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Challenges in Defense Working Capital Fund Pricing

Analysis of the Defense Finance and Accounting Service

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Preface

In 1999, RAND published *Defense Working Capital Fund Pricing Policies: Insights from the Defense Finance and Accounting Service* (Keating and Gates, 1999). That document analyzed the Defense Finance and Accounting Service's (DFAS's) cost structure and recommended changes in Defense Working Capital Fund (DWCF) pricing policies to better accord with DFAS's cost structure.

In early 2001, DFAS leadership asked RAND to further examine DFAS's cost structure and pricing policies via a project entitled "Improving the Defense Finance and Accounting Service's Price Structure." This report summarizes the results of that examination. The authors recommend pricing policy changes to more closely align DFAS's prices to its cost structure, thereby providing DFAS customers with more appropriate incentives in their decisions on how much and what sort of workload to provide to DFAS.

This report should be of interest to the management of DFAS and to policymakers and researchers interested in Department of Defense budgeting and resource management.

The research for this study was conducted for DFAS within the Forces and Resources Policy Center of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the unified commands, and the defense agencies. For more information on RAND's Forces and Resources Policy Center, contact its director, Susan Everingham, susan_everingham@rand.org, 310-393-0411, extension 7654. Comments on this report are welcome and may be addressed to the project leader, Edward Keating, at keating@rand.org.

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Summary

Background

The Defense Finance and Accounting Service (DFAS) provides finance services (such as paying military members, government-employed civilians, and contractors) and accounting services (such as tabulation and analysis of customer obligations and expenditures) to Department of Defense (DoD) customers. This report examines the DFAS pricing structure and its impact on customer incentives and behavior.

We believe the DFAS pricing structure is important on two levels. First, with approximately $2 billion in expenditures per year, DFAS itself is a sizable portion of the DoD infrastructure. Second, we believe the pricing issues that DFAS confronts are similar to those faced by other Defense Working Capital Fund (DWCF) organizations, including the Defense Logistics Agency (DLA), the Defense Information Systems Agency (DISA), the Defense Commissary Agency (DeCA), and the military services' depot systems. Analysis of DFAS's pricing issues might therefore provide insights into the pricing structures of DoD working capital fund organizations in general.

Like other DWCF organizations, DFAS covers its expenditures by charging customers for its services. DFAS charges per "work unit" (e.g., per account paid) for its finance services and charges by the hour for its accounting services. Hourly rates for accounting services vary by customer; finance fees generally do not. Various finance products represented about half of the DFAS regions' fiscal year 2001 (FY01) expenditures, accounting represented about 40 percent of the regions' expenditures, and information services represented about 10 percent.

Prices Matter Most When Customers Have a Choice

Prices matter most to customers when they have discretion in what they buy. For some DFAS finance and accounting products and services, known as "outputs" in the DFAS vernacular, customers have little flexibility in what they can demand for their money, so it is largely irrelevant whether DFAS charges per work unit or simply assesses an annual lump-sum fee. With military pay outputs, for instance, customer demands are exogenous to pricing incentives because the amount of

military-pay services that customers purchase is unrelated to how much DFAS charges for such services.

However, for some outputs, customers have some demand discretion. DFAS customers can exercise that discretion in a number of ways:

- First, DFAS customers could potentially vary the quantity of services they demand based on DFAS's prices. Elasticity in demand could exist for accounting services in particular.
- Second, the amount or quantity of services demanded by customers could vary if customers have a choice of service providers. DoD policy to date has prevented DFAS customers from purchasing services from other non-DFAS governmental providers, such as the Department of Agriculture's National Finance Center (NFC), or private-sector firms. For a few outputs, customers may have the option of providing the services themselves.
- Third, for several outputs, DFAS customers have a choice between automated or electronic commerce (EC) and manual provision of the same output. (Ideally, an EC approach both improves accuracy and reduces costs.) DFAS offers customers various prices depending on whether they choose an EC or manual approach for how DFAS performs the service. Rates of adoption of EC have varied considerably across outputs. We believe that price-setting based on EC processing as opposed to manual processing of outputs could be approached in a number of feasible ways. In other words, customers might receive a small or a substantial discount (or any amount in between) for adopting EC outputs. The greater the discount, the more likely it is that customers will adopt an automated approach. We term large price discounting for EC outputs "aggressive pricing." This approach is most advisable when customers are price sensitive, when EC options have largely fixed costs, and when manual costs fall when the amount of manual workload falls. EC approaches have the potential to reduce DFAS expenditures in the medium and long run.
- Fourth, customers have some discretion in how accurately and effectively they supply work to DFAS, placing a lesser or greater workload burden on the agency. Customers who provide inaccurate input or are delayed in supplying input put an extra burden on DFAS as compared with customers who provide accurate input on time. The current DFAS pricing system imperfectly adjusts for this workload burden heterogeneity. DFAS customers are responsible for penalty interest payments that result from delayed invoice payments. Also, hourly billing for accounting services penalizes highly burdensome DFAS customers. But for many finance outputs,

customers are not meaningfully penalized or rewarded based on the workload burden they place on DFAS.

Simple Prices Lead to Cross-Customer Subsidies

DFAS prices for finance outputs generally do not vary by customer. This simple approach to billing has a drawback: It appears to create fairly extensive cross-customer subsidization.

DFAS does not collect expenditure data by customer. It does, however, tabulate expenditure data by output and by DFAS location. These data are useful because they can help us to infer just how much different customers are costing DFAS. The locations have very different expenditure levels per work unit of a given output, and customers tend to concentrate their workload at specific locations.

If one assumes that expenditures per work unit do not vary by customer within a location, one would conclude that considerable cross-customer subsidization exists. Customers who use inexpensive locations (primarily those of the Army and Navy) are losing out relative to those customers who use expensive locations (i.e., those of the Air Force and Marine Corps). Adopting customer-specific and/or location-specific pricing structures would mitigate this problem.

DFAS's Cost Structure Points to Nonlinear Pricing

We found that few (if any) DFAS costs change in the short run as workload levels vary. DFAS's output-invariant cost structure interfaces poorly with the current DFAS pricing structure. As a result, customers might withdraw work from DFAS to save money, but the DoD as a whole might save nothing because DFAS costs do not fall commensurably.

A specific analysis of the Kansas City region's accounting services shows that the region's expenditures and workload both vary considerably from month to month, but there is no apparent correlation between the two data series. (Expenditure variation appears to be driven by idiosyncratic spikes in nonlabor expenditures.) Neither civilian expenditures overall nor civilian overtime expenditures are correlated with workload.

If DFAS were to adopt nonlinear pricing (e.g., quantity discounts), customer incentives (vis-à-vis giving DFAS more or less work) would more closely align with the agency's cost structure.

Has Hourly Billing for Accounting Changed DFAS Behavior?

In October 1999, DFAS switched from per-account billing for accounting services to the current system of hourly billing for these services. This reform had the virtue of ending widespread subsidization of DWCF customers at the expense of appropriated fund customers.

Some DFAS customers who were interviewed for an earlier RAND study (Keating et al., 2001) expressed the concern that the new billing regime would create bad incentives for DFAS (e.g., little incentive exists for DFAS to rein in its costs). Those customers noted that DFAS can simply pass on whatever costs it incurs under per-hour accounting billing to the customer.

To evaluate these concerns, we analyzed the DFAS regions' accounting expenditures before and after the billing policy change (i.e., prior to and after October 1999). If customers' concerns were valid, we would expect to see increasing levels of accounting expenditures after the policy change.

A variety of statistical analyses found no significant evidence that DFAS accounting services expenditures have evolved adversely since the billing policy change. As best as we can determine, the hourly billing for accounting services has had the beneficial effect of being more equitable to DFAS customers without having an adverse effect on DFAS behavior.

Conclusions

How a DWCF provider such as DFAS prices its services sends a variety of messages to its customers. This report covers a number of areas for improvement in communication between DFAS and its customers in regard to pricing for DFAS services:

- Aggressive pricing (i.e., discounting) of EC outputs could further encourage customer adoption of automated approaches to provision of outputs.
- One-price-for-all policies for finance outputs have the unfortunate effect of cross-subsidizing high-cost customers at the expense of low-cost customers.
- DFAS's linear, expected-average-cost pricing structure does not mesh well with the agency's apparent cost-versus-output invariance. Customers have an over-incentive to withdraw workload from DFAS and inadequate incentive to provide as much work as they can to the agency. Changes in DoD pricing regulations are necessary to allow nonlinear, customer-specific

pricing, which would provide DFAS customers with more appropriate incentives for how much and what sort of workload to provide to DFAS.

In addition, we found no significant evidence that DFAS behavior has been altered by the switch from per-account billing to the more equitable hourly billing for accounting services.

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Of course, remaining errors are the authors' responsibility.

Acronyms

ADP	Automatic Data Processing, Inc.
DeCA	Defense Commissary Agency
DFAS	Defense Finance and Accounting Service
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DoD	Department of Defense
DWCF	Defense Working Capital Fund
EC	Electronic commerce
EDI	Electronic data interchange
FY	Fiscal year
MOCAS	Mechanization of Contract Administration Services
NFC	National Finance Center
OPLOC	Operating location
OSD	Office of the Secretary of Defense
RADSS	Resource Analysis Decision Support System
SAMMS	Standard Automated Material Management System

1. Introduction

As its name suggests, the Defense Finance and Accounting Service (DFAS) provides finance and accounting services to its customers in the Department of Defense (DoD). DFAS's finance services include paying members of the military, government-employed civilians, and contractors, and its accounting services include the tabulation and analysis of customer obligations and expenditures.

RAND has undertaken a series of research projects at the behest of DFAS leadership. Keating and Gates (1999) analyzed the relationship between DFAS's costs and its workload and argued for changes in Defense Working Capital Fund (DWCF) pricing policies. Keating et al. (2001) studied the interactions between DFAS and its customers and suggested how those interactions might be improved. In early 2001, DFAS leadership reengaged RAND to undertake a more in-depth examination of DFAS pricing policies, building upon the Keating and Gates study. This report presents the results of that effort.

Like other DWCF organizations—including the Defense Logistics Agency (DLA), the Defense Information Systems Agency (DISA), the Defense Commissary Agency (DeCA), and the military services' depot systems—DFAS establishes prices for the services it provides. When a customer wants services from DFAS, it must purchase those services from DFAS and then transfer funds to DFAS. DFAS uses this revenue as a self-sustaining way to pay its employees, buy supplies, and buy services from other organizations. DFAS is required to break even over time.

An examination of DFAS and its pricing policy is important on two levels. First, DFAS is a sizable part of the DoD's support infrastructure. DFAS spent about $2.1 billion running its operations in fiscal year 2001 (FY01). Second, we hypothesize that many of the issues that arise in the context of DFAS are also germane to other DWCF entities. For instance, the working capital fund approach is used extensively within the military services (e.g., for their depot repair and supply systems). As such, the insights discussed in this report are valuable to an audience beyond just DFAS.

Chapter 2 presents background information about DFAS, Chapters 3 through 6 present findings about DFAS's pricing structure, and Chapter 7 presents our conclusions. In Chapter 3, we note how DFAS prices are relevant only in certain contexts (e.g., because DFAS customers are subject to constraints in their choice

of service providers). In Chapter 4, we show that because simple per-unit prices for finance services do not vary by customer, a considerable amount of "subsidization" occurs across customers. In Chapter 5, we demonstrate how DFAS's cost structure seems to be characterized by few costs that change, in the short run, with workload levels. Such an output-invariant cost structure argues for nonlinear pricing and against traditional DWCF expected average cost pricing. In Chapter 6, we discuss the results of DFAS's transitioning from per-account to per-hour billing for accounting services. Contrary to customer concerns, we find no significant evidence that DFAS has increased its accounting expenditures as a result of this new billing regime.

2. DFAS Background

Founded in 1991, the Defense Finance and Accounting Service merged finance and accounting operations that were previously separate and specific to each military service. The logic of this agglomeration was that costs could be reduced through economies of scale and a reduction in the number of disparate finance and accounting systems in use.

DFAS Organization

DFAS is headquartered in Arlington, Virginia. Reporting to the headquarters are five regional centers in Cleveland; Columbus, Ohio; Denver; Indianapolis; and Kansas City, Missouri. Three of the five regional centers have operating locations (OPLOCs) that report to them. The regional centers largely devote their efforts to specific military clients, as shown in Table 2.1.

DFAS Services

DFAS is a provider of multiple finance and accounting products, or "outputs" in DFAS vernacular. DFAS also sells computer support services (Information Services), which do not fall under the finance or accounting categories. DFAS's services are listed in Table 2.2.

Figure 2.1 shows that accounting represented almost 40 percent of the DFAS regions' total expenditures in FY01. Information Services, at 9 percent, was the second largest expenditure category. On the finance side, commercial invoices and contract invoices using the Mechanization of Contract Administration Services (MOCAS) system are payments to DoD contractors. The execution of such payments cumulatively represented about 14 percent of DFAS regions' FY01 expenditures. Payments of wages to active military personnel represented about 8 percent of the expenditures. Other products made up the remaining 30 percent, and no other single output's expenditures totaled more than 5 percent of the regions' FY01 expenditures.

Table 2.1

DFAS Regional Centers, OPLOCs, and Customers

Regional Center	Associated OPLOCs	Primary Customer
Cleveland, Ohio	Charleston, South Carolina Honolulu, Hawaii[a] Norfolk, Virginia Oakland, California Pensacola, Florida San Diego, California	Navy
Columbus, Ohio	None	DoD agencies
Denver, Colorado	Dayton, Ohio Limestone, Maine Omaha, Nebraska San Antonio, Texas San Bernardino, California	Air Force
Indianapolis, Indiana	Lawton, Oklahoma Lexington, Kentucky Orlando, Florida Rock Island, Illinois Rome, New York Seaside, California St. Louis, Missouri Kaiserslautern, Germany (Europe OPLOC)	Army
Kansas City, Missouri	None	Marine Corps

SOURCE: DFAS Web site: http://www.dfas.mil.

[a]DFAS also has a satellite facility in Japan that reports to the Honolulu OPLOC.

