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The Impact of Medicare's Prospective Payment System on Psychiatric Patients Treated in Scatterbeds

ABSTRACT

Medicare's Prospective Payment System (PPS) for hospitals was phased-in during the 1984 Federal Fiscal Year. While many providers of psychiatric inpatient care were exempted from PPS patients treated in general hospital beds outside of psychiatric units (scatterbeds) were not. This allows for an initial assessment of the impact of PPS on psychiatric patients. We use a single equation model of hospital length of stay to estimate the impact of PPS. We allow for the possibility of both anticipating behavior and slow adjustment to the new payment scheme. The results indicate a substantial response to PPS over the first year of implementation. The estimated response includes sizable anticipatory and slow adjustment components. The findings suggest that policy discussions may be weighted too heavily in the direction of concern over hospital financial status given the ability of hospitals to change their behavior.

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I. Introduction

On October 1, 1983 the phase-in of the Medicare Prospective Payment System (PPS) began. Although the general impression is that providers treating Medicare psychiatric cases were exempted from PPS, that impression is misleading. Only free standing psychiatric hospitals and psychiatric units in general hospitals (which met certain qualifying conditions and applied for and received an exemption) were exempted from PPS; other providers were not.[1] In fiscal year 1984, 41 percent of psychiatric discharges which accounted for 29 percent of total charges for psychiatric Medicare cases, were paid for under PPS. These patients received their care from general hospitals, either in the so called "scatterbeds" or in nonexempt psychiatric units.

The overall objective of PPS was to stem the growth in hospital costs while continuing to ensure the access of beneficiaries to quality health care (Gutterman and Dobson, 1986). The system was designed to encourage the efficient production of quality care. Clearly, the intent of PPS was to stimulate significant behavioral changes (which could be called supply response) from the providers of hospital services. However, a number of analysts (Goldman et al, 1984 McGuire et al, 1985 and Frank and Lave, 1986a) have raised concerns about the nature of the supply response of mental health providers to the incentives contained in a per case payment system. They have raised the possibility that providers may undertreat mentally ill patients or transfer them inappropriately to State mental hospitals. This concern is enhanced by the fact that the Medicare outpatient benefits for psychiatric cases are more limited than those for the general population.

In this paper we begin to evaluate the effect of PPS on psychiatric care by examining the PPS associated changes in hospital lengths of stay of Medicare psychiatric patients treated in scatterbeds. This represents but a

beginning of a complete evaluation. An evaluation of the overall impact would include an analysis of the factors leading to a psychiatric unit's exemption from PPS, a systematic analysis of the distribution of Medicare patients across types of facilities and any health effects associated with the changed behaviors. An examination of the more complete set of impacts must await future research.

The paper is organized into six sections. The second section briefly reviews recent contributions to the analysis of PPS applied to psychiatric patients. The third section addresses some theoretical considerations that arise in specification and interpretation of the empirical model of length of stay. This is followed by a description of the empirical implementation of the length of stay model. The last two sections present results and a discussion of the implications and limitations of the research.

II. Recent Contributions to the Analysis of PPS and Psychiatric Patients

The introduction of the Medicare prospective payment system has stimulated a significant amount of research by social scientists. PPS related research can be classified into three categories: (1) studies which are concerned with patient classification systems and their strengths and weaknesses as the basis of a payment system; (2) simulations of the impact of changing the structure of hospital payment systems and (3) analyses of the effect on hospital length of stay, of hospital reimbursement systems which are similar to PPS. Here, we discuss only behavioral and payment system related research. We do not review the research on classification systems. It has been reviewed elsewhere (for example, McGuire et al. 1985), and the incentives and responses at issue here would be substantially similar under any classification system so long as payment is prospective.

Two recent studies have attempted to simulate financial effects of PPS on various types of hospitals which provide inpatient mental health care. Freiman and colleagues (1986) assessed the financial implications of PPS payments on exempt and non-exempt psychiatric units of general hospitals in four states (Michigan, North Carolina, Washington, and New Jersey). The simulations compared the revenues that a hospital would receive under the fully phased in prospective payment system (that is the individual hospital payment rates would be based on national costs as opposed to depending, in part, on the hospital's own costs or the costs of the region in which it was located) with the revenues it would receive under a cost based payment system. Freiman, et al.(1986) found that exempt psychiatric units, assuming no supply response, would incur losses in three of the four states. They also found that psychiatric units which did not obtain an exemption would fare systematically better under PPS than the exempt units. The implication of these results is not entirely clear. Under PPS, the units would be expected to their change behavior. Although total revenue from Medicare would decrease, it is possible that costs could be reduced more than proportionately. Thus, the assumption of no supply response to changed payment incentives makes any conclusion about the effect of PPS on the hospital's financial status difficult to draw with confidence.

The study by the National Association of Private Psychiatric Hospitals (NAPPH) sought to address some of the same issues as the work by Freiman et al. The NAPPH study was primarily concerned with whether private psychiatric hospitals would be systematic winners or losers under the PPS system. The NAPPH performed a variety of simulations of the financial impact of the fully phased in PPS, as well as some potential modifications, on their member hospitals. The

results of the simulations led the NAPPH to conclude that there would be substantial redistribution of Medicare dollars among their sample hospitals. This conclusions is difficult to interpret because the characteristics of the winning and losing hospitals were not reported. As in the Freiman et al. analysis, no behavioral responses to new incentives were permitted in the analyses.

