 index over 10 years and subtracting the yield on the 10-year Treasury Note.

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This equity risk premium example is merely an illustration of the purpose of a risk premium. An EPA clause is designed to target very specific risks, in most cases inflation. Fortunately, this type of risk can be decoupled from certain types of publicly traded debt instruments. For a fixed rate note, the value of the interest payments is eroded should the rate of inflation exceed the rate that was assumed when the note was originally issued.[9] The IRP compensates investors for bearing the risk of inflation.

The other extreme case is when the risk is due to exposure to price volatility of specific commodities, only a fraction of the overall cost of the contract value is at risk. In this case, if the government hedges the contractor from commodity price inflation, the value of the risk premium is more like that embedded in the related commodities futures market—if one exists—in which commodities producers hedge price risk by selling futures contracts. Commodities make up only a small fraction of the cost of major defense acquisition programs. Even with the largest historical price swings for such commodities as titanium or nickel, the overall cost of the contract is unlikely to change by more than 1 percentage point (Arnold, Patel, & Harmon, 2011; Tran-Le & Thompson, 2005). While a risk premium based on specific commodities can be estimated, it may be the case that such an EPA would not justify the cost of its implementation and management effort.[10]

The U.S. Government raises debt through two main offerings: U.S. Treasury securities, which pay nominal interest rates, and Treasury inflation-protected securities (TIPS), which pay "real rates."

An EPA clause is most likely to be used in situations between these two extremes where most of the input price volatility is correlated with volatility in the overall inflation rate.[11] In these cases, one approach is to begin with the IRP and adjust it for the fraction of total contract cost represented by the inputs covered by the EPA clause.

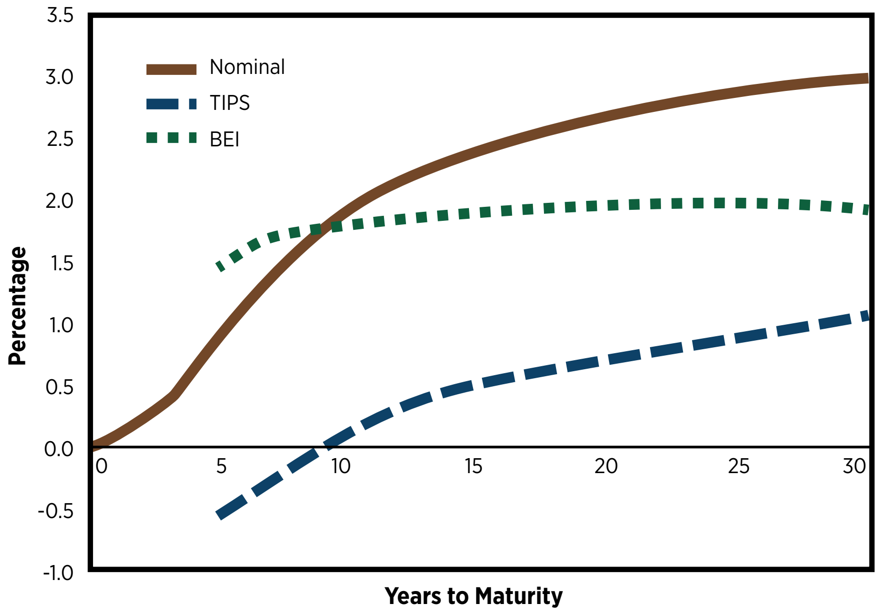
The U.S. IRP can be estimated by analyzing U.S. Treasury securities along with a consistent inflation forecast.[12] The U.S. Government raises debt through two main offerings: U.S. Treasury securities, which pay nominal interest rates, and Treasury inflation-protected securities (TIPS), which pay "real rates." The *term structure* of interest reflects the set of yields on fixed interest rate notes maturing in the future. Comparing the effective yield of U.S. Treasury notes against their maturity date shows the term structure that reflects the market's expectation of future interest rates. When the economy is expected to grow, the curve is usually upward-sloping. The market's expected inflation—inferred from price forecasts, commodity futures, and other economic data—is also embedded in this term structure. The Figure shows the yield curve for nominal Treasury securities and TIPS from September 26, 2011 (Board of Governors, 2011).