Table 2.2

DFAS Products and Services ("Outputs")

Finance	Accounting
Civilian Pay	Direct Billable Hours
Commercial Invoices	Finance and Accounting Commissary
Commercial Payments—Government Purchase Card	
Contract Invoices (MOCAS)	
Contract Invoices (SAMMS)	
Foreign Military Sales	
Military Active Pay Accounts	
Military Pay, Incremental	
Military Reserve Pay Accounts	
Military Retired Pay Accounts	
Out-of-Service Debt Cases	
Transportation Bills	
Travel Vouchers	
Information Services Support	

NOTES: MOCAS = Mechanization of Contract Administrative Services; SAMMS = Standard Automated Material Management System.

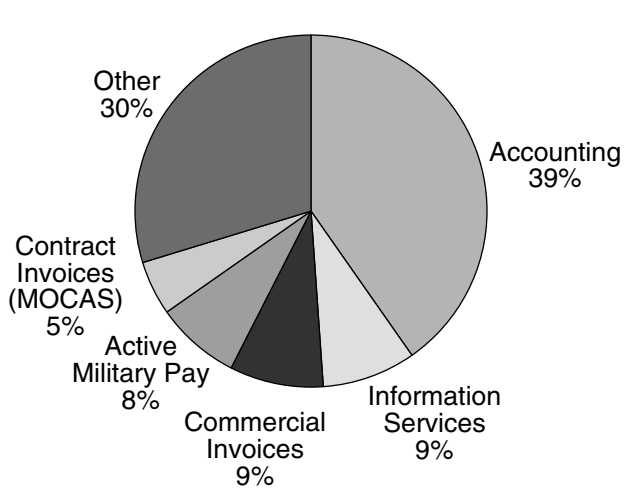

Figure 2.1—DFAS Regions' FY01 Expenditure Shares by Output

DFAS Pricing

DFAS is a DWCF entity. As such, it is supposed to charge its customers for services performed to recover its operating costs.

As discussed in Keating and Gates (1999), DFAS's price structure is linear, i.e., DFAS revenue increases in direct proportion to its workload. For each output, DFAS has a service provision measure defined in terms of "work units," and each output's work unit has an associated price, as shown in Table 2.3. For finance outputs, the work unit metric is the action undertaken, e.g., the processing of a travel voucher or the issuance of a check. For accounting, on the other hand, most billing is by the hour, with accounting for the Defense Commissary Agency (billed on a per-commissary account basis) being the sole exception. Information Services work is also billed by the hour.

For finance outputs, all customers typically pay the same price per work unit. For accounting, however, hourly rates are customer-specific.

The finance per-work-unit rates and the accounting hourly rates are burdened. They include not only direct DFAS personnel costs, but also allocations of DFAS overhead and facilities' costs.

DFAS adjusts its prices on an annual basis, with the prices designed to reflect its revenue and costs. Price determination is developed over a two-year-long process. First, DFAS estimates its costs and workload for each output for two

Table 2.3

DFAS FY01 Prices per Work Unit

Output	Price ($)
Finance	
Civilian Pay	3.17
Commercial Invoices	17.88
Commercial Invoices (EC)	8.54
Commercial Payments—Government Purchase Card	6.21
Contract Invoices (MOCAS)	113.80
Contract Invoices (MOCAS)—EC/EDI	88.60
Contract Invoices—DeCA	2.89
Contract Invoices (SAMMS)—DLA	14.28
Contract Invoices (SAMMS)—EC/EDI	5.90
Foreign Military Sales	166.24
Military Active Pay Accounts	8.92
Military Pay Incremental	10.95
Military Reserve Pay Accounts	4.16
Military Retired Pay Accounts	2.11
Out-of-Service Debt Cases	4.60
Transportation Bills	28.78
Travel Vouchers	32.60
Travel Vouchers—Disbursement Only	3.33
Information Services Support	56.53
Accounting	
Direct Billable Hours	
Air Force	65.39
Army	66.21
Navy	85.89
Marine Corps	83.86
Defense Logistics Agency	73.22
Defense Agencies	69.56
Finance and Accounting Commissary (per account per month)	3,059.00

NOTES: EC = Electronic Commerce; EDI = Electronic Data Interchange; DLA = Defense Logistics Agency.

years into the future. The cost and workload estimates are then vetted through customers with the Office of the Secretary of Defense (OSD) Comptroller ultimately adjudicating disagreements between DFAS and its customers. DFAS cost estimates, for price-setting purposes, include not only the direct costs of providing the output, but also allocations of OPLOC, regional center, and headquarters overhead, plus assessments (if needed) to cover losses from the previous year. The U.S. General Accounting Office's report GAO/AIMD-97-134 (1997) describes the DWCF price-setting process in more depth.

3. Prices Matter Most When Customers Have Some Choice

As discussed earlier, DFAS, like other DWCF providers, charges for its services. For example, DFAS provided 434,818 military reserve pay "actions" (i.e., work units) to the Marine Corps in FY01. At $4.16 per reserve pay work unit (see Table 2.3 in Chapter 2), the Marines were asked to transfer $1,808,842.88 to DFAS for military reserve pay services.

In fact, this payment transfer could have occurred without the use of any pricing system: If the Marine Corps had simply been forced or agreed to transfer $1.8 million to DFAS, DFAS might have agreed to fulfill all the Marine Corps' military reserve pay needs. Indeed, prior to the formation of DFAS, the Marine Corps provided military reserve pay services itself without using a transfer pricing system.

So then, what is the value added from the use of a pricing system in this case? Or, to put it another way, what concerns might have arisen if DFAS and the Marine Corps had simply signed a contract whereby DFAS agreed to provide all military reserve pay services the Marines needed for the year for $1.8 million, with no adjustment in the payment based on the specific number of reservists paid?

One might imagine at least two concerns with such a no-incremental-cost, flat-fee approach. DFAS might be concerned that the Marine Corps would take advantage of a situation in which they paid a flat fee for military reserve payment services (e.g., the Marine Corps might ask DFAS to pay more personnel than originally anticipated). On the other hand, the Marine Corps might be concerned that a flat-fee arrangement would not be fair to the service if, for some reason, the Marine Corps ends up having fewer military reservists than expected. In Chapter 5, we discuss DFAS's cost structure and why we are generally unsympathetic to either of these concerns.

The remainder of this chapter focuses on possible ways DFAS customers might have some ability to respond to how outputs are priced. For instance, the Marines, to continue the previous example, may change their behavior based on the level of the per-unit fee charged (e.g., $4.16 for each additional military reservist versus no additional charges for each extra reservist under a flat-fee arrangement).

How Customer Behavior Might Vary Depending on Pricing

A primary reason to have a pricing system within the DoD, rather than direct funding for output provision, would be if pricing affects customer behavior. In the DFAS context, customers can alter their behavior in several different ways.

Changing the Quantity of Work Demanded

A customer may increase or decrease the workload it provides to DFAS in response to pricing changes. However, much of DFAS's workload (i.e., the output demand) is determined exogenously. For instance, the number of Marine reservists is determined by national military strategy. That number is almost certainly not influenced by the cost of processing paychecks for reservists, nor should it be, of course.

Many other DFAS outputs (e.g., pay to members of the military and civilians, contract payments, travel vouchers) share the same characteristic: The quantity of work demanded is driven by a wide variety of factors external to DFAS and apart from its prices. Thus, the quantity of output demanded will not vary with DFAS's prices (i.e., the demand is inelastic with respect to price) as long as DFAS is the only possible provider.

The most clear-cut exception to this inelasticity in demand lies in accounting services. Previous RAND research (Keating et al., 2001) found considerable latent demand for cost accounting services such as activity-based costing. Cost-effective provision of such services by DFAS could lead to considerable increases in how much accounting work is requested of DFAS.

The general inelasticity of demand for DFAS services would also change markedly if customers were able to consider alternative providers. We discuss this scenario next.

Changing Service Providers

At present, most DFAS customers are "stuck," in their words, with DFAS. They have only limited flexibility in who performs their finance and accounting services work. One way in which they can be flexible is in deciding whether to perform the work themselves.

There are a few examples of such "borderline" cases in which the customer could purchase DFAS services or elect to do the work itself. For instance, the Army has

DFAS provide it with installation-level "Military Pay Incremental" services. The Navy and Air Force, by comparison, provide such services themselves and do not hire DFAS to perform this function. In a borderline case such as this, one could imagine a military service reclaiming or relinquishing a function based on DFAS's prices.

In general, however, the military services have lost the capability to provide many DFAS-provided services themselves. The clear alternative would be for the military services to hire outside providers. There are alternative providers within the federal government, such as the Department of Agriculture's National Finance Center (NFC), and myriad private-sector providers such as Automatic Data Processing, Inc. (ADP). It is beyond the scope of this study to assess the feasibility or desirability of letting DFAS customers buy services from outside providers. There would clearly be considerable challenges and opportunities in policy reform such as this.

Heretofore, DoD policy has been for DFAS itself to undertake some "A-76" cost comparisons. (A-76 refers to the Office of Management and Budget circular describing the rules for cost comparisons between public and private providers.) With an A-76 cost comparison, a "performance work statement" or "statement of work" is developed that describes the work to be performed. Then, private contractors and government employees both bid to perform the work.[1] A recent A-76 competition resulted in workload for military retiree/annuitant pay services being transferred to the private firm ACS Government Services (see Defense Finance and Accounting Service, 2001). DoD policy has been to not allow specific customers to move workload from DFAS to the NFC or to private providers via A-76 competitions. Instead, DoD policy has called for DFAS to directly administer A-76 competitions.

Changing How Service Is Provided

In recent years, DFAS customers have been given flexibility in how services are provided to them. In particular, for commercial invoices, MOCAS contract invoices, SAMMS contract invoices, and travel vouchers,[2] discounts are provided to customers who accept an automated approached, such as electronic commerce

[1] An extensive literature exists on the A-76 process. See, for example, Gates and Robbert (2000).

[2] With "disburse-only" travel vouchers, DFAS customers perform the associated preparation work (e.g., receipt validation). DFAS simply receives an electronic list of whom to pay and how much to pay them. We categorize this approach as automated, but we have no way to determine if the processes used by customers prior to their handing the electronic payment list to DFAS are automated to any degree.

(EC), rather than the traditional manual approaches.[3] (See Table 2.3, which shows that customers pay less for the EC versions of these outputs than for the parallel non-EC outputs.)

Figure 3.1 shows that EC approaches by far have been used to the greatest degree for travel vouchers and SAMMS contract invoices, and use of EC has lagged for commercial invoices and MOCAS contract invoices. (All four of these outputs were introduced at the beginning of FY 2000, so the different adoption rates for EC are not due to different times at which the outputs were made available to customers.)

Setting prices for manual outputs versus prices for parallel automated outputs is a challenging task. As discussed in Chapter 2, current DWCF regulations typically require use of *expected average cost pricing.* With expected average cost pricing, expectations for future costs and future volume are formulated for each output. The ratio of these cost and volume expectations is the output's price.

Multiple price/quantity combinations for outputs delivered via EC could possibly satisfy DWCF pricing rules. For example, a relatively high price for EC output might result in limited adoption of EC. Meanwhile, a relatively low price for EC output might result in greater adoption of EC. When determining an EC-based price, the manual price must be simultaneously determined. The manual price will be higher in comparison with the relatively low-priced EC output than it would with the relatively high-priced EC output because the fixed manual costs would be distributed over a smaller manual workload.

Figure 3.2 presents an illustration of manual-based pricing versus EC-based pricing using commercial invoices as an example. In FY01, DFAS charged $8.54 per EC commercial invoice and $17.88 per manual commercial invoice. Roughly 95 percent of DFAS's commercial invoice workload was manual that year; the vertical line in Figure 3.2 is at the observed 5 percent EC level.

Meanwhile, DFAS's regions spent $15.76 per manual commercial invoice and $5.86 per electronic commercial invoice in FY01 . If one assumes all these costs are fixed in the short run (i.e., changing the manual/EC workload mix would not have changed either the total manual or EC expenditures), one can trace out the two curves shown in Figure 3.2. (In Chapter 5, we defend the first-order assumption that all DFAS costs are fixed in the short run.)

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[3]With EC, products and services are delivered electronically via computer rather than delivered on paper using manual methods.