The second type of evidence on possible impacts of PPS on inpatient psychiatric care is based on observations of hospital behavior under reimbursement systems which contain some incentives similar to PPS. Rupp, Steinwachs, and Salkever (1985) estimated the impact of a per case prospective payment system on length of stay of psychiatric patients. Using data from the state of Maryland the authors compared the length of stay of psychiatric patients discharged from general hospitals paid under Maryland's Guaranteed Inpatient Revenue (GIR) method with those discharged from the hospitals paid under a prospective per service scheme. The GIR system put into place a projected case mix adjusted revenue cap per case for all live discharges. If hospital revenues either exceeded or fell short of the projected revenues, the hospital's rate was adjusted in the following year. The Maryland GIR system is therefore a mix of per case prospective payment and a budget review system. Thus, the incentives to shorten length of stay are weaker under GIR than under PPS. The authors estimated multiple regression models for roughly 11,000 discharges from Maryland hospitals for the years 1977 through 1980. Their results indicate that lengths of stay fell by from 5 to 7 per cent in hospitals under the per case system. Rupp, Steinwachs and Salkever conclude that even under modest financial incentives a decrease in length of stay was observed and therefore more stringent policies might produce larger responses.

A payment system which sets limits on reimburseable days per hospital episode has incentives similar to PPS. Under such a system, the hospital receives a fixed daily payment until the day limit is reached and then its marginal revenue falls to zero. Under PPS, a hospital receives a fixed sum for taking care of a patient. Thus, (unless the patient is classified as an outlier), the hospital receives no marginal revenue, but does incur additional costs, for each day of care provided. Frank and Lave (1986 b) analysed the effect of setting limits on the number of reimburseable days by State Medicaid programs. Using national data on Medicaid discharges from the psychiatric units of general hospitals, they found that the imposition of a 25 day per episode stay limit reduced length of stay by approximately 30 per cent. This is a very large response. However, since the study population was based on a small sample of Medicaid patients (976) discharged from psychiatric units (where the lengths of stay tend to be quite long), the results should be considered only suggestive of what might be found under PPS.

III. Theoretical Considerations

Under the Medicare propective payment system, a hospital receives a fixed amount for providing services to a given patient. The payment varies with the patient's DRG classification. If the patient is an "outlier patient", that is, if he/she has, compared to the average patient in a DRG, either a significantly longer length of stay or higher incurred costs, the hospital can receive additional payments. The revenues received under the fixed payments (plus the outlier payments) are to cover the operating costs of treating Medicare patients. Capital costs and most of the costs associated with graduate medical education are paid for on a cost basis. Thus, compared to cost based reimbursement, PPS shifts some of the risk from Medicare to the hospital.

Under PPS, the hospital receives a fixed dollar sum for taking care of a patient regardless of the actual costs incurred in treating that patient. The setting of a prospective payment means that net revenues are systematically reduced for each unit of service provided the patient, where the reduction in net revenues will depend on the marginal cost of producing the services. The hospital has strong financial incentives to reduce the number of services provided. Since treatment costs have a strong positive relation to the patient's length of stay, hospitals consequently have a strong motivation to reduce the length of stay. However, other factors will moderate the incentives to decrease length of stay that would result from the simple pursuit of profit maximization. Some minimum level of quality must be maintained. In addition, some administrators may want to provide care of slightly higher quality either for altruistic purposes or to decrease the chances of being cited for malpractice. In addition, physicians are usually paid on a per visit basis and, therefore, have an incentive to advocate for longer stays.

Sloan and Steinwald (1980), Ellis and McGuire (1986), and Seidman and Frank (1986) have developed theoretical models of hospital behavior which have incorporated factors other than the maximization of net revenue into the hospital's objective function. They have used these models to analyze how hospitals would respond to the implementation of a per case prospective payment system. The qualitative predictions of all the models are the same: relative to a cost based payment system, the average length of stay will fall.

However, in the empirical analysis to be discussed below, we compare the length of stay of Medicare psychiatric patients for whom the hospitals were paid under PPS rules not with that of patients for whom hospitals were paid under cost based rules but rather with that of patients for whom the hospitals

were paid under TEFRA rules. Under TEFRA (the Tax Equity and Fiscal Responsibility Act of 1982), hospitals' payments were based on the historical cost of each hospital, an inflation adjustment, and hospital cost performance relative to cost per admission targets. The provisions under TEFRA offer incentives to reduce costs and length of stay by offering hospitals a share of the savings. Hospitals are penalized for exceeding cost targets by having to absorb 75% of the overrun. In addition, cost limits are specified (120% of similar hospital costs) which if exceeded require a hospital to absorb 100% of the excess. This means that below the cost limits there is "cost sharing" of profits and cost overruns while above the cost limits the hospital absorbs all losses. Thus, one might consider TEFRA a intermediate step between a cost based and a PPS payment system, and therefore lengths of stay should be longer under TEFRA than under PPS.

Since our empirical work is based on observations from the first year of PPS phase-in, and because the payment system changed during the year for most hospitals we may observe a disequilibrium situation. Because it is costly to adjust to a new reimbursement system one might expect hospitals to begin a gradual adjustment prior to the commencement of PPS in anticipation of the new incentive structure.[2] It is also possible that the adjustment process adopted by the hospital would not lead to a new equilibrium level by the time PPS had been implemented. The likelihood that hospitals do not instantaneously adjust to new incentives means that in order to obtain unbiased estimates of the impact of PPS on length of stay, the empirical model must incorporate variables that represent the dynamics of adjustment.

IV. Empirical Implementation

a. The Data

The data set is composed of data from three sources of information. They are: the Health Care Financing Administration's (HCFA) Patient Billing File (PATBILL) for fiscal year 1984, the American Hospital Association's (AHA) Annual Survey of Hospitals for 1984, and the HCFA Provider of Service File (POS) for November of 1985. The PATBILL file covers all hospital discharges paid for by Medicare during fiscal year 1984 (October 1, 1983 to September 30, 1984). The PATBILL file contains information on patient characteristics such as age, sex, race and diagnosis as well as measures of hospital utilization such as length of stay and incurred charges. The AHA and POS files contain information on hospital characteristics. These include the number of beds, hospital teaching status, location of the hospital and ownership category. Table 1 defines and indicates the data source for selected variables used in the empirical analyses presented below. The means and standard deviations are also reported.

