REFERENCE INCOMES, LOSS AVERSION, AND PHYSICIAN BEHAVIOR

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Abstract—We examine the effects of reference income on the behavior of young male physicians. Using a unique panel of data, we relate physicians' reference and actual incomes to their subsequent income growth. Reference income has a strong positive effect on subsequent income for physicians who are below their reference points, but not for physicians who are at or above their reference points. Loss aversion, which posits a kink in utility at the reference point, explains this puzzling pattern. Physicians respond strongly to shortfalls from the reference point—they take unappealing actions to boost earnings—because the marginal utility of income is steep in that range. Competing prominent theories, tested here, fail to explain these relationships.

I. Introduction

REFERENCE points play an important role in affecting economic decisions. In the corporate sector, for example, firms consider analysts' estimates and current dividend levels to be benchmarks, and strive to meet them, presumably mostly to impress others. This paper examines how reference points affect the earnings of individual young male physicians. They are their own primary audience, since others will not know these earnings. For this study, an individual's response to the question "Considering your career stage, what do you consider to be an adequate income after expenses but before taxes from your professional activities?" is his reference income (RI).

We wish to determine whether and how RIs help predict subsequent earnings. A priori, there would seem to be three possibilities: no relationship, a significant relationship, or a selective significant relationship. The no-relationship conjecture would observe that RI is merely a verbal statement; hence, it should not predict future earnings. Desirable tradeoffs between income and the unattractive activities that produce it—for example, sacrificing leisure—should have already been made. The significant-relationship hypothesis assumes that the RI contains information that does predict subsequent income. Perhaps the RI is an estimate, though possibly a biased estimate, of what the respondent expects to earn—for example, an indicator of permanent income. That would produce a statistical relationship between the two, even though RI has no influence on future actual income. That relationship would hold independently of other parameter variables.

In the third pattern, a selective significant relationship, RI should be strongly predictive for individuals with some parameter values, but weakly or not at all for others. We provide a theoretical explanation why we should expect this pattern, drawing on the notion of loss aversion and its associated concept of reference points, both central elements of prospect theory (Kahneman and Tversky, 1979, 1991).[1] The theory predicts a very specific pattern: RIs will be important predictors of future income if they are above actual incomes, but not if they are below. This highly refined prediction, if confirmed, would be striking.

Physicians can control their income-earning activities better than most individuals. For example, they can switch practice locales, work additional hours in many settings, or alter the mix of treatments they deliver. Being young—the cutoff for the study was age 40—also meant that they were more likely to be able to adjust work and earnings patterns.

We are fortunate to have available a unique data set on the earnings and qualifications of young physicians. Our data panel reports physicians' incomes in two different years, 1986 and 1990, and their answers to questions about adequate-income reference points. This enables us to provide a direct and econometrically defensible assessment of the importance of reference points for income gains. The panel also provides significant data on their backgrounds, such as their specialty and board certification status, which helped us assess and control for their levels of human capital. We focus on male physicians, who constitute 85% of the sample.[2] Our strategy exploits the longitudinal nature of the data, by relating physician-specific measures of actual incomes in one year (1986) and reference points (adequate incomes) the next year (1987) to actual incomes four years later (1990). Fortunately, our data give doctors' reports of their adequate incomes for the year following the one for which they report actual incomes. This allows time for reflection on past actions, changed aspirations, or dissatisfaction with past income accomplishments.[3]

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[1] Prospect theory is mentioned in Kahneman's 2002 Nobel Prize citation.

[2] We confine our analysis to male physicians because, as is well known in the labor economics literature, labor market behavior differs substantially by gender along a variety of dimensions. For example, Pencavel (1986) and Killingsworth and Heckman (1986) treat labor supply by gender in different chapters. A subsequent study examines the significant contrast in behavior between male and female physicians (Rizzo and Zeckhauser, 2000).

[3] Evidence suggests that people can respond to hypothetical questions about earnings expectations with reasonable accuracy. In his study of earnings expectations, Dominitz (1998) concludes that "earnings expectations elicited in the form of subjective probabilities vary in sensible ways with contemporaneous earnings realizations and with other individual attributes" (p. 385).