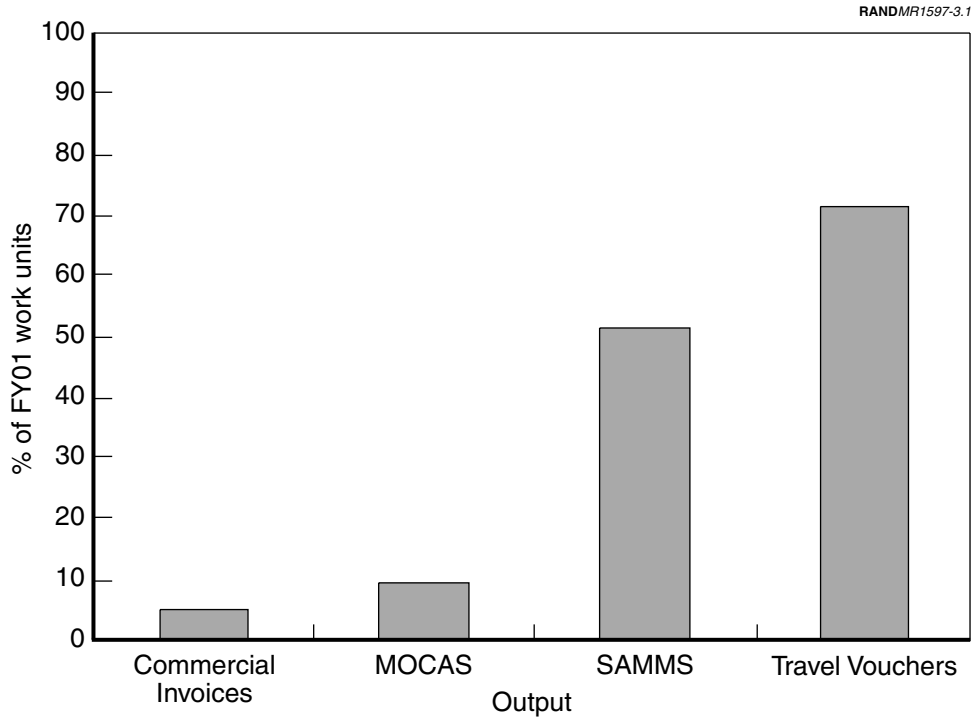

Figure 3.1—Percentage of Work Units by Output Delivered Using Electronic Commerce, FY01

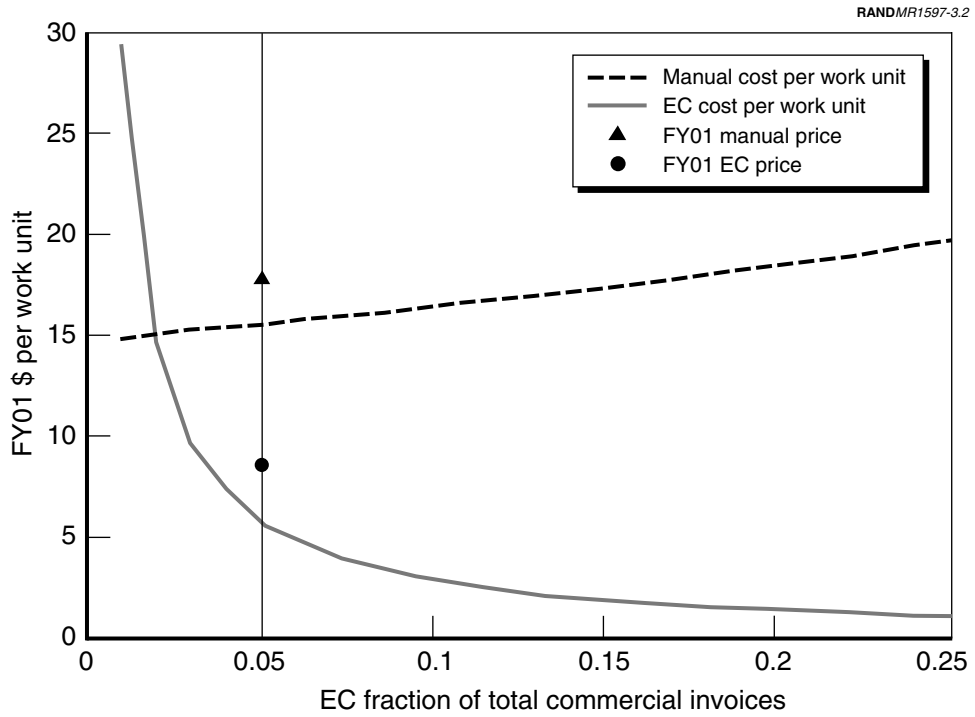

Figure 3.2—Actual and Notional Commercial Invoice Pricing for Manual Output Versus EC Output, FY01

Figure 3.2 illustrates how average regional expenditures per work unit would change as the amount of EC workload changes. We infer from Figure 3.2 that commercial invoice EC prices could be very low, as long as one believed that the low EC price would markedly increase adoption of EC. We define "aggressive pricing" as the case of discounting EC outputs considerably with the belief that such discounts will be justified by large-scale shifts in quantity toward automated approaches. Aggressive pricing is most likely to succeed when customers are price-responsive, when EC costs do not increase substantially with workload quantity, and when manual costs fall rapidly due to the decline in manual workload.

Will EC Approaches Save DFAS and Its Customers Money in the Long Run?

In Figure 3.2, we assume both manual and EC commercial invoice costs are fixed in the short run. Of course, if the costs of both types of output were fixed in the long run, it would not matter whether customers adopted EC approaches, and there would be no reason to engage in aggressive pricing.

Aggressive pricing is an appropriate choice when greater utilization of EC reduces total DFAS expenditures in the medium or long run. The cost of manual output must fall more than the cost of EC output rises when the workload shifts from a manual to an EC approach. Some evidence exists to support this hypothesis. Figure 3.3 shows civilian labor as a percentage of FY01 total DFAS expenditures for Commercial Invoices, MOCAS, SAMMS, and Travel Vouchers. In the case of SAMMS and Travel Vouchers, the more automated approaches are considerably less civilian labor intensive than their manual counterparts. If one assumes that labor costs are variable in the medium and long run, Figure 3.3 suggests SAMMS and Travel Voucher total costs will fall in the long run as an increasing amount of workload shifts toward automated approaches.

Figure 3.4 shows that computer-related expenses are greater for automated SAMMS and Travel Vouchers than they are for Commercial Invoices and MOCAS.[4] We hypothesize that computer-related expenditures tend to be output-

[4]Some DFAS computer-related expenditures are capitalized and then amortized over time. Other computer-related expenditures are recorded as "lump sums" in specific months and are not amortized, even if they represent multiple months' computer services. For example, three or four months of DISA computer charges might be expensed in a single month in the Resource Analysis Decision Support System (RADSS). Due to this "lump sum" computer charge phenomenon, month-to-month DFAS computer expenditures are artificially variable in RADSS. In Figure 3.4, however, we display annual data for which we believe the effects of nonaccrual computer expense accounting are less pronounced than they would be with monthly data.

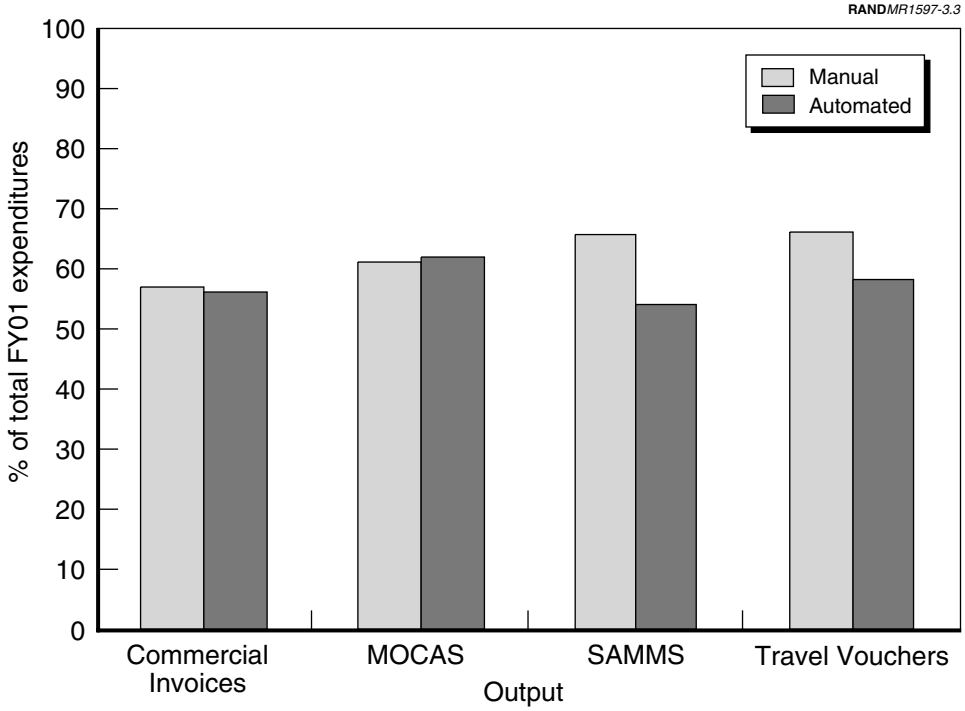

Figure 3.3—Civilian Labor Costs for Manual and Automated Output as a Percentage of Total FY01 Expenditures

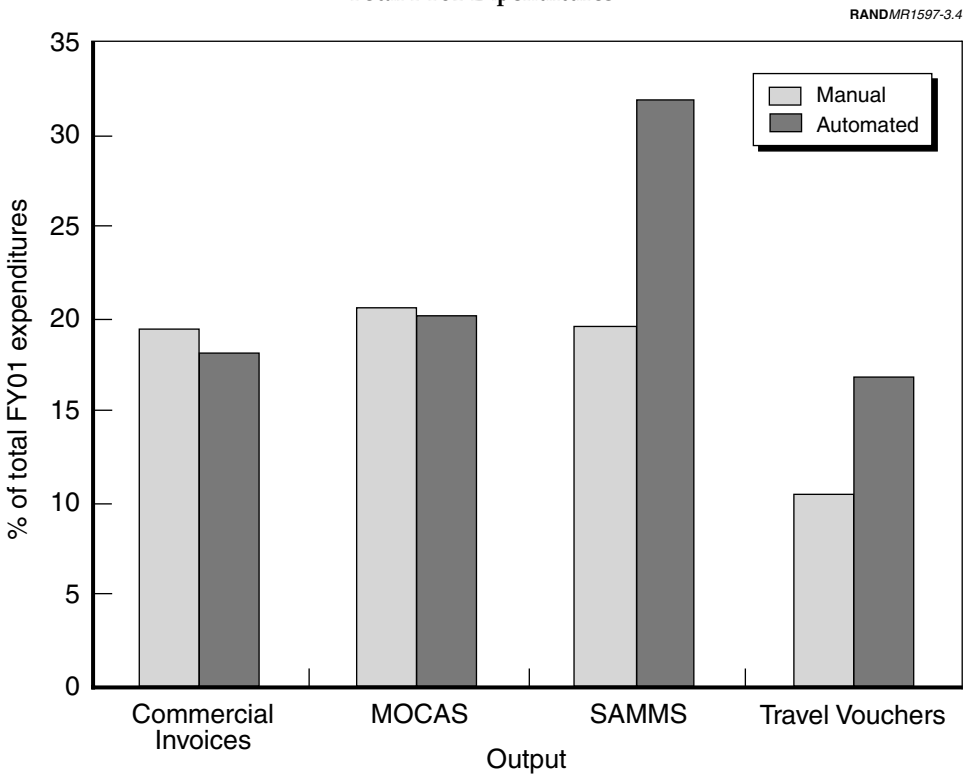

Figure 3.4—Computer-Related Costs for Manual and Automated Output as a Percentage of Total FY01 Expenditures

invariant. A piece of software designed to deal with Travel Vouchers might almost as easily handle 100,000 units per month as it would 1,000 units. As in Figure 3.3, Figure 3.4 suggests that an increase in SAMMS and Travel Voucher automation would reduce DFAS expenditures for these outputs in the long run, if one accepts the argument that computer costs are more output-invariant than civilian labor costs.

The results for the Commercial Invoices and MOCAS outputs shown in Figures 3.3 and 3.4 are puzzling. For those outputs, there is no meaningful difference between manual and automated approaches in terms of either civilian labor costs or computer-related services as a percentage of total DFAS expenditures.

For Commercial Invoices, however, there is some evidence that the type of civilian labor used in the automated approach is different from that used in the manual approach. Figure 3.5 shows the FY01 average civilian expenditures per civilian work year for the four types of outputs.

The average expenditure for automated Commercial Invoice civilian labor exceeding the average expenditure for manual civilian labor is consistent with the hypothesis that automated output uses greater numbers of higher-skilled,

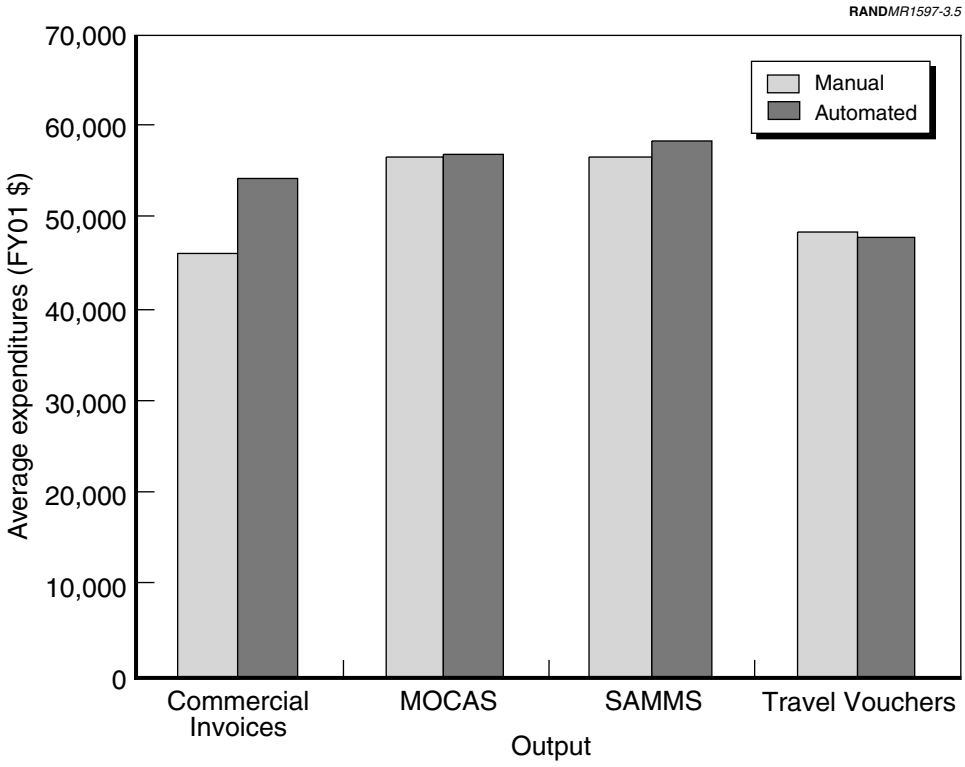

Figure 3.5—Average Civilian Labor Expenditure per Civilian Work Year, FY01

computer-literate, high-cost labor (e.g., programmers) than does manual output of Commercial Invoices. If this hypothesis is true, it might be that these "computer programmer" costs are output-invariant, so increasing automation of commercial invoices could still decrease total DFAS costs. We view this argument as speculative and not definitive.

We cannot explain the lack of meaningful difference between the manual and automated approaches for the MOCAS output in any of the three previous figures. It may simply be that EC MOCAS processes are not all that different from manual MOCAS processes. In FY01, DFAS regions' average expenditure per EC MOCAS contract invoice was $94.22. The average expenditure per manual MOCAS invoice was only slightly higher, at $97.71.