In 1984 there were roughly 346,000 psychiatric and substance abuse discharges reported in the PATBILL data. Of these, 41 per cent were in Major Diagnosis Category (MDC) 19- the psychiatric DRGs while 57 per cent were in MDC 20 the substance abuse. Considering MDC 19 discharges only the discharges from freestanding psychiatric hospitals comprise 18.6 percent of the total. Discharges from general hospitals accounted for 81.4 percent, with 47 percent from general hospitals with psychiatric units and 34 percent from hospitals with no unit. Hospitals without psychiatric units made up 78 per cent of the general hospitals in the data set.

However, in order to examine the effect of PPS on patient length of stay, we limited our analysis to discharges of patients from general hospitals with no psychiatric units - the pure scatterbed patients. We concentrate on this subset of patients and hospitals for essentially three reasons. First, as noted above, psychiatric units in general hospitals could apply for an exemption from PPS and continue to be paid under TEFRA. Thus, if one were to study the impact of PPS on the psychiatric units that chose to receive PPS reimbursement, one would have to take into account the decision not to seek the exemption in order to obtain unbiased estimates of the PPS effect. This is a complicated matter for a preliminary analysis. Second, for hospitals that treat patients both in psychiatric units and in scatterbeds, the patients treated in scatterbeds in unit hospitals are likely to be different from the patients treated in hospitals with no units. Finally, for hospitals with units under PPS it is impossible to distinguish between a discharge from a unit and a discharge from a scatterbed, while for hospitals with exempt units, one can distinguish between them only after the hospital was exempted from PPS. For all of these reasons we chose to focus on the pure scatterbed discharges. There were 74,416 discharges from pure scatterbeds. However, in order to control computer costs, we selected a 10 per cent random sample of discharges.

The selection criteria led to a systematic selection of hospitals and psychiatric patients. For example, relative to the population of all psychiatric discharges, those from hospitals outside of Metropolitan Statistical Areas (MSAs) were overrepresented in the analysis file. Forty-five per cent of the discharges were from hospitals outside of MSAs while 7.2 percent were from hospitals in central cities. The diagnostic mix and demographic composition is similar to that found in all scatterbeds (it should be remembered that scatterbeds in hospitals with units have been excluded) but quite different from the

mix in units. Twenty-nine percent of the patients in scatterbeds had a DRG of psychosis compared to 70 percent in the exempt psychiatric units. Thirty-four percent of scatterbed patients were diagnosed as having an organic disorder relative to 11 percent of the discharges from psychiatric units. Clearly, these substantial differences across treatment settings limit the breadth of the generalizations that can be made based on the specific estimates obtained from the analysis of scatterbed discharges.

There is, however, a different type of selection issue that needs to be addressed. Was the population of patients treated in scatterbeds different before and after the implementation of PPS? If it was, then any decrease in observed or estimated length of stay in response to PPS might be due not to differences in hospital practice patterns but rather to differences in the inpatient population arising from changed hospital sorting patterns. To address this issue, we first analyzed the flow of discharges from scatterbed hospitals and then we analyzed the diagnostic mix of patients before and after PPS.

In Fiscal Year (FY) 1984, the monthly flow of discharges ranged from 6.8 percent to 9.0 percent of total discharges. The portion of FY 84 patients discharged during the first three months of fiscal year 1984, when most hospitals had not yet come under PPS, was 25.7 percent. The share of FY 84 discharges in the last three months of fiscal year 1984, when almost all hospitals were on PPS, was 23.1 percent. This is not a significant difference.[3]

Table 2 reports the diagnostic composition of scatterbed discharges pre and post PPS. There appear to be no significant changes in diagnostic mix related to PPS. The share of discharges accounted for by DRG 425 (acute adjustment reaction) and DRG 429 (Organic Illness) did decrease slightly while the share accounted for by DRG430 (Psychoses) increased slightly. Thus, if anything is reflected by such changes, it is a shift in patient composition

toward patients who are somewhat more difficult to manage. Other explanations such as "DRG creep" are also consistent with the change. In conclusion, the available evidence suggests that it is probably reasonable to assume (as we do) that no major changes in patient sorting occurred during the change from TEFRA to PPS.

b. Specifications

The length of stay of individual discharges is hypothesized to be a function of three classes of explanatory variables - patient characteristics, hospital cost characteristics, and the set of rules under which the hospital is paid (Ellis and McGuire 1986 and Seidman and Frank 1986). The characteristics of the patients treated will be a major factor influencing how long they stay in the hospital. The type of treatment provided will depend on the patient's clinical conditions, his age, and the patient's support system. The patient's response to treatment and his subsequent clinical status, in part, determine the feasibility of discharging a patient and the consequences of such action. A second set of factors is related to the structure of hospital costs. As discussed above, the marginal cost of a hospital day defines the rate at which hospitals exhaust their net revenues in a per case prospective payment system. For this reason hospital characteristics which underlie the cost structure serve to constrain a hospital's decision making regarding an individual patient's stay. Finally, the incentives contained in the payment system are constraints a hospital faces in pursuit of its goals such as providing quality care and obtaining net revenues.

In order to analyze the length of stay, one must have measures for each of the factors affecting length of stay. In this paper, clinical characteristics of patients are measured by the patient's DRG, age, sex, race and

Medicare eligibility status. We characterize patient diagnoses by using the DRGs in MDC19. The age variable is specified as a quadratic function. This reflects the common finding of an inverse U shaped relation between age and health care utilization. The presence of information on Medicare eligibility status allows for the differentiation between individuals qualifying for Medicare because of age versus disability status. The psychiatric inpatient who is disabled is quite likely to be chronically mentally ill and may have different patterns of use than acutely ill patients. The sex, race and diagnoses measures are all specified as dichotomous dummy variables.

Unfortunately we cannot directly measure many of the key factors that might be included in a hospital's cost function. We thereby rely on indirect measures of hospital cost factors. Hospital size and ownership are included in the model to control for economies of scale and any possible slack or X-inefficiency sometimes hypothesized to be associated with non-profit and public ownership (see Frech and Ginsburg, 1981). It should be pointed out that larger hospital size has also been associated with greater severity of illness in patient populations. Hospital teaching activities have been shown to be associated with higher hospital costs, we therefore include a variable which indicates the presence of a teaching program.[4] In order to account for input cost differences we include dummy variables which indicates hospital location (e.g.: central city).