The difference between the yields on similarly maturing nominal Treasury securities and TIPS is the "break even" inflation (BEI) rate. The BEI rate can be deconstructed into the expected inflation rate and the IRP, as follows:

Break Even Rate = IRP + Expected Inflation

The inflation-protected and nominal Treasury securities parallel the pricing of contracts with and without an EPA (linked to general inflation), respectively. The government saves the IRP by providing inflation risk protection; alternatively, the IRP is the cost of paying nominal rates. The government implicitly charges TIPS investors this premium relative to the buyers of nominal Treasuries. In similar fashion, an FFP contract with an EPA (linked to general inflation) is like providing inflation protection and the value of this IRP.

FIGURE. NOMINAL TREASURY AND TIPS YIELD CURVE WITH BREAK EVEN INFLATION RATE



Note. Adapted from "Selected Interest Rates – H. 15: Daily Updates" by Board of Governors of the Federal Reserve System (U.S.) (September 26, 2011). Retrieved from http://www.federalreserve.gov/releases/h15/update/

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Application

The process of applying this to a procurement contract starts with a clear identification of what input is being covered and whether the contracting officer can identify a good market index or price series. Next, the overall effect of the commodity's price volatility on the contract cost must be estimated. Large price fluctuations for inputs such as titanium in the F-35 have a relatively insignificant effect on the overall cost of the contract, because they represent a small fraction of the cost. On the other hand, even mild fluctuations to general inflation can affect all of the contract's inputs, leading to relatively large cost changes.

Although the IRP concept is relatively simple, computing an estimate from interest rate data can be a relatively complicated task.[13] It has been done using time series analyses of interest rate data and both historical and forecast inflation rates (Grishchenko & Huang, 2008). The IRP can also be estimated from prices for fixed income securities other than Treasuries.

The risk exposure from materials and other specialty commodities' price volatility may be too small to merit an EPA clause.

Examples of IRP estimates show that the premium varies over time. Inflation volatility is not stationary, and the IRP varies with economic uncertainty and expectations of high or low inflation.[14] Recent estimates of the IRP show it as low during periods of low inflation expectations and high during periods of high uncertainty. Shiller and Campbell (1996) estimated the IRP to be between 50 and 100 basis points by analyzing nominal 5-year Treasury yields over the period 1953 to 1994.[15] More recently, Durham (2006) of the Federal Reserve reported the IRP ranging from 15 to 120 basis points over the period from late 2000 to 2005. Grishchenko and Huang (2008) reported a smaller IRP—2 to 63 basis points—from their vector autoregression analysis of TIPS prices. A more recent staff report by Adrian and Wu (2009) of the Federal Reserve points to a higher IRP ranging from around 40 to over 250 basis points.

As stated earlier, the risk exposure from materials and other specialty commodities' price volatility may be too small to merit an EPA clause. One exception to this could be a contract for a product or service for which commodities such as food services or fuel were a high fraction of the cost. The commodities risk premium is typically higher than the IRP. Estimates from commodities futures data find the premium is similar to that for equities—about 4 to 5 percent. This premium was estimated by Fama and French (1987), among others (Gorton & Rouwenhorst, 2005; Basu & Miffre, 2011), using an equally weighted portfolio of commodities.

One way to deal with this would be for an FFP contract with an EPA clause to have a fee decrement of 50 basis points relative to an FFP contract without the clause, reflecting the IRP estimates for the present period of low inflation risk. The fee decrement could be adjusted by the cost share ratio if the contract type was an FPIF. This fee adjustment reflects the cost of bearing the risk that input prices could differ from expectations. The contract should already reflect the expected inflation rate so that the bearer of the risk exposure can reasonably expect to get the same degree of good news versus bad news.

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Other Considerations

Other issues of risk and cost arise from the inclusion of an EPA clause in a contract. For example, effort required to manage the clause once the contract is executed carries an additional administrative cost. Also, the government faces a number of risks, discussed previously in the background section, by accepting the clause. These risks are closely related to the concept of an EPA clause as insurance. The risks include the basis risk associated with the indexes used; other risks can be related to risks inherent in any insurance: adverse selection (contractors with higher inflation risk opting into an EPA) and, to some extent, moral hazard (the contractor having an incentive to change its behavior to manipulate the EPA).