The Burden Customers Place on DFAS

DFAS personnel we interviewed in the course of the research noted that the burden that customers place on DFAS varies depending on the quality of the input the customer supplies. For instance, customers who provide inaccurate or delayed input place a greater extra burden on DFAS than do customers who are timely and accurate.

This heterogeneity in the quality of customer input has been addressed to some degree. First, as discussed in Keating et al. (2001), customers are responsible for penalty interest payments that result from delays in paying their invoices. Second, hourly billing for accounting services, which started in October 1999, implies that customers whose practices put an excess accounting burden on DFAS will pay for those burdensome practices. For a number of finance outputs, however, customers are not substantially punished or rewarded for level of burden they place on DFAS.

In Chapter 6, we discuss hourly billing for accounting services in more depth. Addressing some customer complaints heard during the course of previous RAND research (Keating et al., 2001), we found no evidence that DFAS has behaved opportunistically (e.g., increased total costs) in the presence of hourly accounting billing. Hourly billing has the considerable virtue of charging customers who present a higher burden to DFAS (e.g., working capital fund customers)[5] more accurately for the accounting services they receive. Indeed, one could imagine DFAS evolving toward hourly billing, versus per-work-unit billing, for finance outputs.

[5]See Keating et al. (2001) for a discussion of the workload demands of working capital fund customers.

Summary

DFAS's per-work-unit prices matter most to customers when those customers have discretion of some sort. For the purchase of some outputs, we found that customers had no discretion whatsoever under current constraints. For example, the Army cannot pay soldiers itself and current rules preclude hiring an outside provider. And the Army is certainly not going to increase its forces just to opportunistically take advantage of a flat-fee structure for Military Active Pay services.

As we discuss in Chapter 4, we suspect DFAS's marginal cost per Military Active Pay account is essentially zero. Given the purchasing constraints on customers and the inelasticity in the DFAS cost structure, charging flat annual fees with no marginal costs for Military Active Pay services seems appropriate.

Per-work-unit prices have the most impact in cases in which customers have some choice in providers and/or output methods. Current rules leave little room for choosing among providers, but customers have some leeway in choosing between manual and automated approaches. The setting of manual and automated prices may have multiple feasible solutions. We urge aggressive pricing policies in which low prices for EC output encourage adoption of such automated approaches. EC approaches have the potential to reduce DFAS expenditures in both the medium and the long term.

4. How Simple Prices Lead to Cross-Customer Subsidies

In this chapter, we advance the argument that DFAS's current pricing structure is too simple and results in large-scale cross-customer subsidization of some DFAS customers at the expense of others. Referring back the DFAS FY01 price list in Table 2.3 in Chapter 2, there are 18 separate per-work unit prices for finance outputs and 6 separate customer-specific hourly rates for accounting outputs. For finance outputs, prices do not generally vary by customer.

Expenditure Differences by Output and by Location

There are several reasons for the differences in customers' hourly rates for accounting. Some customers have their accounting services provided by more-expensive personnel and/or at more expensive locations (e.g., locations such as Seaside, California, with a higher local cost of living). Also, customers with more computer-intensive accounting (such as the Navy with its Standard Accounting and Reporting System) pay a higher hourly rate because the labor rates are burdened with computer and other nonlabor accounting costs. DFAS does not, however, charge customer-specific rates for finance outputs.

Unfortunately, DFAS's Resource Analysis Decision Support System (RADSS) data do not tabulate finance expenditures by customer. RADSS does, however, tabulate expenditures by DFAS location. The average expenditure per work unit varies considerably across different locations. Illustrating this phenomenon, Table 4.1 shows the average expenditure per Commercial Invoice in FY01 across the locations that provided this output in FY01.

It is interesting to note that Norfolk, Virginia, DFAS's largest commercial invoice location, has the lowest average expenditure per invoice of all the locations. This fact is consistent with there being economies of scale in providing this output.

DFAS locations disproportionately (but not entirely) serve specific customers. Table 4.2 shows the locations from which customers received Commercial Invoice services in FY01 and the number of work units received by customer.

Table 4.1

Commercial Invoice Expenditures and Work Units by Location, FY01

Location	Expenditures ($000s)	Work Units (000s)	Average Expenditure per Invoice ($)
Charleston	5,845	343	17.05
Columbus	9,960	618	15.68
Dayton	6,508	270	24.11
Europe	10,170	526	19.34
Honolulu	5,383	246	21.85
Indianapolis	23,901	1,282	18.64
Kansas City	5,211	243	21.48
Lawton	3,189	305	10.46
Lexington	947	95	9.98
Limestone	5,451	266	20.51
Norfolk	13,703	1,672	8.20
Oakland	3,495	207	16.92
Omaha	6,448	373	17.28
Orlando	6,674	325	20.82
Pensacola	4,853	489	9.92
Rock Island	5,127	280	18.34
Rome	5,170	481	10.75
San Antonio	11,207	460	24.38
San Bernardino	6,388	134	47.50
San Diego	7,340	679	10.81
Seaside	857	56	15.29
St. Louis	2,281	166	13.71
Total	149,929	9,515	15.76

Computing Average Location-Specific Costs and Subsidization

As noted earlier, RADSS data do not tabulate finance expenditures by customer. Therefore, RADSS does not indicate whether, for instance, St. Louis's 2,063 Navy Commercial Invoices imposed a different cost per work unit than the 3,140 "Other DoD" Commercial Invoices.

If, however, one makes the simplifying assumption that each location's Commercial Invoice work-unit cost is constant across customers, one can compute a weighted average cost per Commercial Invoice work unit for each customer. Table 4.3 shows these computed weighted averages.

We offer a couple of observations on Table 4.3:

- First, it is not surprising the DFAS's regions' overall average expenditure per Commercial Invoice was less than what was charged. Costs incurred at the

Table 4.2

Commercial Invoice Work Units by Customer and Location, FY01

Location	Air Force	Army	Marine Corps	Navy	DLA	Other DoD Entities
Charleston	3,287	3,051	641	320,592	495	14,814
Columbus	25,428	22,301	721	38,849	304,166	226,634
Dayton	253,577	8,589	677	4,390	459	2,281
Europe	199,781	218,273	1,194	6,729	65,107	34,795
Honolulu	70,000	113,961	5,326	56,405	324	376
Indianapolis	22,214	1,165,430	8,472	16,208	6,364	63,540
Kansas City	1,023	1,504	230,940	8,592	151	424
Lawton	2,195	300,382	675	335	297	875
Lexington	731	93,075	537	213	34	309
Limestone	250,486	8,705	563	3,850	439	1,725
Norfolk	4,037	56,865	15,715	1,578596	3,408	13,070
Oakland	2,775	2,429	3,413	195,976	737	1,298
Omaha	299,902	23,829	776	8,390	685	39,625
Orlando	79,083	240,068	1,217	2,345	294	1,943
Pensacola	33,515	33,995	407	387,901	250	33,332
Rock Island	1,843	274,913	926	1,046	137	778
Rome	19,695	437,944	3,792	12,351	443	6,598
San Antonio	214,428	237,694	1,559	4,143	330	1,523
San Bernardino	127,432	3,370	479	1,833	408	963
San Diego	337	460	221	677,592	21	352
Seaside	2,158	45,379	259	2,837	13	5,372
St. Louis	1,072	159,279	599	2,063	180	3,140
Total	1,614,999	3,451,496	279,109	3,331,236	384,742	453,767

Table 4.3

Estimated Average Cost per Commercial Invoice Work Unit, by Customer, FY01

Customer	Average Expenditure ($)
Navy	10.85
Other DoD entities	16.01
DLA	16.34
Army	16.85
Marine Corps	20.36
Air Force	22.53
Overall average	15.76
Price	$17.88

NOTE: Assumes equal per-customer costs within a location.

locations represent only a portion of total DFAS costs. DFAS must also recover DFAS-wide overhead and past losses from its price per work unit. It would be problematic if the average cost by location exceeded the price.

- Second, we see marked heterogeneity in Table 4.3. The Air Force's weighted average cost per Commercial Invoice exceeded the Navy's by more than a factor of 2. The explanation for this result is that the preponderance of Navy Commercial Invoices was processed by the Norfolk operating location, the least expensive location with an $8.20 average expenditure per work unit (see Table 4.1). Meanwhile, the locations processing many of the Air Force's Commercial Invoices, most notably Dayton and San Bernardino, tend to be quite expensive, with a $24.11 and $47.50 average per work unit, respectively.

One can utilize Table 4.3 to calculate an estimate of cross-customer subsidization that results from overly simple pricing. Suppose instead of charging one price for Commercial Invoices, DFAS charged location-specific prices, holding constant customer demands and DFAS costs. (For simplicity in this calculation, we ignore issues of DFAS-wide overhead. Instead, we simply use $15.76, the overall average expenditure, as our base.) Table 4.4 shows the results.

We developed the estimated change in the Air Force's bills shown in Table 4.4, for example, by subtracting $15.76 (the overall average) from the Air Force's $22.53 average. Then we multiplied the $6.77 difference by 1,614,999 total Air Force FY01 Commercial Invoices, resulting in a computed net subsidy to the Air Force for this output of about $10.9 million.

It is no surprise that only the Navy's Commercial Invoice bill amount would have fallen with location-specific pricing. In Table 4.3, only the Navy had below-average Commercial Invoice costs. The explanation for the Navy's comparatively inexpensive Commercial Invoices (inexpensive to DFAS, that is) is that the Navy matches Commercial Invoices and receiving reports before handing off the work to DFAS. They receive no specific discount for the effort they save DFAS.

We replicated the analysis in Tables 4.1 through 4.4 for six other "mature" DFAS finance outputs, i.e., outputs DFAS has offered for several years.[1] The net subsidy results from simple pricing for all seven "mature" finance outputs are shown in Table 4.5.

Table 4.5 suggests that the Air Force, of all DFAS customers, has the most pronounced gains from DFAS's current pricing of finance outputs. Providing

[1]We do not present similar calculations for DFAS's newer finance outputs, e.g., EC Commercial Invoices. We found the RADSS data for these outputs to be unreliable. For instance, the data say that the Charleston location spent $0.61 per EC commercial invoice in FY01 while Omaha spent $48.20 per invoice. A variation this wide is undoubtedly due to inconsistencies in the RADSS data tabulation, and not massive differences in the locations' EC Commercial Invoice productivity.

Table 4.4

Unburdened Change in Customers' FY01 Bills If DFAS Had Charged Location-Specific Prices for Commercial Invoices ($millions)

Customer	Change
Navy	–16.3
Other DoD Entities	+0.1
DLA	+0.2
Army	+3.8
Marine Corps	+1.3
Air Force	+10.9

Table 4.5

Unburdened Change in Customers' FY01 Bills If DFAS Had Charged Location-Specific Prices for Mature Finance Outputs ($millions)

Output	Air Force	Army	Marine Corps	Navy	DLA	Other DoD Entities
Civilian Pay	–0.1	–0.2	–0.0	+0.2	–0.0	+0.1
Commercial Invoices	+10.9	+3.8	+1.3	–16.3	+0.2	+0.1
Military Active Pay	+7.9	-9.7	–0.4	+2.2	0	0
Military Reserve Pay	+3.3	–11.4	+6.0	+2.0	0	0
Military Retired Pay	-0.1	+0.3	–0.1	–0.1	0	0
Out-of-Service Debt	+0.0	-0.6	–0.0	–0.0	+0.6	+0.0
Travel Vouchers	+0.1	–1.5	+0.4	+0.2	+0.2	+0.7
Total	+21.9	–19.3	+7.2	–11.8	+1.0	+0.9

finance services to the Air Force has proven to be more expensive than it is for other customers. One possible explanation is that the Air Force's finance work is the most difficult. Another explanation is that DFAS's Air Force–focused locations are unusually expensive.

We found that, among the DFAS customers, the Army is the biggest loser with the current pricing arrangement. In particular, Army Military Active and Military Reserve Pay work is conducted at locations that are much lower cost than the locations where other military services' Active and Reserve Pay work is done.

Clearly, it is not DFAS's intent to engage in multimillion dollar cross-subsidization of one customer at the expense of another. Instead, this outcome is endemic to a situation in which DFAS charges a single price across the board for a particular type of output.

Alternative Pricing Options

If DFAS wishes to reduce its cross-customer subsidization, it could implement location-specific, customer-specific, or location-and-customer-specific prices. It would be difficult, in the short run, to develop customer-specific prices because, as we noted earlier, RADSS does not currently tally costs by customer. Location-specific pricing would be easier to implement, e.g., it would be relatively easy to apply a DFAS-wide overhead factor to estimates such as the average expenditure per work unit by location used in Table 4.1.

Presumably, if customers were price responsive, we would see, for instance, the Air Force attempting to move some of its Commercial Invoice workload from San Bernardino to a less expensive location such as Norfolk. Such an effort would raise other questions. First, could Norfolk absorb more workload, particularly from the Air Force, which is not traditionally its customer? Second, how much would Norfolk's commercial invoice costs go up? Does it matter which customer wishes to send additional workload to Norfolk? (We suspect that the answer to the last question is yes because, as noted earlier, the Navy matches Commercial Invoices and receiving reports before DFAS receives them whereas the Air Force does not.) Also, how much would the San Bernardino location's total costs fall if the Air Force moved Commercial Invoice workload away from that location?

A reallocation of workload would be only, on net, beneficial to DFAS and, ultimately, the DoD (holding quality constant) if the cost decrease at the losing location exceeded the cost increase at the gaining location.

Based on our findings presented in this chapter, we urge

- further examination of the feasibility and desirability of location-specific pricing
- investigation of the costs of enhancing RADSS to collect customer-specific expenditures.

5. Why DFAS's Cost Structure Points to Nonlinear Pricing

In the preceding chapter, we suggested that simple "every customer pays the same" finance output prices result in considerable cross-customer subsidization. In this chapter, we reiterate a different concern first voiced in Keating and Gates (1999). Specifically, we found that few (if any) DFAS costs change in the short run as workload levels vary. DFAS has considerable short-term fixed or output-invariant costs. This output-invariant cost structure interfaces poorly with the current DFAS pricing structure. Whereas customers see the marginal cost of supplying additional workload to DFAS as being equal to the prices shown in Table 2.3, DFAS itself perceives low or no marginal costs.