The financing arrangements according to which Medicare patients are paid are characterized in a number of ways. One might view the change in payment method as a shift in relative prices to the supplier. The change in quantity supplied will therefore be explained by both a substitution and an income effect. Salkever, Steinwachs and Rupp (1986), for example, noted that unless hospitals were at risk of significant financial losses, relative prices at the

margin may have a somewhat weak impact on hospital behavior. This is important for model specification because it suggests that ideally one would want to incorporate an indicator of income effect (DRG bite) for the hospital. One such variable might be a hospital's average per case cost for a psychiatric patient relative to the DRG payment for psychiatric patients. While we do not measure this directly, most of the hospital characteristics along with geographic dummy variables (both state and region specific) are explanatory variables for such an income effect.[5] Due to data limitations we rely on only direct PPS measures to characterize the relative price change.

We use three measures to capture the effect of PPS. The first is a dummy variable indicating whether the hospital was paid for treating a given patient under PPS rules. The second measure, TIMEPRIOR, represents how many days prior to the implementation of PPS a given discharge occurred. The third measure, TIMEPOST, indicates how many days after the implementation of PPS, the discharge occurred. As we argued above, it is unlikely that the hospital would respond instantaneously to the implementation of PPS. We would expect that hospitals would anticipate the implementation of PPS and would begin to implement new procedures to control the use of hospital resources prior to PPS. On the other hand, after the implementation of PPS it becomes more costly not to reduce length of stay to the equilibrium level. Thus one would expect that adjustment would occur relatively quickly. We hypothesize that length of stay would increase as TIMEPRIOR to PPS increases, and that length of stay would fall as TIMEPOST increases. Since hospitals came under PPS at different times of the year, the TIMEPRIOR and the TIMEPOST variables will differ across hospitals. About 16 percent of the hosptials began PPS on October 1, 1983 while 24 percent began on January 1, 1984 and 36 percent started on July 1, 1984.[6]

Finally, we include a number of variables to control for possible confounding factors. They include a variable indicating whether a patient was admitted on a weekend (Friday, Saturday or Sunday). Cannoodt and Knickman (1984) found this variable to have a positive impact on length of stay. Geographic dummy variables are included (both state and regional). Length of stay has been hypothesized to vary during various parts of the calendar year. For example, hospitals and physicians may be more reluctant to discharge patients with little community support during the winter than in the summer. To take account of this factor we include a dummy variable which takes on a value of one during the winter months and zero otherwise (November through March). Whether a patient was discharged against medical advice (AMA) was also measured. Finally we control for level of urbanization by using five dummy variables which describe the size of the MSA, central city versus suburban location, and a rural area indicator.

The basic length of stay model which we have just described assumed that PPS effects could largely be captured as direct effects. We relax that assumption and assess interaction effects. In particular, we assess PPS interactions with hospital ownership. It may be that hospitals without the backing of public budgets (privately owned) may have larger responses to changed incentives than publicly owned providers.[7]

In formulating the empirical model, the dependent variable was transformed into logarithms. One reason for the logarithmic transformation of length of stay is to make the dependent variable approximately normal. However, ordinary least squares tends to be quite robust when departures from normality occur. A more important reason for transforming length of stay is the assumption that PPS will not effect all parts of the length of stay distribution with the same absolute magnitude. It seems more reasonable to assume that PPS will have a propor-

tional effect on the length of stay (that is, that the length of stay of both the long stay cases and the short stay cases will fall by x percent) than it is to assume that PPS will have a linear effect on length of stay (that is that both long stay and short stay cases will experience a given decrease in their length of stay).[8]

The model was estimated using ordinary least squares regression. Since the individual discharge is the unit of observation in this analysis and groups of patients are discharged from the same hospitals variance estimates based on ordinary least squares regressions may be biased due to autocorrelation. Generalized least squares would be appropriate in this case. However, with a 10% random sample the numbers of discharges from each hospital are small and makes intrahospital covariance estimates not very meaningful. Because we were interested in determining not only the PPS effect but also how sensitive the estimated effect was to the way the PPS variable was measured, we estimated three separate regressions. In Model I the PPS variable is specified as a single dummy variable. In Model II the PPS impact is measured by three variables, TIMEPRIOR, TIMEPOST and the PPS dummy (PPSIND). In Model III the three PPS variables are included plus a PPS-ownership interaction term. The results are presented in Table 3. Overall the models account for about 12 percent of the variation in the length of stay of Medicare psychiatric patients. Although the R^2s are low, they are comparable to those obtained by other investigators who have analyzed the length of stay of individual patients (Frank and Lave 1986b, McGuire, Dickey and Shively 1986, and Taube et al 1984). The R^2s were 0.12, 0.12 and 0.11 respectively. The parameter estimates for the three models presented on Table 3 are consistent with both our expectations and with previous research.

The results of primary interest are those that offer insight into the impact of PPS on length of stay. Model I characterizes PPS by a single dummy variable. Models II and III attempt to capture the full adjustment to PPS by attributing to PPS reductions before implementation due to anticipation and reductions following implementation due to slow adjustment. Since we characterize PPS in this manner it is important to carefully define the comparison that is being made. By considering both anticipatory and slow adjustment types of behavior we are estimating a 365 day PPS impact for a typical hospital (one that went on PPS in March) relative to TEFRA.[9] This specification should lead to larger estimates than those resulting from inclusion of a single PPS dummy variable. In the case of an immediate adjustment in length of stay at the time that a hospital implements PPS the single dummy approach and our more complicated formulation would yield identical results. That is, the TIMEPRIOR and TIMEPOST variables would have coefficients of zero and the PPS dummy would capture the full effect.