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The rest of this paper is divided into seven sections. Section II describes the data and variables used in the empirical analysis, and patterns of income growth. Section III outlines the four alternative theories that we consider. Section IV discusses past work on loss aversion and reference incomes. Section V fleshes out our theoretical model (theory L), which applies these concepts to physician behavior. Section VI presents our hypotheses, conducts simple initial tests, and specifies the multivariate models that test the competing theories. Section VII presents multivariate regression results and also begins the inquiry on *how* below-RI physicians increase their earnings. Section VIII concludes.

II. Data, Variables, and Basic Patterns

Our study uses data from the 1987 and 1991 Practice Patterns of Young Physicians Surveys, which were conducted by the American Medical Association under a Robert Wood Johnson Foundation grant. These telephone surveys provide information on a nationally representative sample of young physicians practicing in the United States during 1987 and 1991. The surveys provide data about the respondent's current practice arrangements, career choice, family background, patient care activities, and current income and expenses. Respondents were also queried about their employment arrangements, areas of specialization, hours and weeks worked, and other practice characteristics. The survey also asked physicians about their incomes during the previous year, after practice-related expenses but before taxes. "Young" physicians were defined as physicians under the age of forty with one to eight years of postresidency practice experience. A random sample of about half of the 1987 survey respondents were resurveyed in 1991; by that time some of them would have been over 40 years of age. The surveys achieved response rates of about 70%. Our sample is restricted to self-employed physicians, who constitute the majority of practicing physicians in the United States. Such physicians have more freedom to adjust their practices to achieve reference incomes than do employee physicians, who are typically paid a salary.[4] The panel available for estimation purposes includes 641 male physicians; 408 had incomes below their reference points, and 233 had incomes at or above their reference points.

Table 1 provides descriptive statistics on actual and reference incomes, both measured in current dollars.[5] Separate results are reported for physicians who were below their reference points in 1986, and those at or above their reference points in 1986. (Hereafter "above" implies "at or above.") In the below-RI cohort, actual income averages

TABLE 1.—ACTUAL INCOME AND REFERENCE INCOME STATISTICS

Cohort / Variable	Actual Income for Physicians below Reference Income in 1986 — Mean (Std Dev)	Actual Income for Physicians at or above Reference Income in 1986 — Mean (Std Dev)
A. Actual Income and Reference Income ($1,000s)		
Actual income, 1986	80.3 (40.3)	152.5 (90.5)
Reference income, 1987	122.9 (73.3)	129.9 (70.3)
Actual income, 1990	170.4 (115.9)	230.7 (147.7)
Reference income, 1991	186.0 (116.3)	205.1 (119.4)
B. Income Ratios		
(Actual income 86)/(reference income 87)	0.65	1.17
(Actual income 90)/(reference income 91)	0.92	1.12
REFRATIO = (87 reference income)/(86 actual income)	1.79	0.90
INCRATIO = (90 actual income)/(86 actual income)	2.42	1.64
C. Correlations		
Correlation between INCRATIO and REFRATIO	0.82	0.14

only 65% of the 1987 RI. In 1990, their actual income averages 92% of their 1991 RI, a major jump. In contrast, the ratio of actual to reference income appears fairly constant over time for physicians who were above their RIs in 1986.

Figure 1 shows how the dramatically greater gains for the below-RI cohort were distributed. Two-thirds of this cohort increased their income more than 50% in four years; only two-fifths of the above-RI cohort gained that percentage. This is precisely the pattern predicted by our RI theory. Alternative explanations are explored below.

The final line of Table 1 suggests our most critical finding. In the below-RI cohort, the ratio of reference to actual income is dramatically related to income growth, but that relationship is only one-sixth as strong in the above-RI cohort. Much of our multivariate analysis explores this relationship.