One could envision an unpleasant scenario in which a DFAS customer withdraws work from DFAS to save money, but the DoD as a whole saves nothing because DFAS costs do not fall commensurably, if at all, with the reduced workload. DFAS would then incur losses that would force an increase in future years' prices through a past-loss surcharge, which is borne by all DFAS customers. If DFAS were to adopt nonlinear pricing (e.g., quantity discounts), customer incentives (vis-à-vis giving DFAS more or less work) would more closely align with the agency's cost structure.

Figure 5.1 uses an accounting services example from the Kansas City center to illustrate the typical pattern of expenditures versus workload, with output measured in billable hours. The accounting expenditures (indicated by the solid line) and billable hours (indicated by the broken line) both vary considerably from month to month, but the two data series have no apparent relationship.

We do not fully understand the month-to-month variability in either of the series in Figure 5.1. However, the September 2001 expenditure spike was driven by spikes in four nonlabor expenditure categories: hardware depreciation, software maintenance, computers/peripherals, and standard level charges (e.g., rent), as Figure 5.2 illustrates.

We do not know why such expenses are recorded by DFAS as one-month spikes as opposed to accruing more uniformly over time. In any case, the recorded expenditure spikes bear no apparent relationship to billable hour workload.

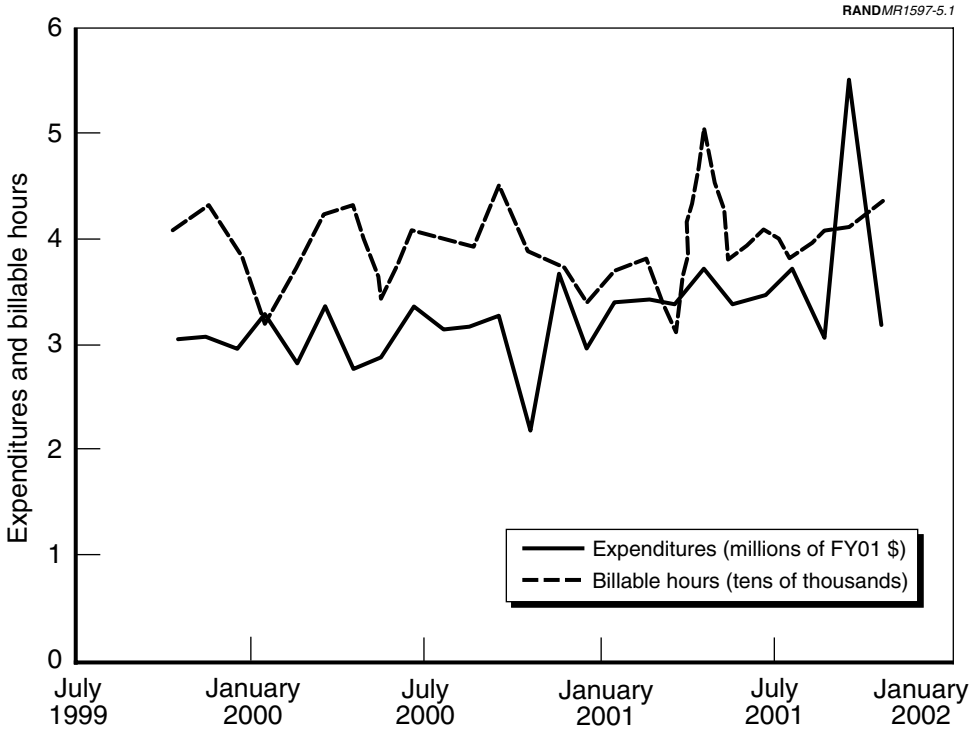

Figure 5.1—Kansas City Accounting Expenditures and Billable Hours

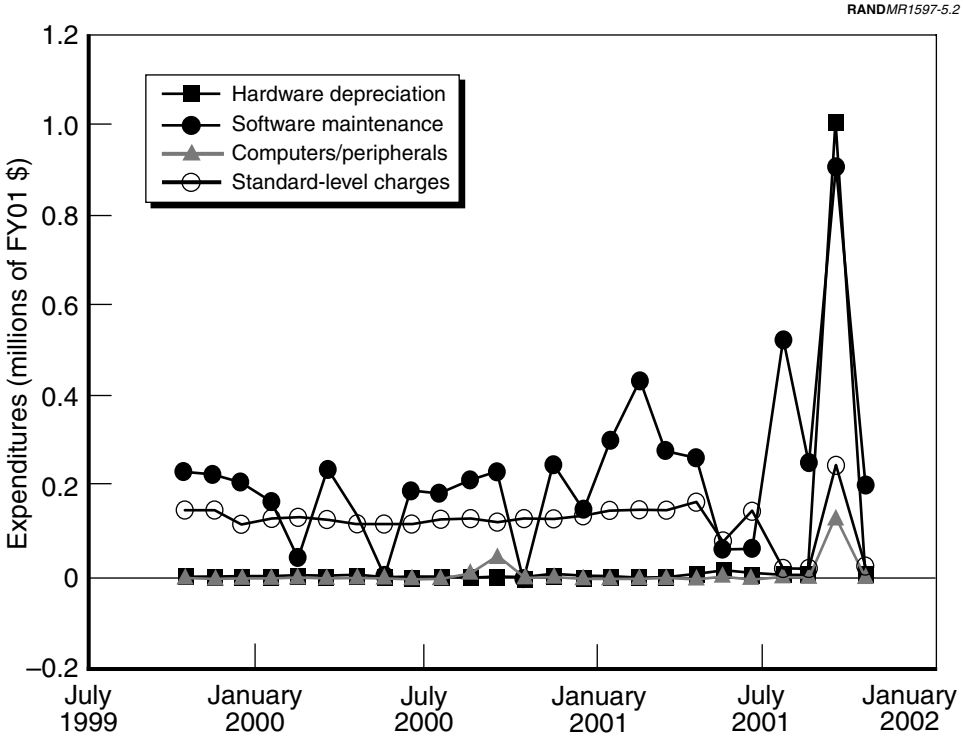

Figure 5.2—Kansas City Accounting Expenditures by Class Codes (Illustrating September 2001 Expenditure Spike)

Figure 5.3 isolates Kansas City expenditures for paying DFAS civilian employees who provide accounting services. The horizontal axis shows monthly direct billable hours in FY00 and FY01, and the vertical axis shows monthly accounting civilian expenditures in millions of dollars. The figure illustrates that there is no strong evidence that increasing billable hours also increases civilian accounting services expenditures.

Finally, Figure 5.4 specifically illustrates Kansas City's overtime expenditures for civilian accounting services. The figure illustrates two key points. First, increasing billable hours does not seem to have a strong effect on spending for civilian overtime. Second, overtime is a comparatively trivial expenditure category. Kansas City averaged about $3.3 million per month in accounting expenditures over this period. Civilian overtime spending averaged about $35,000 or about 1 percent of the total accounting services spending.

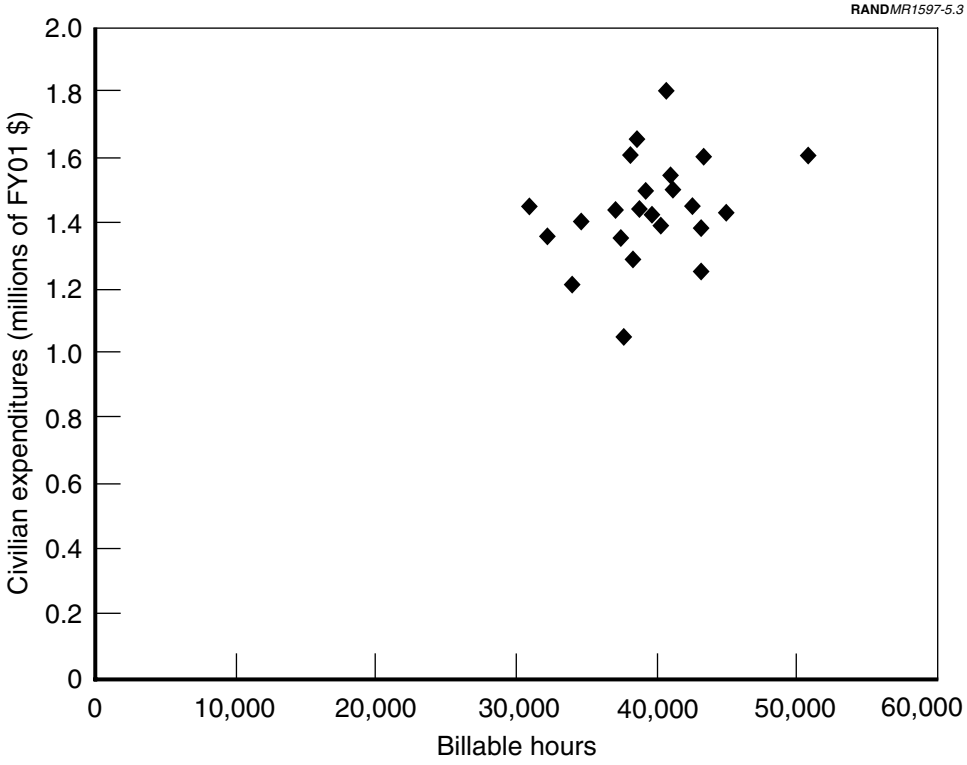

Figure 5.3—Kansas City Accounting Services Billable Hours and Civilian Pay Expenditures

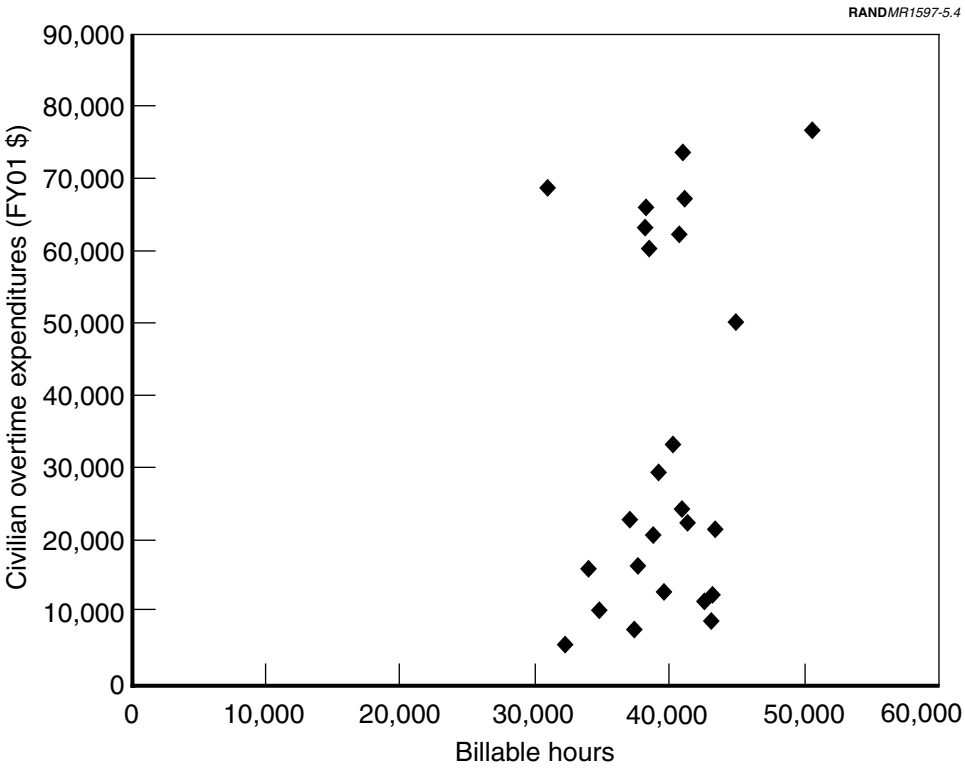

Figure 5.4—Kansas City Accounting Services Billable Hours and Civilian Overtime Expenditures

DFAS-wide, civilian overtime has averaged about $1.8 million per month since January 1998.[1] This also represents about 1 percent of total DFAS expenditures over this period.

The Kansas City accounting findings are representative of the apparent nonrelationship between workload levels and DFAS expenditures at the other DFAS locations and for other DFAS outputs. We found no DFAS outputs nor any DFAS locations for which there is a marked short-term positive correlation between DFAS workload and DFAS expenditures. Instead, DFAS has a variety of costs that, even if they vary month to month, are not correlated with workload. Within typical workload ranges, DFAS workload can apparently increase or decrease without expenditures changing markedly.

Such a finding is quite antithetical to the current linear (i.e., "same price for every work unit") DFAS pricing. If the agency received fixed payments from customers

[1]This civilian overtime amount dates back to January 1998 because that is how far back our DFAS-wide data go. Based on the regions for which we have pre-1998 overtime data, we do not believe overtime usage prior to January 1998 was meaningfully different from the usage after that date. Overtime usage shows no particular time trend since January 1998.

(or appropriations from Congress) plus much lower fees per work unit, that would fit much better with DFAS's actual cost structure. The current price structure calls for charging $\$a$ per work unit purchased. Chapter Four argues that prices should be $\$a_i$, varying for each customer i. This chapter argues that DFAS should receive $\$b$ in up-front payments from customers and a smaller $\$c_i$ per work unit where $b > 0$ and $c_i < a_i$. Indeed, if no costs vary in the short run with changes in workload level, one would want $c_i = 0$, so that all costs would be recovered through the fixed charge b.

6. Has Hourly Billing for Accounting Changed DFAS Behavior?

Until the beginning of FY 2000, DFAS charged for accounting services by account (or "monthly trial balance" in DFAS vernacular). This pricing method was troublesome for two reasons. The work unit used by DFAS was not clear to either DFAS or its customers. It was a somewhat ill-defined bundle of accounting services, with the bundles varying considerably by customer. Also, DFAS customers received no reward for providing DFAS with accurate and timely data. Thus whether the accounting job was large or small, the customer paid the same amount.