The components of the PPS impact estimate can be seen on Table 3. The coefficients for the TIMEPRIOR and TIMEPOST variables indicate that adjustment was not instantaneous on the PPS implementation date. The positive coefficient for the TIMEPRIOR variable suggests that for every day one moves away from the PPS implementation date length of stay is increased. This, of course, also means that as the PPS starting date becomes closer length of stay falls.[10] Similarly, the TIMEPOST coefficient estimate is negative and significant which means that hospitals continue to cut length of stay after the PPS starting date. These coefficients taken together indicate that PPS implementation took place continuously over the observed time period. The TIMEPOST coefficient is larger in absolute value than the TIMEPRIOR coefficient. This was expected since the cost of adjustment to the new equilibrium after PPS has gone into effect is

greater than the adjustment cost under TEFRA since marginal revenues for each day under PPS are zero. Thus, the hospital that had not fully adjusted by the time PPS took effect had a strong incentive to reach its new equilibrium relatively quickly. Using an incremental F test, the two groups of coefficients in Models II and III are significantly different from zero.[11]

The PPS dummy had a negative and statistically significant impact on length of stay even when the TIMEPRIOR and TIMEPOST variables were included in the model the coefficient ranged from -0.049 to -0.064 indicating a 5 to 6 percent shift in length of stay. This suggests that the impact of PPS became stronger at the time of implementation. The estimated 365 day effect can therefore be characterized in a manner illustrated in Figure 1. The discontinuity at the PPS start date shows the impact of the PPS dummy. Note also that the slope of the PPS adjustment curve is steeper following the start of PPS than it was in the time prior to PPS. This reflects the magnitudes of the TIMEPRIOR and TIMEPOST coefficients.

Table 4 summarizes the estimated PPS effects for the three regression models. The three models indicate declines in length of stay associated with implementation of PPS of 13 percent for Model I, 16.5 percent for Model II and 17 percent for Model III. Since the for-profit sector is relatively small and the coefficient estimates rather stable in the two models the addition of the PPS-ownership interaction changes little. As expected the 365 day PPS impacts are substantially larger in magnitude than the PPS impact obtained using only the PPS dummy variable. Thus we may view the 13 percent decline in length of stay as a conservative lower bound estimate and the 17 percent decline as an upper bound. The estimated 365 day PPS impacts are calculated on the basis of a weighted average of days prior and days post. This allowed us to consider the situation of the "average: hospital given that hospitals were phased into PPS

throughout the fiscal year. The point estimate of the PPS impact varies as one considers different points at which a hospital might have commenced PPS. Again, because our prior reasoning suggest that a logarithmic transformation is most reasonable we focus on those results.

Table 4 also shows the "raw" decreases in length of stay. These numbers compare the average lengths of stay of all discharges which occurred prior to PPS with those after PPS. In absolute terms, the average length of stay fell from 9.14 days to 7.24 days. This represents a decrease in the arithmetic mean of 20.4 percent. In constrast the geometric mean declined by 12 percent. As indicated above, unless detailed investigations of the length of stay show otherwise, we think that it is more likely that the lengths of stay of all cases fell by 12 percent than it is that the length of stay of each type of case in the DRG class fell by 1.9 days. It is also of interest to note that the decrease in the geometric mean length of stay of 12 percent is almost identical to the PPS effect estimated in Model I.

One must exercise some caution in interpreting the results. Attributing the full effect captured by the TIMEPRIOR, TIMEPOST and PPSIND variables may lead to overstating the effect of PPS. Since the TIMEPRIOR and TIMEPOST in part will reflect secular trends in length of stay one must examine recent trends in psychiatric length of stay . Using data from the National Hospital Discharge Survey (HDS) we examined the average length of stay for the United States as a whole and for the greater than 65 year old age group for 1980 through 1983. Those data suggest that for the entire population psychiatric length of stay has risen slightly (11.6 days to 12.4 days). For the greater than 65 years old segment of the population length of stay remained essentially constant (13.7 days to 13.5 days).[12] Thus it is unlikely that a secular trend in length of stay is a dominant factor in interpreting the PPS

results. A second issue relates to the possibility that our measure of anticipatory effects in part represents slow adjustments to TEFRA. This is clearly a possibility. However, the age specific national length of stay data suggest little impact of TEFRA in 1983. Thus, virtually the entire TEFRA effect would be occurring with at least a one year lag. While some lagged impact is probable the lack of a one year effect leads us to believe that its magnitude is small.

Few of the hospital characteristics specified in the model had significant impacts on length of stay. Hospital size was estimated to have a positive and significant effect on length of stay. Hospital ownership appeared to have little effect on length of stay, neither did the teaching variable. This may in part be because we measure the presence of any teaching activity (residency program) rather than specific psychiatric training. Although one would expect little psychiatric training in general hospitals without a psychiatric unit.

Variables capturing the time of admission were not significantly different from zero at conventional levels. The WEEKEND variable did have the expected positive sign. The WINTER variable had a negative sign which was counter to our hypothesis. To some extent this weak result should not be surprising since winter means such different things in the various regions of the country.

Several patient characteristics had important impacts on length of stay. Patient gender and race were both significantly related to length of stay. Females had significantly longer stays than men (approximately 7% after adjusting for the semilog form of the model). Non-whites had stays that were about 16 percent longer than those of whites. Finally, the diagnoses were estimated to be important determinants of length of stay. DRGs 425, 426, 427, 429, and 431 all had significantly shorter stays than did the reference category. The DRGs as a group explained roughly 4.5 percent of the variation in length of

stay (when run alone against length of stay). This is quite consistent with the findings of Taube et al. (1984) and Frank and Lave (1986b).

VI. Discussion

In this section we attempt to place the results for the PPS impact in the context of other recent studies of length of stay. Table 5 again summarizes our results and presents the results of two recent studies of per case payment systems based on DRGs.