In addition to adjusting the contract fee by the IRP, the government should also consider managing basis, adverse selection, and moral hazard risks the way insurance companies deal with these risks. The government should evaluate its level of understanding of the contractor's costs and its incentives given an EPA clause. If the government deems itself at a significant informational disadvantage, it may need to apply insurance-like provisions to its contracts to share risks. One common insurance practice is coinsurance—only insuring a fraction of the loss exposure, perhaps 75 percent. A variation on coinsurance is a trigger band that is directed in the DFARS and is common in EPAs: The contractor is exposed to a narrow band of volatility—say ±3 percent—outside of which the government is fully exposed to the loss or gains.

Ultimately, assessing these other risks is idiosyncratic and requires an in-depth assessment of the specific contract and contractor. This is in contrast to the methodology described in this article to use market-derived risk premiums to price specific, but not supplier, idiosyncratic risks.

Discussion

An EPA clause transfers risk from the contractor to the government; in essence, it constitutes an insurance contract. EPA clauses, therefore, provide value to the contractor and cost to the government, and the government could take this into account in determining contract price. Setting the target fee used to establish contract price provides an opportunity to account for the value of an EPA clause, and the DFARS Weighted Guidelines now provide contracting officers with some flexibility to do so. If the government wanted to account for the value of the risk transfer systematically, it could develop adjustment factors for inclusion in the weighted guidelines.

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The IRP, which is based on the Consumer Price Index (CPI), reflects a more diversified portfolio of goods than a typical EPA clause linked to a single commodity such as steel. Further study could also be performed to gauge the risk exposure of the various contract elements for which the government is willing to allow EPA clauses. Simplicity in constructing these clauses is important, and it may be that a single risk premium is sufficient to equitably price the EPA clause. To develop systematic guidelines, the government would have to consider adjustments to the EPA fee decrement to reflect changes in the IRP during periods of very high inflation expectations. While the literature does provide estimates of the IRP, a consistently applied method, possibly based on TIPS and nominal notes, might provide an effective pricing tool that captures changing inflation trends.

It is important to remember that the IRP will not keep the government from paying inflation adjustments associated with an EPA clause; rather, compensation to the government for bearing the volatility risk may drive the adjustments. Furthermore, the fee adjustment concept outlined herein does not consider the premium for bearing other risks associated with EPAs, namely basis risk, adverse selection, or moral hazard.

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References

Adrian, T., & Wu, H. (2010). *The term structure of inflation expectations* (Staff Report No. 362). New York: Federal Reserve Bank of New York Staff Reports.

Arnold, S. A., Patel, P., & Harmon, B. (2011). *The material breakdown of the F-35 Joint Strike Fighter and the Mine Resistant Ambush Protected Vehicle* (IDA Paper P4648). Alexandria, VA: Institute for Defense Analyses.

Basu, D., & Miffre, J. (2009). *Capturing the risk premium of commodity futures: The role of hedging pressure.* Retrieved from http://ssrn.com/abstract=1340873

Board of Governors of the Federal Reserve System (U.S.). (2011, September 26). *Selected interest rates – H.15: Daily updates.* Retrieved from http://www.federalreserve.gov/releases/h15/update/

Department of Defense Inspector General. (2008). *Effect of payment into Boeing pension funds on economic price adjustment clauses in DoD contracts* (Report No. D2008099). Arlington, VA: Author.

Department of Defense Inspector General. (2009). *Cost increases related to the Producer Price Index for titanium mill shapes on DOD multiyear contracts* (Report No. D-2010-004). Arlington, VA: Author.

DFARS Procedures, Guidance, and Information, § 216.202-4 (2012).

Durham, J. B. (2006). *An estimate of the inflation risk premium using a three-factor affine term structure model* (Finance and Economics Discussion Series). Washington, DC: Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board.

Fama, E., & French, K. (1987, January). Commodity futures prices: Some evidence on forecast power, premiums, and the theory of storage. *Journal of Business, 60*(1), 55–73.

Federal Acquisition Regulation, Vol. 1 § 16-203-2(i) (2005).

Goldberg, V. P., & Erickson, J. R. (1987). Quantity and price adjustment in long-term contracts: A case study of petroleum coke. *Journal of Law and Economics, 30*(2), 369–398. Retrieved from http://www.jstor.org/stable/725501

Gorton, G., & Rouwenhorst, K. (2005). *Facts and fantasies about commodity futures.* National Bureau of Economic Research Working Paper 04-20. Cambridge, MA: Yale School of Management.