Under the old system, accounting customers with small demands, which tended to be appropriated fund customers, subsidized customers who made large demands, which tended to be in DWCFs.[1]

In response to the concerns regarding horizontal equity, which were caused by unit billing for accounting, DFAS decided to begin charging customers by the hour. This revised approach began in October 1999 at the beginning of FY00, and substantially redistributed the charges across customers. In general, DWCF customers paid more, and appropriated fund customers paid less.

Some of DFAS's customers were concerned about the change in billing policy. They were upset that they would have to pay for DFAS's mistakes—in other words, when DFAS made an error and had to put in extra time to fix it, the customer would be charged for that extra time. Also, DFAS customers were worried that DFAS would take advantage of the new hourly billing format by taking longer to do the same job, and thus make the customer pay more than the minimum possible cost. Put differently, customers were worried that the new billing regime would present an opportunity for a "moral hazard" that DFAS would exploit. This chapter analyzes whether DFAS took advantage of this opportunity offered by the billing policy change.

[1] "Appropriated fund" customers are those customers whose funding largely emanates from the annual congressional appropriation process. "Warfighting" organizations like the Air Combat Command, Atlantic Fleet, and Forces Command receive appropriated funding. By contrast, many "support" organizations (e.g., Air Force Materiel Command, Army Materiel Command, DFAS, DLA, and Navy Sea Systems Command) are largely in various types of working capital funds. They "sell" goods and services to warfighters, directly or indirectly.

Defining "Moral Hazard"

A situation is said to have a moral hazard if one individual can take an action that cannot be observed by a second individual but would nonetheless impact the second individual. In other words, to quote Kreps (1990), "one party to a transaction may undertake certain actions that (a) affect the other party's valuation of the transaction but that (b) the second party cannot monitor or enforce properly." This sort of problem is viewed from the perspective of the principal (the second individual) who wants to induce the agent (the first individual) to behave in a particular way but cannot be sure that the agent is behaving as the principal desires.

Purchasing insurance from car rental companies serves to illustrate the concept of moral hazard. When you rent a car, you are not likely to take as good care of it as you would your own car, in part because you are not liable if the car is stolen. This is clearly a problem from the perspective of the principal, the car rental company, who would prefer that you use the utmost care with the car. Likewise, when you buy insurance for your jewelry, you may not be as careful with it as you would if you did not buy the insurance. This is a problem for the jewelry insurer, who would prefer that the jewelry is extremely safe at all times.

In the DFAS context, the customer is the principal, and DFAS is the agent. The customer cannot observe how hard and effectively the agent actually works and cannot make an informed decision about the value of the accounting service in advance of receiving it. Analogous to a worker who decides whether or not to shirk his or her work duties, and who has the ability to evade work because he or she is not monitored, DFAS employees may have a choice in how efficiently they should work. Because DFAS's actions are hidden from its customers, the customers fear that DFAS may be taking longer to do a job than is necessary.

The economics literature makes some suggestions as to how principals might at least partially remedy the moral hazard problem. For example, a principal can monitor an agent's work to see if the agent is as productive as the principal desires. This remedy is not without its costs, however.

In a work context, principals may pay agents according to how productive they are relative to other agents (Mookherjee, 1984). However, this type of scheme works only when there is an observable and controllable metric upon which to base agents' pay. In cases in which uncertainty exists regarding how much effort the agent must expend, it may be advantageous for a principal to use a fixed-fee contract, with the agent being paid upon successful delivery. This transfers the burden of risk to the agent (Baron and Besanko, 1987). If the agent is a business

firm, it may wish to avoid doing bad work in order to keep a good reputation if it believes that a good reputation is important to future work or future prices. Finally, limited warranties are designed to solve a double moral hazard problem: The buyer determines the actual quality of the product before making the purchase, and the seller cannot observe the buyer's treatment of the goods after the purchase is made. A limited warranty makes both parties responsible for quality and upkeep (Cooper and Ross, 1985).

How Do Private-Sector Accountants Deal with the Moral Hazard Issue?

As a first step in considering whether billing by the hour may lead accountants to take advantage of their customers, we examined how private-sector accountants bill their clients and whether or not those clients appear to be worried about moral hazard problems. A survey of the literature indicates that accountants use both hourly billing and fixed-fee billing. In fixed-fee billing, the accountant and client agree in advance on a fixed amount for the service to be performed. With hourly billing, accounting firms bill as DFAS does now—charging for the time it takes to complete a given job.

Of course, private-sector accountants face a serious constraint that DFAS does not. If a private-sector accountant's client is not satisfied with the accountant's work, the client may switch to another accountant. Private-sector clients may find switching accountants costly and aggravating, but DFAS customers have no such threat to keep their accountants in line. To a small extent, DFAS customers may choose to do the work in house; however, this option is not available for all customers or for all kinds of accounting work.

Additionally, in the private sector, clients would not be willing to cross-subsidize other clients, as was the case with DFAS appropriated fund customers subsidizing DWCF customers under per-account billing, rather than hourly billing, for accounting services. In the private sector, a client would likely switch to a different provider who would charge for the actual work done instead of staying with a provider that used its fees to subsidize work for other clients.

Private-sector accountants face an additional moral hazard that DFAS does not face. Specifically, private-sector accountants are under pressure to approve lucrative clients' accounting statements, irrespective of being in accordance with Generally Accepted Accounting Principles. The recent situation involving Enron Corporation and its auditor, Arthur Andersen, starkly highlights how grave such problems can be. DFAS has a statutory responsibility to move the DoD toward

having auditable financial statements, but previous RAND research (Keating et al., 2001) found little evidence of DoD customer interest in this issue.

The question of how private-sector accountants should bill for their services is long standing. A 1910 article from the *Journal of Accountancy* soundly criticized accounting firms for advertising their services and reprinted typical advertisements of the time. Those advertisements offered billing by either the hour or by fixed fee. In a letter soliciting business, the Interstate Audit Company wrote at the time, "If you prefer a Flat Price, we would be pleased to give you a figure for a Monthly, Quarterly, Semi-annual or Annual Audit" ("Deluded Old School Accountants," 1910). Although the letter was highly critical of the idea of accountants taking out advertising, it did not criticize their billing practices, which leads us to conclude that both flat-fee and hourly billing were at least somewhat accepted.

There is not much literature available on how, exactly, modern private-sector firms choose the type of billing to use for a particular project or client. However, both fixed-fee and hourly rates are quite common. A survey of the then-Big 6 accounting firms indicated that the firms billed 22 percent of their projects on an hourly basis (Margheim and Kelley, 1992). Palmrose (1989) asked companies how they were billed for audits and a little less than half of them responded that they were charged by the hour. However, Palmrose wrote that "audit contracting involves a continuum of contract types, not just the dichotomous classification used in this study." In other words, fixed-fee arrangements are often accompanied by an agreement in which the client agrees to pay more than the base amount if there is an unexpected increase in the amount of services needed.

As opposed to the concerns of DFAS customers, studies of the accounting industry have treated hourly billing as the norm, and researchers have asked whether fixed-fee billing causes troublesome behavior by accountants. According to Palmrose (1989), economic theory asserts that a fixed-fee contract makes the auditor bear the risk of any cost uncertainty in conducting an audit, whereas an hourly billing scheme places the risk on the shoulders of the client. Perhaps it is this transfer of risk from accountant to client that is at the heart of the dissatisfaction of DFAS customers. Palmrose surmised that fixed-fee contract prices should be higher in exchange for the accountant bearing this risk; however, fixed-fee contracts would also give auditors an incentive to perform at the lowest cost, which would translate into lower audit fees. The net effect of fixed-fee contracting, then, was ambiguous. However, firms are also constrained by worries about their reputation, as we discussed earlier in considering solutions to the moral hazard problems, and might not want to make any sacrifices to perform a job at the lowest cost.

Palmrose tested this theory using her data, and her regressions showed that clients with fixed-fee contracts tended to have somewhat lower audit fees than those with hourly contracts. The number of hours worked was unaffected by the contract type, contrary to theory, which predicted that the number of hours should decrease under fixed-fee billing. The fixed-fee contract tended to be more prevalent in the early years of a contract, perhaps because a risk-averse client would face greater uncertainty in the early years and could solve the uncertainty problem with a fixed-fee arrangement.

In contrast, Margheim and Kelley (1992), operating under the same theoretical framework as Palmrose but using a survey of auditors instead of client companies, found that accountants believed that fixed-fee audits caused them to spend less time on those contracts. This is in contrast to Palmrose's finding of no effects from contract type on hours worked. In agreement with Palmrose's findings, accountants tended to believe that fixed-fee audits were less profitable than hourly billed audits. (Palmrose found that fixed-fee audits decreased fees.) When asked about the negative impacts of fixed-fee audits, almost half of the accountants surveyed by Margheim and Kelley responded that they were concerned about misunderstandings over the fees and the difficulty of collecting fees for any cost overruns. Indeed, the goal of equating a client's cost to the fees charged was one of the motivations that led the DFAS to change its billing structure.

A broad survey of the literature did not find any great consternation on the part of clients, accountants, or researchers on the specific moral hazard problem of hourly billing. Perhaps this is because in the private sector there are elements that remedy the moral hazard problem. For the private sector, the most salient of the remedies is the concern that accountants have for their reputations. Because analysis has shown that accountants' fees are tied to their reputations, it is easy to believe that this concern should keep them from overstating their hours (Firth, 1990).

As a particular example of moral hazard remedies, an experimental study by DeJong et al. (1985) found that the moral hazard problem in an accounting setting was partially remedied by the provider's concern with his or her reputation and the client's investigation of the provider. In the laboratory setting, these remedies lessened but did not entirely solve the problem of auditors shirking their responsibilities.

Testing for Moral Hazard

If there were a moral-hazard-induced change in DFAS's accounting expenditures, we would expect to see an increase—either a level increase or a trend increase—after the change in the billing regime. As noted earlier, we know the exact date, October 1999, of the introduction of hourly billing. The combination of our knowledge of DFAS expenditures and the exact timing of the introduction of the new billing system gives us the ability to test whether DFAS took advantage of the moral hazard opportunity.

Figures 6.1 through 6.5 show inflation-adjusted monthly total accounting expenditures for each DFAS region. We plotted the actual months' expenditure levels against the three-month moving average for each region. The three-month moving average line serves to mitigate what may be idiosyncratic expenditure spikes or troughs in the recorded expenditures. A cursory examination of these figures does not show any obvious changes in either the level of expenditures or the expenditure pattern trend after the DFAS billing regime change.

Note: The position of the vertical line at the October 1999 point in the following figures marks the division between the unit-based and hourly billing regimes.