The Prospective Payment Assessment Commission (PROPAC) study reports results based upon the 1984 PATBILL file for all Medicare hospital discharges. Their decrease in lengths of stay are calculated by comparing the arithmatic mean of pre PPS discharges with that of post PPS discharges. The overall decline in length of stay "attributable" to PPS was 7.6 percent. They also reported results that are disaggregated by class of DRG (medical vs. surgical) and market type (rural vs. urban). For the medical DRGs, declines in length of stay associated with PPS were considerably more dramatic than for the overall Medicare population. Medical DRG cases treated in rural hospitals had on average an 11 percent fall in length of stay during 1984 following implementation of PPS. Similarly medical cases treated in urban hospitals had a 12.9 percent drop in length of stay. Declines for surgical DRGs were substantially smaller (3.5 and 1.7%).

Recent work by Rosko and Broyles (1986) found that the New Jersey per case prospective payment system was associated with 3.4 percent lower lengths of stay than in hospitals paid under the parallel prospective per diem rate setting system. The New Jersey study focuses on the hospital as the unit of analysis which means the findings are not entirely analagous to those based on individual discharge data.

Propac has called the 7.6 percent decrease in length of stay associated with PPS "striking", (p.62). Since our analysis indicates that hospitals began to adjust to the incentives embedded in PPS before they actually came under it, the raw comparison of means will provide an underestimate of the complete PPS effect. However, it is clear that PPS had a larger effect on the length of stay of psychiatric patients in scatterbeds than it did overall. The observed decrease in the "raw" length of stay of psychiatric patients associated with PPS was 20.4 percent. This is a much larger decrease in length of stay than was observed for any group of general Medicare discharges. Although we have taken issue with using the decrease in the arithmetic mean length of stay as an indicator of PPS impact, it is clear that the conclusion would not be changed if we compared changes in the geometric mean length of stay.

The supply response to PPS for psychiatric patients is large, particularly when it is observed over a single year. The reduction in psychiatric length of stay is particularly impressive given the fact there is little evidence of a time trend towards shorter lengths of stay. This finding is consistent with the notion that there is considerable flexibility in the treatment of psychiatric inpatients relative to medical or surgical patients. The implications of hospitals exercising this flexibility are not clear. For example, one explanation for the dramatic response to PPS is that there was substantial waste of resources in the delivery of hospital based psychiatric care under TEFRA. In such a case an average length of stay of 7.24 days may be consistent with high quality psychiatric care delivered at least cost. A second hypothesis suggested by the work of Frank and Lave (1985b) is that patients may be shifted to other types of providers of mental health care. This could be undesirable if the referrals were not clinically appropriate. A third possibility is that pointed to by Rupp and her colleagues (1984) which is that readmissions increase

in response to lower lengths of stay. This would not be consistent with high quality care delivered at least cost. Which of these competing explanations dominates is not known. However, it is important to develop information to reveal whether undertreatment is occurring so that the social benefits associated with the observed declines in length of stay can be evaluated.

Substantial concern has been raised by the work of Freiman et al. (1986) and the NAPPH (1986) as to the financial status of providers of psychiatric care under PPS. While our results do not directly address this issue, they do suggest that if supply responses for psychiatric units and psychiatric hospitals are at all similar to those found for scatterbeds, simulations of payments that do not incorporate such response may be seriously misleading. Large supply responses over a single year indicate an ability to quickly reduce per case costs of treating psychiatric inpatients. It is this ability that is a crucial determinant of the financial performance of hospitals under PPS. Moreover, our results indicate that for-profit hospitals have only slightly more flexibility in reducing length of stay than do either the public or non-profit general hospitals.[13] Thus an important implication of our analysis is that there may be an overemphasis, in recent policy discussions, on protecting hospitals from losses. Instead one might focus attention on protecting patients who might be hurt by dramatic supply response. Of course, in the long run if the payment system is tightened and not refined, the issue of loser hospitals may become quite important.

Several important limitations to our analysis need to be pointed out. The most obvious and probably most significant is that our sample consists of "pure scatterbeds." The extent to which these hospitals respond to PPS in ways similar to psychiatric hospitals and psychiatric units is not known. We do not know that rural hospitals are overrepresented among the "pure scatterbeds." The

psychiatric case mix in the hospitals analyzed here is different from that found in psychiatric units and psychiatric hospitals. A second limitation is the dearth of information on mental health status among the sample discharges. Variables such as previous history of mental health care use, and educational attainment were not available. Our theoretical framework called for the inclusion of an income effect. While there are some econometric difficulties in specifying such a variable in our model, it would be desirable to experiment with a direct income effect measure. Since we observe discharges over only one year with some hospitals beginning PPS on the first day, our data is censored. Thus, anticipatory behavior prior to October 1, 1983 is missed.

Finally because adjustment to TEFRA may have been slow, some of the adjustment attributed to PPS may in fact be due to TEFRA. Again, because length of stay did not decline in 1983 we believe the magnitude of the slow TEFRA adjustment is probably small.

In conclusion our analysis provides a first glimpse at the hospital supply response for psychiatric patients paid for under PPS. That glimpse suggests a larger response than observed for medical patients paid for by Medicare and relative to the experience in New Jersey. The results suggest that adjustment to the new payment system was not immediate but rather took place continuously over the phase-in year. Moreover, the adjustment process appears to have accelerated as the PPS start date approached. This also indicates hospital sensitivity to financial incentives. The approach to characterizing the PPS effect suggests that calculation of winners and losers under PPS must be mindful of a hospital's ability to dramatically alter per case costs. Finally, the strong response observed in this analysis makes it even more critical to distinguish between increased efficiency and undertreatment.