III. Four Theories Relating Reference Incomes and Income Growth

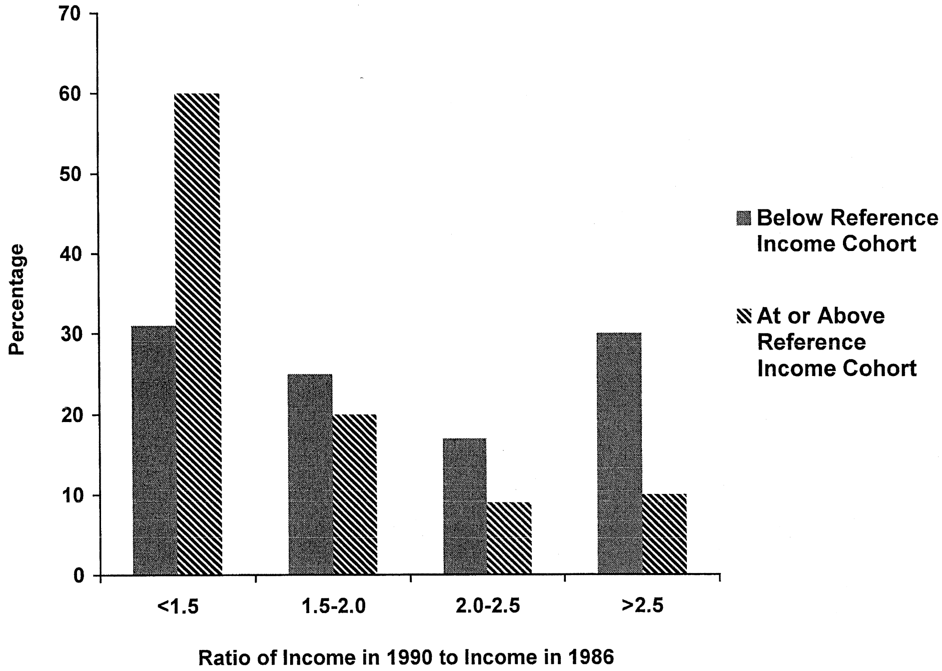
We consider four theories that might explain the differences in the growth rates of actual incomes across the two RI cohorts.

Theory A. Changing Distribution of Income over Time. The differential relationship we observed between growth rate and RI across the above- and below-RI cohorts could be

[4] We also excluded hospital-based specialists (such as radiologists, anesthesiologists, and pathologists), as such specialists tend to have less discretion in setting their practice patterns. There were 113 female physicians in the original sample of physicians.

[5] The medical care price index increased by 33.4% between 1986 and 1990, the CPI by 19.3%.

FIGURE 1.—RATIO OF 1990 TO 1986 INCOME: DISTRIBUTION BY REFERENCE-INCOME STATUS



spurious, arising only because the income distribution changed between 1986 and 1990. Perhaps below-RI physicians disproportionately had low incomes and above-RI physicians had disproportionately high incomes. If the income distribution merely tightened, with doctors maintaining their income positions, this would boost low earners and trim back high earners. Hence, below-RI physicians would gain more than those above RI. Conversely, a spreading out at either end would enhance the income gains of above-RI physicians relative to below-RI physicians.

Theory B. Regression toward Mean Income in Group. Doctors above their RIs earned considerably more than those below in 1986. The greater proportional income gains reaped by the latter group from 1986 to 1990 can be explained by traditional regression toward the overall mean in incomes by either group or both.

Since theories A and B do not address RIs, they are silent on the relations we observe between RIs and income gains. Theories C and L explain how reference incomes might predict future income gains.

Theories C and C′. RIs Contain Information about Earnings Expectations. Under these theories, RIs predict what physicians believe they will earn, or at least contain information about earnings opportunities. Thus RIs should be positively associated with income growth. An important special case of theory C applies when reference income represents the physician's permanent income, a "personal mean" value to which his actual income regresses. Because below-RI physicians have greater RIs relative to their actual incomes than above-RI physicians, theory C would predict modestly greater percentage income gains for the below-RI cohort.

A variant of theory C, call it C′, notes that RI and actual incomes could be jointly determined, perhaps with strong influence from a third variable.[6] If so, RI would help predict future income. Note, however, that neither theory C nor theory C′ would predict the principal empirical finding of our paper, namely the much stronger association we observe between RIs and income gains in the below- than in the above-RI cohort.