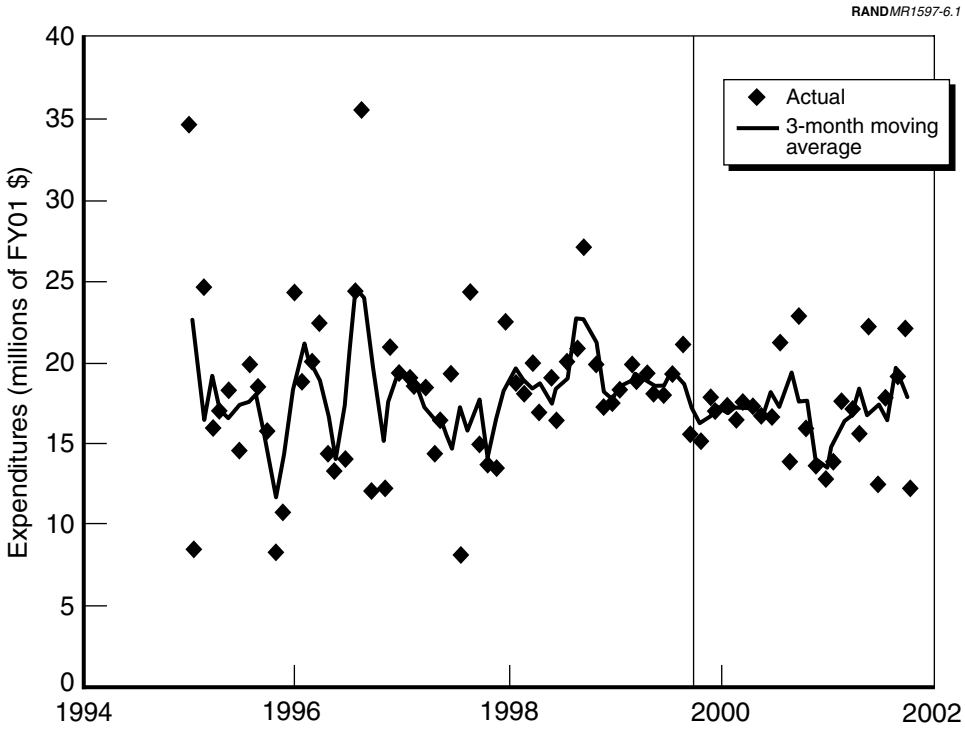

Figure 6.1—Cleveland Region Monthly Accounting Expenditures

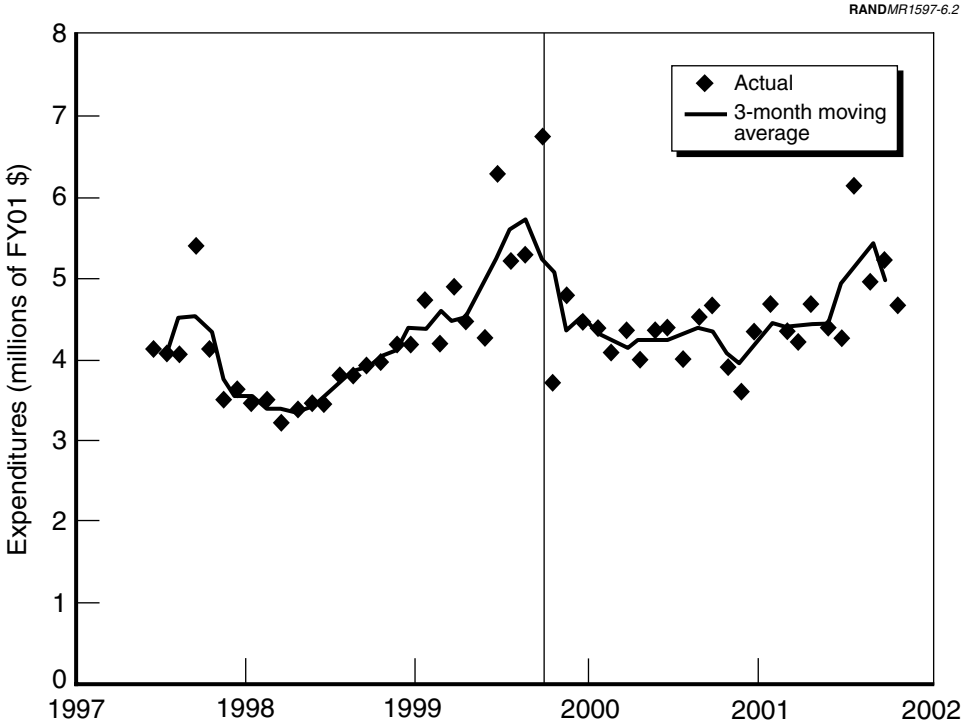

Figure 6.2—Columbus Region Monthly Accounting Expenditures

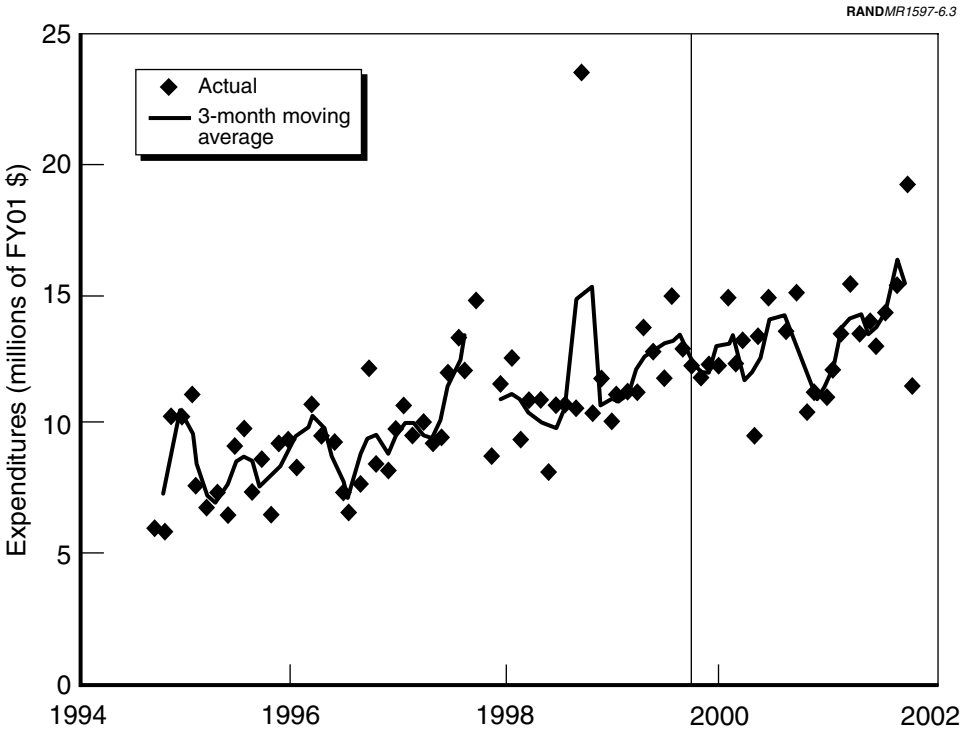

Figure 6.3—Denver Region Monthly Accounting Expenditures

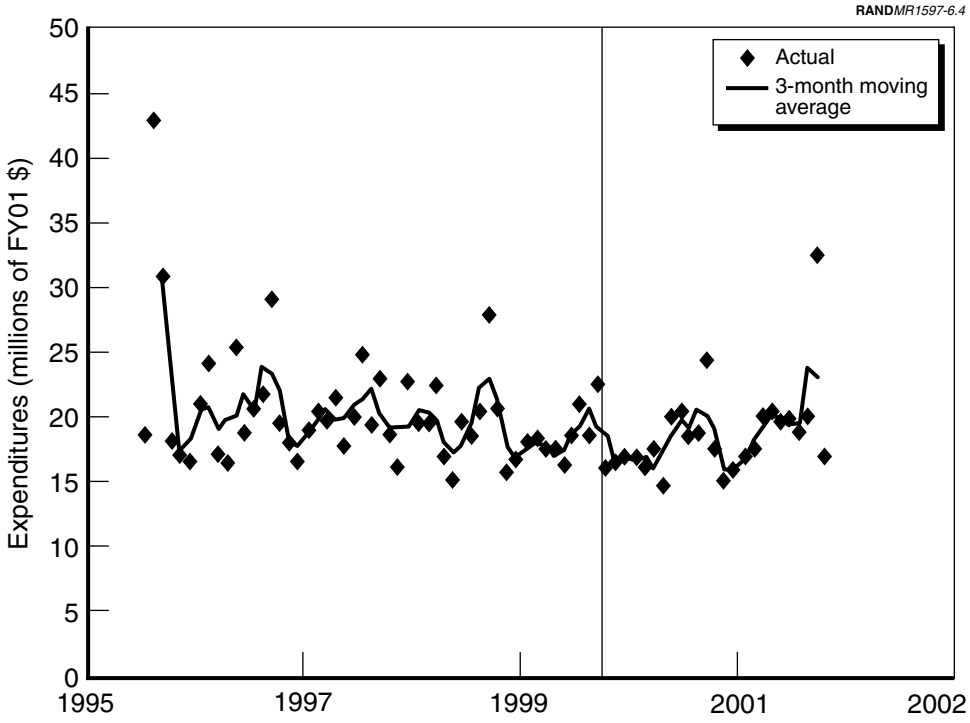

Figure 6.4—Indianapolis Region Monthly Accounting Expenditures

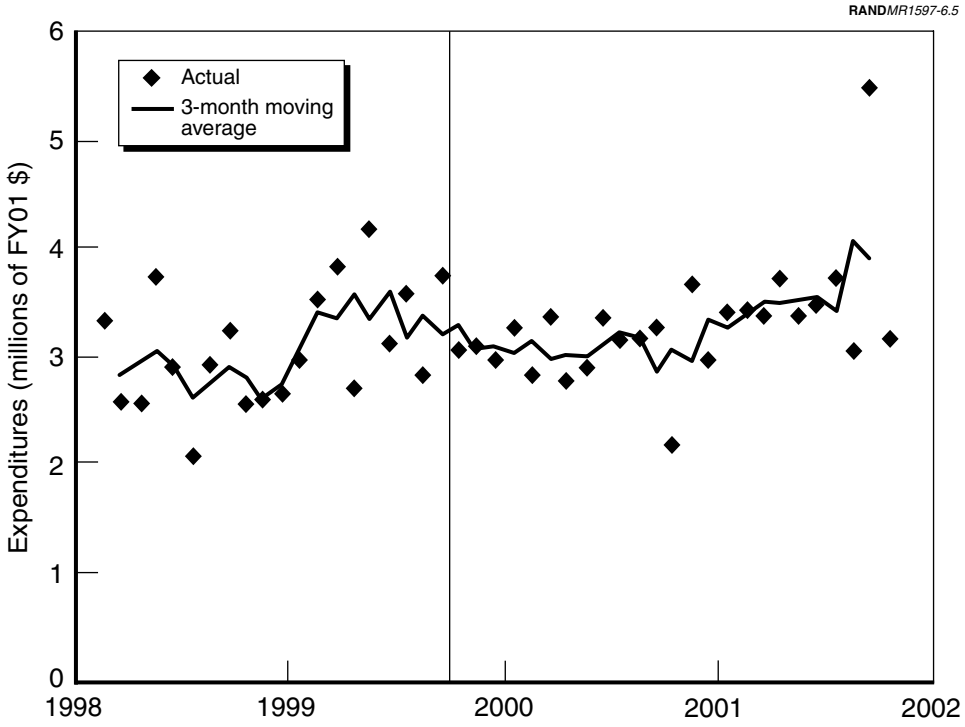

Figure 6.5—Kansas City Region Monthly Accounting Expenditures

Table 6.1 shows the mean monthly accounting expenditures and standard deviations for those expenditures before and after the billing rate change in constant FY01 dollars. Average monthly accounting expenditures increased somewhat in Columbus, Denver, and Kansas City, but fell in Cleveland and Indianapolis. Overall, average regional accounting expenditures fell slightly from $57.8 million to $56.9 million per month since the billing change.

Data Analysis

To more rigorously investigate whether there was a significant change in accounting expenditures after the billing policy change, we estimated a regression model that allowed the slope and intercept of the observed expenditure to change with the billing change. Also, we wanted to control for

Table 6.1

DFAS Regions' Monthly Accounting Expenditures

Category	Cleveland	Columbus	Denver	Indianapolis	Kansas City	All Regions
Months of data before change	58	28	60	51	20	20
Mean monthly expenditure before change ($)	18,364,070	4,247,461	10,274,442	20,476,001	3,085,030	57,801,925
Standard deviation of monthly expenditures ($)	5,086,395	863,188	2,744,344	4,599,718	546,020	7,566,910
Months of data after change	25	25	25	25	25	25
Mean monthly expenditure after change ($)	16,972,651	4,422,277	13,290,887	18,894,233	3,293,074	56,873,122
Standard deviation of monthly expenditures ($)	2,946,845	509,528	2,007,970	3,541,808	568,420	8,118,906

general policy or operational changes that affected all of DFAS that might be obfuscating a moral hazard–driven change in DFAS accounting expenditures. Perhaps it was the case that spending on accounting services after the switch tended to increase (or tended to decrease less slowly) as compared with spending on other outputs, such as Military Pay and Transportation Bills, which did not experience a change in billing procedures. To this end, we wanted to consider the difference between spending on other outputs and spending on accounting services.

To make a valid comparison between the trend in accounting expenditures and expenditures for other outputs, we wanted to define a measure of the difference in spending between accounting and the other outputs to determine whether the trend in the difference changed over time. However, we faced the problem that expenditures on the other outputs were of different magnitudes than the expenditures on accounting. Thus, any straightforward measure of differences would be obscured by problems of relative magnitude. To get around this problem, we constructed a normalized measure for each output, including accounting. This normalized measure, called a "z-score," was constructed using following the equation:

$$z_t = (\text{expenditure}_t - \text{mean})/\text{standard deviation}$$

The mean and standard deviation in the equation are the mean and standard deviation for the period before the billing change and are used in the calculations both before and after the billing change. Thus, the z-scores for each output before the billing change have a mean of zero and a standard deviation of one, with z_t being the z-score for each period t. The z-scores after the billing change are not necessarily distributed with a mean of zero and a standard deviation of one because we still use the mean and standard deviation of the pre-change period to calculate the z-score for the post-change period (Casella and Berger, 1990).

The DFAS regions produced different outputs at different times. To define valid control outputs, we kept only those outputs that were produced throughout the entire time frame considered for each region, and we disregarded those outputs that were being phased in, phased out, or otherwise had large-scale workload changes. The control outputs we used are listed by region in Table 6.2.

To make a composite control output for comparison purposes, we averaged the z-scores of the nonaccounting outputs. Finally, the difference measure d_t was constructed by subtracting the average z-scores of the other outputs from the z-score for accounting, as in the following equation:

Table 6.2

DFAS Regions' Control Outputs

Region	Control Outputs
Cleveland	Civilian Pay Military Active Pay Military Reserve Pay Military Retired Pay
Columbus	Commissary Finance and Accounting Out-of-Service Debt
Denver	Military Active Pay Military Reserve Pay Military Retired Pay
Indianapolis	Military Active Pay Military Reserve Pay Transportation Bills
Kansas City	Military Active Pay Military Reserve Pay

$$d_t = z_{t,accounting} - \frac{1}{n}\sum_{i=1}^{n} z_{t,output_i}$$

where i = (1, 2, ..., n) and n = number of other outputs.

This difference measure has the virtue of being unit-free, and because both elements of the pre–October 1999 difference are drawn from distributions with a mean of zero and standard deviation of one, there is no worry that the measure of difference will be overpowered by relative magnitudes.

We then ran region-by-region time-trend regressions using the d_t's as the dependent variables. We let the dummy variable *post* be 0 in the first part of the sample. Hence, our regression equation was as follows:

$$d_t = \beta_1 + \beta_2 * t + \beta_3 * post + \beta_4 * post * t$$

where t is the month number and *post* is 1 if and only if the month is October 1999 or later.

With this parameterization, β_1 is the baseline monthly accounting d_t with β_2 showing if there is any time trend in d_t. β_3 estimates whether the baseline d_t level changed with the billing change while β_4 reflects any change in the time trend. This parameterization is based on McDowall et al. (1980).

One test of the importance of the billing change would be to test the joint hypothesis $\beta_3 = 0$ and $\beta_4 = 0$, i.e., to test whether a restricted regression of the form $d_t = \beta_1 + \beta_2 * t$ would suffice. If this hypothesis cannot be rejected, it would suggest the billing procedure change had no measurable effect on DFAS behavior.

If $\beta_3 = 0$ and $\beta_4 = 0$ can be rejected, the next question is, what values do these parameters take on? Were DFAS to have taken advantage of the moral hazard opportunity, its expenditures should have increased from the level or trend they followed before the billing change. More specifically, there are four possible ways for the expenditure line to change paths after the billing change, as depicted in Figure 6.6. If the slope and intercept both increase (Case A), then it is certainly possible that there was a moral-hazard-driven increase in expenditures. If the intercept decreases, but the slope increases (Case B), the case for moral hazard is less clear, but moral hazard is still possible. Neither an increase in intercept combined with a decrease in slope (Case C) nor a decrease in both slope and intercept (Case D) is a likely candidate for a moral hazard explanation.

Table 6.3 shows our regression estimation results.