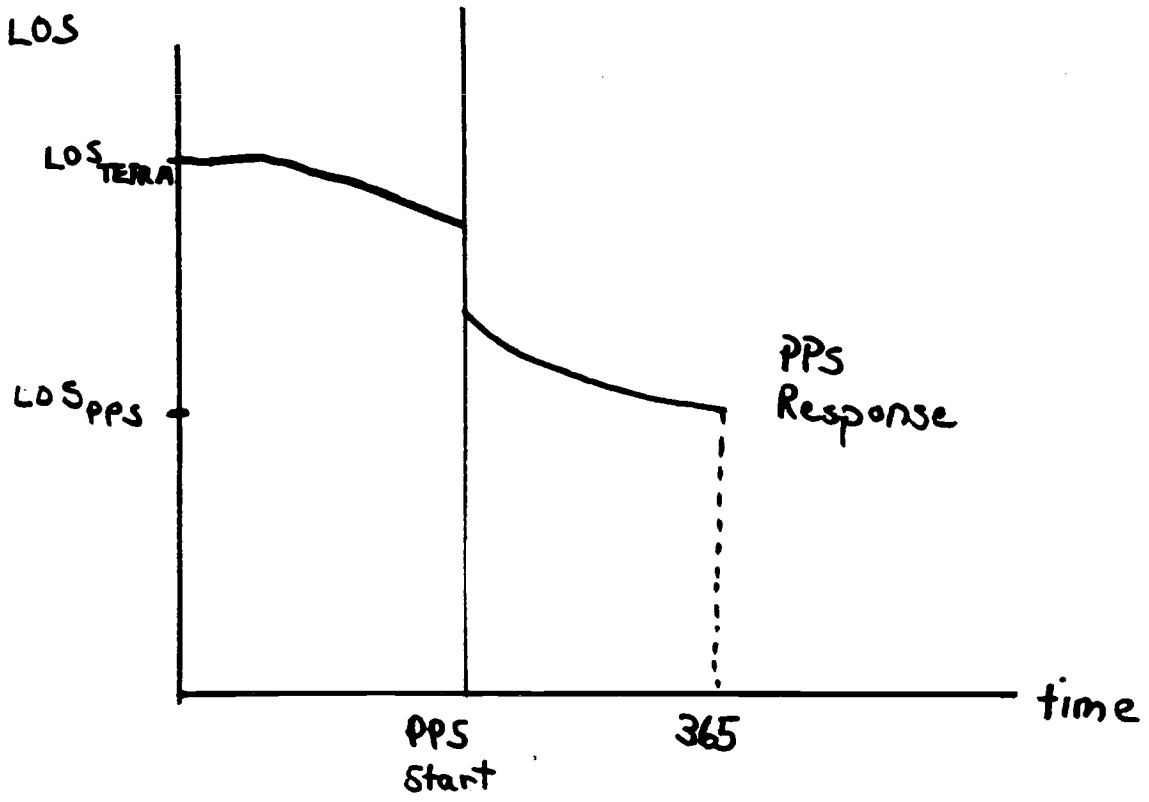

FIGURE 1

365 DAY IMPACT OF PPS

TABLE 1

SELECTED DESCRIPTIVE STATISTICS

VARIABLE	MEAN (SD)	SOURCE
Length of stay	8.23 (5.8)	PATBILL
TIMEPRIOR (days)	204	PATBILL/POS
TIMEPOST (days)	161	PATBILL/POS
BEDS	122.2 (83.0)	POS
PUBLIC %	23.0 (42.0)	AHA/POS
NON-PROFIT %	61.0 (48.0)	AHA/POS
PROFIT %	14.0 (34.0)	AHA/OS
SEX (Female) %	63.0 (48.0)	PATBILL
RACE (White) %	90.2 (29.7)	PATBILL
Medicare Status (Disabled) %	15.7 (36.4)	PATBILL

TABLE 2

DIAGNOSTIC MIX IN SCATTERBEDS

PRE AND POST PPS*

DRG	% of PRE PPS Discharges	% of POST PPS Discharges
424	2.7	2.2
425	16.0	12.6
426	16.3	17.6
427	1.5	1.4
428	0.7	1.0
429	36.5	32.7
430	25.0	31.0
431	0.5	0.3
432	0.9	1.1
N	2884	3786

* No significant differences using a test of proportions

TABLE 3

REGRESSION RESULTS

(Dependent Variable = LN LOS)*

VARIABLE	MODEL I	MODEL II	MODEL III
Age	0.011	0.009	0.010
	(2.35)	(2.00)	(2.37)
Age^2	$-0.006e^{-2}$	$-0.004e^{-2}$	$-0.004e^{-2}$
	(1.67)	(1.32)	(1.67
Sex	0.073	0.063	0.067
(1=Female)	(3.59)	(3.14)	(3.31)
Race	0.167	0.166	0.154
(1=Nonwhite)	(5.29)	(5.19)	(4.90)
Medicare Status	0.045	0.039	0.039
(1=Aged)	(0.99)	(0.85)	(0.86)
Admission Day	0.025	0.022	0.019
(1=Weekend)	(1.26)	(1.11)	(0.99)
DRG			
424	0.351	0.346	0.348
	(5.45)	(5.38)	(5.41)
425	-0.477	-0.478	-0.471
	(15.03)	(-15.06)	(14.95)
426	-0.119	-0.121	-0.122
	(4.00)	(4.09)	(4.09)
427	-0.234	-0.233	-0.245
	(2.89)	(2.88)	(3.03)
428	-0.9075	-0.071	-0.050
	-(0.71)	-(0.68)	-(.48)
429	-0.061	-0.061	-0.062
	(2.35)	(2.33)	(2.36)
430	-0.047	-0.051	0.019
	(0.29)	(0.32)	-(0.12)
431	-0.341	-0.341	-0.345
	(3.49)	(3.49)	(3.53)

TABLE 3 (continued)