Grishchenko, O. V., & Huang, J. (2008, April). *Inflation risk premium: Evidence from the TIPS market.* Paper presented at the meeting of the 18th Annual Derivatives Securities and Risk Management Conference, Arlington, VA.

Hicks, J. R. (1946). *Value and capital* (2nd ed.). Oxford: The Clarendon Press.

Keating, E. G., Murphy, R., Schank, J. F., & Birkler, J. (2008). *Using the steel-vessel material-cost index to mitigate shipbuilder risk* (Tech. Rep.). Santa Monica, CA: RAND National Defense Research Institute.

Keynes, J. M. (1930). *A treatise on money* (Vol. II). New York: Harcourt, Brace, & Company.

Shiller, R. J., & Campbell, J. Y. (1996). A scorecard for indexed government debt. In B. S. Bernanke and J. Rotemberg (Eds.), *National Bureau of Economic Research Macroeconomics Annual 1996.* Cambridge, MA: MIT Press.

Tran-Le, J., & Thompson, S. (2005). *China's impact on metals prices in defense aerospace.*

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Endnotes

1. In the FAR and DFARS, fixed price contracts (encompassing contacts that would otherwise be FFP or FPIF) with an EPA clause are considered a unique contract type. Thus, guidance regarding the EPA clause is included in sections describing contract types, specifically, FAR part 16 and DFARS subpart 216.
2. This article uses the term fee to refer to the difference between the contract price and the underlying cost of the contract to the contractor. This is to reflect the distinction with contractor economic or accounting profit, which is unlikely to be identical to the negotiated fee. The concept of fee here is referred to as profit in DFARS subpart 215.4.
3. Section 215.404-71-3 of the DFARS titled "Contract type risk and working capital adjustment" provides guidance on pricing contract type risk. If an EPA clause is included under the contract type category "Fixed-price with redetermination provision," the guidance is to set the fee as if it were a fixed-price incentive contract with below normal conditions. If, without the EPA clause, the contract would be priced as an FFP contract with a "normal fee" for contract risk of 3 percent, then this means that adding an EPA would reduce the fee to less than 1 percent. This fee adjustment may be reasonable for fixed-price contracts with prospective price redetermination (FP-PPR) where the price of the entire item being purchased could be adjusted upward in the future. However, for an FFP contract with an EPA, this could be a severe fee reduction if the clause references direct labor or materials that could be small fractions of the overall contract value.
4. In the finance and economics literature, this is referred to as "adverse selection" and is addressed later in our article.
5. Although there was no evidence of manipulation in this case, using an index driven by a contractor's own labor rates opens the possibility of increasing enterprise-wide profits though cost-shifting.
6. For government contracts, the tools for pricing FAR part 15 contracts are limited to percentage-of-contract-cost fee guidelines that outline the amount that should be paid as a function of the level of cost risk and management effort to which the contractor is exposed.
7. The fee difference between FFP and FPIF contracts could also partially reflect the greater level of government management effort required for an FPIF contract.
8. There may be other costs associated with the EPA that the government may seek to recover from the contractor. For example, there could be recompensable costs associated with administering the EPA. In this article, we are restricted to examining the cost of quantifiable risk.
9. Inflation is not the only economic factor that can erode the value of a bond; other factors are credit risk and the risk that market interest rates may rise.
10. Note that titanium may be vulnerable to potential gaming as the majority of domestic titanium metal is used in aerospace applications (DoDIG, 2009).
11. The expected inflation rates for contract inputs should already be reflected in the contract price excluding the EPA.

12. Alternatively, if the general forecast is believed to be not significantly different from the recent past, the IRP could be estimated from historical U.S. Treasuries and Consumer Price Index data.
13. For example, Adrian and Wu (2009) use a Kalman filter to estimate the parameters of a generalized autoregressive conditional heteroskedasticity model (GARCH) of the inflation rate risk premium.
14. Adrian and Wu (2009) found the IRP was strongly correlated with the equity Chicago Board Options Exchange Volatility Index or VIX.
15. Shiller and Campbell (1996) also estimated that the option value of inflation protection was about 140 basis points.