For every region, we found no significant billing approach effect. Figure 6.7

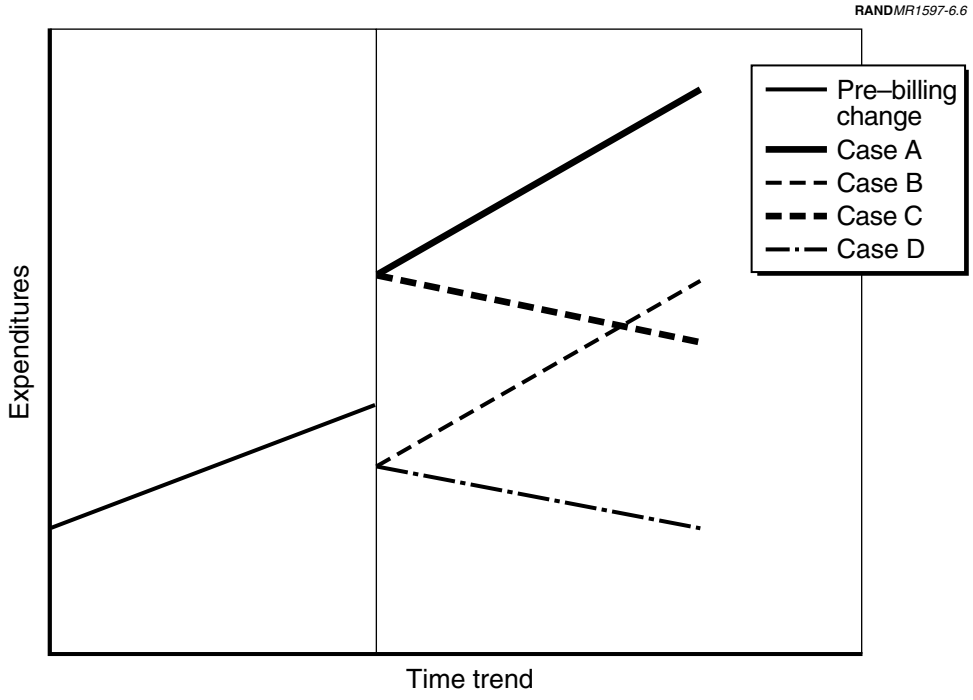

Figure 6.6—Possible Expenditure Time Trend Cases

Table 6.3

DFAS Regions' d_t Regressions

Category	Cleveland	Columbus	Denver	Indianapolis	Kansas City
Number of observations	82	53	85	76	45
Restricted R-squared	0.0017986	0.1998791	0.5382672	0.2052663	0.3829164
Restricted regression sum of squares	0.0040642	0.192773	3.7554741	0.9528099	0.6436010
Restricted residual sum of squares	2.2555284	0.7716753	3.2214964	3.6890125	1.0371864
Restricted F-statistic	0.1441512	12.740365	96.757628	19.112957	26.682615
Restricted significance F-statistic	0.7051946	0.0007904	1.392E-15	3.963E-05	5.877E-06
Restricted β_1	0.0052624	–0.0561205	–0.2554862	-0.1216539	–0.1154342
Restricted β_1 standard error	0.0373638	0.0342767	0.0429809	0.0517324	0.0470866
Restricted β_1 t-statistic	0.140841	–1.6372769	–5.9441734	–2.3516005	–2.4515296
Restricted β_2	–0.0002924	0.0039426	0.0084203	0.0051040	0.0092085
Restricted β_2 standard error	0.0007701	0.0011046	0.0008560	0.0011675	0.0017827
Restricted β_2 t-statistic	–0.3796725	3.5693648	9.8365455	4.3718368	5.1655218

Table 6.3—Continued

Category	Cleveland	Columbus	Denver	Indianapolis	Kansas City
Unrestricted R-squared	0.0045508	0.2012142	0.541469	0.248872	0.4426101
Unrestricted regression sum of squares	0.0102829	0.1940607	3.7778129	1.1552439	0.7439334
Unrestricted residual sum of squares	2.2493097	0.7703876	3.1991575	3.4865785	0.9368540
Unrestricted F-statistic	0.1188614	4.1143683	31.883691	7.9521665	10.852374
Unrestricted significance F-statistic	0.9487675	0.0111059	1.039E-13	0.000119	2.227E-05
Unrestricted β_1	–0.0032508	–0.0605858	–0.2359292	–0.0569183	–0.0666268
Unrestricted β_1 standard error	0.0452311	0.0486909	0.0515326	0.0625456	0.0702197
Unrestricted β_1 t-statistic	-0.0718709	–1.2442922	–4.5782534	-0.9100276	–0.9488337
Unrestricted β_2	0.0001104	0.0041783	0.0076394	0.0021892	0.0063454
Unrestricted β_2 standard error	0.0013322	0.0029335	0.0014471	0.0020934	0.0058618
Unrestricted β_2 t-statistic	0.0828398	1.4243449	5.2790438	1.0457452	1.0824971
Unrestricted β_3	–0.0363779	0.0111080	0.0097641	–0.0014734	–0.1099353
Unrestricted β_3 standard error	0.0827906	0.0693010	0.0962910	0.1091818	0.0901560
Unrestricted β_3 t-statistic	–0.4393962	0.1602864	0.1014022	–0.0134952	–1.2193896
Unrestricted β_4	0.0006660	–0.0011644	0.0030324	0.0112177	0.0108164
Unrestricted β_4 standard error	0.0048946	0.0045497	0.0056987	0.0064523	0.0072068
Unrestricted β_4 t-statistic	0.1360630	–0.2559372	0.5321133	1.7385581	1.5008531
Restricted-unrestricted F-statistic value	0.1078241	0.0409511	0.2828005	2.0901929	2.1954473
Statistical significance	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

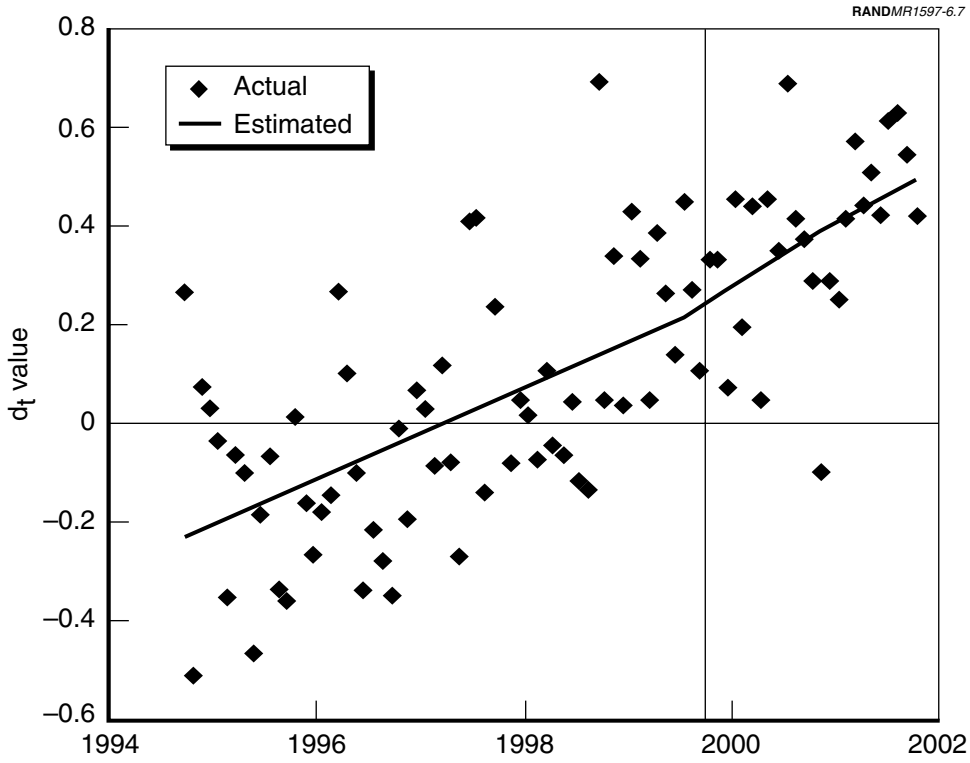

Figure 6.7—Denver Accounting d_t Values

shows that the Denver region accounting d_t results are illustrative of this finding: The region had generally rising d_t values, suggesting accounting expenditures tended to grow relative to Denver's control outputs—Military Active, Reserve, and Retired Pay expenditures. But this trend was not significantly altered by the billing policy change.

Only in Cleveland was the typical trend not one of increasing accounting d_t values (i.e., Cleveland's restricted $\beta_2 < 0$), but the other regions' trends of increasing accounting expenditure shares existed well before the billing rate change and were not significantly altered by the change.

We conclude that there is little evidence to suggest DFAS changed its accounting expenditure behavior, as was feared, after its accounting billing policy changed.

Why Did DFAS Not Respond to the Moral Hazard?

There are several possible explanations for DFAS's resistance to the moral hazard opportunity presented by the new billing system. One possibility is that DFAS managers allotted a certain number of budgeted hours for their divisions to do

the accounting work, and based this number on the time that it had taken workers in the past to perform the work. Basing the work hours on past accounting needs would tend to keep the number of hours available for accounting services relatively fixed and tend to keep the expenditures in line with past DFAS expenditures.

In addition, DFAS has a limited ability to grow or reduce its staff because it is a civil service organization and cannot hire or fire easily (see Robbert, Gates, and Elliott [1997]). If workers tend to bill for eight hours' work per day, regardless of the actual number of hours worked over or under that number, the total number of hours charged to customers remains relatively static. In this event, increases or decreases in the number of hours worked might be masked by employees who always report a fixed number of hours.

Finally, because DFAS customers have a fixed budget for expenditures on accounting, any large increase in the cost of accounting charged to them would be obvious and unacceptable. Perhaps the system of budgeting in advance leads to a de facto fixed price, which DFAS cannot exceed.

Hence, although many traditional remedies against moral hazard, most notably potential loss of business, are not applicable to the DFAS environment, it nevertheless appears that hourly billing for accounting services has not led to opportunistic behavior on the part of DFAS.

7. Conclusions

How goods or services are priced is a key form of communication between a firm and its customers. For example, prices indicate to customers which products are in short supply (those that are high priced) and which products a firm is eager to sell (those that are low priced). This report has shown that DFAS's current price structure sends its customers mixed messages, some of which are unintentional.

Pricing and Billing Policies: Findings by Chapter

Some DFAS customers, to extend the communication analogy, are "deaf" to whatever messages the DFAS pricing policy sends. As we discussed in Chapter 3, under current constraints (e.g., customers cannot hire an outside provider), it does not matter, within a reasonable range, what DFAS charges for some outputs such as Military Active or Civilian Personnel pay services. The choice of just how much of DFAS's services a customer purchases is exogenous to the provider-supplier relationship.

Some discretion in the demand for services on the part of customers does exist, however. For example, customers may decide to switch to more-automated approaches for the delivery of some outputs. We think DFAS could be more aggressive in discounting its EC outputs with the reasonable belief that such discounts would encourage more widespread adoption of automated delivery of outputs by DFAS.

The current policy of charging one price for all customers for finance outputs results in cross-customer subsidization, as discussed in Chapter 4. We think this pricing policy sends the wrong message to customers. Instead, specific customers should be rewarded if they impose less of a burden on DFAS, whereas customers who want enhanced finance services should have to pay for them. The current message that DFAS finance output prices send to customers is "you are all the same" despite the considerable cost-workload evidence that says they are not.

In Chapter 5, we showed that DFAS's linear, expected-average-cost pricing structure sends customers a message that DFAS probably does not intend to convey. Specifically, the price structure proportionally rewards customers who withdraw workload from DFAS and proportionally penalizes customers who supply DFAS with additional workload.

Our analysis has consistently found that DFAS has largely fixed costs. Therefore, within observed ranges, DFAS costs barely decrease in the short run when the workload decreases, and DFAS costs barely increase when the workload increases. Nonlinear prices with lower incremental fees (also termed "marginal pricing") would communicate a much more appropriate message to DFAS customers.

In Chapter 6, we evaluated the impact of the FY00 reform to DFAS accounting pricing. Prior to October 1999 (the beginning of FY00), DFAS charged for its accounting services by account. This practice had the unfortunate effect of cross-subsidizing DWCF customers, whose workloads tend to be relatively demanding, at the expense of appropriated-fund customers, whose workloads are less demanding. Under the new approach, customers are billed by the hour for accounting services so that the amount of their bills more closely parallels the burden customers place on DFAS (although the fixed-cost problems still exist with the reformed approach).

Some DFAS customers who were interviewed as part of earlier RAND research (Keating et al., 2001) expressed concern about the accounting billing reforms. Specifically, they feared that the new approach did not provide DFAS with sufficient incentive to control costs because all costs would be charged back to customers through the hourly rates.

In our analysis, we find little evidence that DFAS has taken advantage of the "moral hazard" (discussed in Chapter 6) that is allegedly created by the new pricing scheme. Trends in DFAS regions' monthly accounting expenditures have not meaningfully changed since the switch in accounting billing practices.

Further Reform of DFAS Pricing Policies

Changes in DoD pricing regulations are needed to allow DFAS to adopt nonlinear, customer-specific pricing structures.

DFAS should receive appropriations from Congress or fixed fees from customers to cover fixed costs it will incur irrespective of customers' decisions on how much it sells. It is not constructive to distort customers' incentives with fees for costs DFAS will incur irrespective of its workload. Also, we suggest that using per-unit prices of any sort is essentially meaningless for outputs such as Military Active Pay in which the quantity of work output demanded is exogenous to DFAS's price. The size of the military is not going to change based on what DFAS charges for the Military Active Pay output.

For some outputs, prices lower than current levels that reflect DFAS's incremental costs could be valuable, however. For example, discounting of automated services can hopefully encourage customers to adopt more-efficient processes (even if they prefer current approaches that are more expensive for DFAS). In addition, cross-customer subsidization should be minimized.

Ultimately, DFAS cannot and should not tell its customers what to do. Instead, DFAS should provide customers with a price "menu" that is more detailed and customer-specific than the current list of prices and that reflects DFAS's incremental costs of various approaches. Customers can then decide what sort of finance and accounting services to purchase. A price-menu approach would be more complex than the current DFAS pricing structure, but the relative simplicity of the current pricing regime comes at a considerable cost in terms of customers' distorted incentives for how much and what type of workload to provide to DFAS and in cross-customer subsidization.

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