VARIABLE	MODEL I	MODEL II	MODEL III
PPS dummy	-0.128	-0.064	-0.049
	(6.11)	(2.02)	(1.84)
TIMEPRIOR	-	0.0001	0.0001
	-	(0.82)	(0.73)
TIMEPOST	-	-0.0005	-0.0004
	-	(3.49)	(3.42)
WINTER	0.039	0.017	0.019
	(0.90)	(0.81)	(1.91)
BEDS	0.097	0.099	0.101
	(6.37)	(6.47)	(7.06)
LOCATION DUMMIES	included	included	included
	-	-	-
TEACHING	-0.042	-0.043	-0.044
	(1.29)	(1.32)	(1.38)
PUBLIC	-0.035	-0.039	-0.039
	(1.36)	(1.40)	(1.59)
PROFIT	0.009	-0.019	0.027
	(0.29)	(0.62)	(0.68)
PPS-PROFIT	-	-	-0.107
	-	-	(1.94)
GEOGRAPHIC	included (states)	included (states)	included (regions)
INTERCEPT	0.845	0.811	0.561
	(3.70)	(3.54)	(2.84)
R^2	0.12	0.12	0.11
F	22.53	12.38	12.48
N	6662	6662	6662

* (statistic in partheses

TABLE 4

SUMMARY OF PPS IMPACTS

Raw Comparison (Linear)[1] (1.9/9.14)	- 20.4%
Raw Comparison (Logs)[2]	- 12%
PPS Dummy (Model I)	-13%
365 day effect (Model II)[3]	- 16.5%
365 day effect with interactions (Model III)[4]	- 17.0%

[1] (1.9/9.14) = 20.4%

[2] $\ln LOS_{PRE} - \ln LOS_{POST} = 1.80 - 1.68 = 0.12$

[3] $b_{PPS} - b_{TRR} \times \overline{(TIMEPRIOR)} + b_{TPO} \times \overline{(TIMEPOST)}$

[4] See 3 add $b_{PPS} \times PROFIT$ (PROFIT)

TABLE 5

COMPARATIVE IMPACTS ON LENGTH OF STAY

Raw PPS - TEFRA (Linear) Comparison for Psychiatric Cases	-20.4%
Raw PPS - TEFRA (Log) Comparison for Psychiatric Cases	-12.0%
PPS - TEFRA (PPS dummy only) Comparison for psychiatric cases	-13.0%
365 day PPS - TEFRA Comparison for Psychiatric Cases	-16.5%
Overall Medicare PPS - TEFRA Comparison (PROPAC)	- 7.6%
PROPAC Rural Medical DRGs (PPS vs. TEFRA)	-11.0%
PROPAC Urban Medical DRG (PPS vs. TEFRA)	-12.9%
PROPAC Rural Surgical DRGs (PPS vs. TEFRA)	- 3.5%
PROPAC Urban Surgical DRGs (PPS vs TEFRA)	- 1.7%
Overall New Jersey DRGs versus Per Diem Rates (Rosko and Broyles 1986)	- 3.4%

FOOTNOTES

1. Criteria for exemption of a psychiatric unit are outlined in Section 405.471 of Medicare regulations. Three criteria regarding diagnoses of patients, qualification and presence of treatment personnel and maintenance of medical records were articulated in the regulations.

2. Adjustment is costly in that practice patterns must be altered, contracts must often be concluded or renegotiated, administrative procedures must be altered. These costs are not explicitly reimburseable.

3. This is particularly remarkable when one considers that the last 3 months of the fiscal year are July, August and September.

4. Sloan, Feldman and Steinwald (1983) review the evidence on this. They find that most of the differences in costs can be accounted for by casemix and physician payment factors. However, since our measures of a number of hospital features are limited we include teaching status as a control variable.

5. If one were specifying an instrumental variables solution to this problem, one would probably choose teaching study, size, inner city location, ownership and geographic region as instruments. This is sensible since a key factor in the wealth effect is the hospital's cost structure. Moreover, inclusion of these variables along with a wealth effect indicator may lead to collinearity problems and bias because the wealth effect indicator and the error term will be correlated. Unfortunately, one cannot identify the wealth effect from the instruments.

6. These measures are of course subject to measurement error because they measure the distance between discharge and PPS. Admission might be a more appropriate measure if stays are long.

7. It has become popular to estimate the 'total effects' evaluated at the mean of all the interacting variables. This practice is accompanied by construction of a confidence interval for that estimate. That test is somewhat narrow since the estimate of the total effect will vary with values of the interaction variables. We prefer to more general incremental F test of the joint hypotheses that group of coefficients comprising the total effect are significantly different from zero.

8. One implication of the logarithmic transormation of the dependent variable is that dummy variable coefficients must be adjusted. Assume the following general model

$$\text{Ln } Y = a + b_1 X_1 + c_1 d$$

C_1 is actually an estimate of

$C_1 = 1_n (1+g)$ where $g \times 100$ is the percent change in Y attributable to d. To obtain an estimate of g C_1 must be transformed in the following manner

$$g = \exp [C_1 - \tfrac{1}{2} V(C_1)] - 1$$

where $V(C_1)$ is the variance of the coefficient estimate. Thus if $V(C_1)$ is large g and c_1 may be quite different. This is derived by Kennedy (1981).

9. We use 365 days because that is the period for which we observed hospital behavior. Clearly the longer or shorter you make the adjustment period the bigger or smaller is the PPS impact. However, it seems sensible to use the time period from which the coefficient estimates were made.

10. We specified a PPS case as one that was admitted after a hospital began PPS. We also experimented with discharge after PPS. The results were not sensitive to these differences

11. $$F = \frac{S_1/(p-1)}{S_2/(M_p - p - K + 1)}$$

where $S_1 = \hat{x}'D'y + \hat{\beta}'x'y - \hat{\beta}'x'y$

$S_2 = y'y - \delta'D'y - \beta'x'y$

D = is the vector of PPS effects

12. NCHS (1983, 1984, 1985 report average length of stay for psychiatric discharges in the nation as a whole and for those over 65 years of age as follows:

Year	1980	1981	1982	1983
All Ages	11.6	11.9	12.1	12.4
65+	13.7	13.3	13.0	13.5

13. To illustrate this point with a simple example Freiman et al. report that in Michigan psychiatric patients in all hospitals would on average lose $255 per case. Assuming a modest 15% reduction in average cost due to PPS the average loss might well become an average gain of $187. This, of course, is a rough back of the envelope calculation.