Theory L. Loss-Averse Preferences and RIs Enter the Utility Function. In the theory of loss aversion, reference points play a crucial role in determining preferences. Income targets serve as reference points when physicians weigh the benefits and costs of a push to higher incomes. Loss aversion posits that the utility function for money has a break at the reference point, and is considerably steeper in the negative than in the positive domain. Hence, below-RI physicians seek to close the gap, producing far stronger income growth than their above-RI peers, and producing a much stronger correlation between RIs and income growth. Theory L, unlike theories C and C′, predicts a significant strength-of-relationship difference between cohorts. Section IV presents Theory L in greater detail.

[6] Theory A and the permanent-income theories were suggested by referees. Robert Pindyck urged us to focus further on the joint-determination issue.

IV. Loss Aversion and Reference Incomes

A growing empirical literature supports the key concepts of loss aversion: reference points (typically current wealth) and a break in slope in the utility function. For example, individuals are more sensitive to out-of-pocket costs than to opportunity costs, and more sensitive to losses than to forgone gains (Thaler, 1980; Kahneman and Tversky, 1984). Similar asymmetries have been documented in consumers' judgments about whether firms' pricing and wage decisions are fair or not (Kahneman, Knetsch, and Thaler, 1986).[7] Asymmetries appear dramatically in workers' evaluations of tradeoffs between income and leisure (Dunn, 1996). Looking across labor markets, Dunn finds sharp bends in workers' indifference curves near their current positions, as loss aversion would predict. Loss aversion explains asymmetric consumption responses to expected losses or gains in income (Bowman, Minehart, and Rabin, 1997).[8] Taxi drivers in New York City (Camerer et al., 1997) work enough hours to earn some predetermined RI. When returns per hour are high, they actually work fewer hours to earn the RI. This pattern, precisely the opposite of what a rational maximizing model would predict, is readily explained by loss aversion.

Many prominent economists, such as Brady and Friedman (1947), Duesenberry (1949), and Johnson (1952), argue that relative income affects savings and consumption behavior. More recently, Becker (1974), Frank (1985a, 1985b), and Cole, Mailath, and Postlewaite (1992) provide theoretical models in which interpersonal comparisons affect economic behavior.[9] Shafir, Diamond, and Tversky (1997, p. 350) consider female peers taking similar jobs at different firms. Carol earns \$36,000, but less than her coworkers; Donna receives \$34,000, but more than her coworkers. Most respondents thought Donna would be happier. Coworkers' incomes, in effect, provide a RI.[10]

Yet RI effects are largely ignored by contemporary economists. Frank (1985a) suggests that economists may have difficulty accepting such factors because they have been trained to model utility with absolute measures of consumption and income, not with relative measures.[11] Perhaps increased mathematical rigor has caused such comparisons to be pushed aside (Becker, 1974).

A. *Reference Incomes and Physician Behavior*

The role of RI in health economics has been investigated as part of the "target income hypothesis." It states:

> Physicians earning less than their reference (target) incomes will adjust behavior to attempt to meet their respective reference points. For such physicians, the higher a physician's RI, ceteris paribus, the greater will be his subsequent income growth.

This hypothesis has been tested using studies of physician pricing behavior, labor supply, and the quantity or intensity of services provided.[12]

Loss aversion has been demonstrated convincingly with compound events having one element of loss and another of gain. Physicians face such a situation. To boost earnings, they must engage in income-generating activities; such activities entail a utility loss. Only if the corresponding gain from increased income is sufficiently great will they do so. Given loss aversion, the marginal utility of income is far greater below than above RI. This leads to two hypotheses: (1) incomes below physicians' RIs will grow much faster than those above; and (2) RIs will predict much stronger growth in actual incomes in the below-RI than in the above-RI cohort. These were the two major findings emerging from Figure 1 and Table 1.

Physicians can respond to target incomes more than most workers. Most consumers of their services are desensitized to price because they are insured and pay little at the margin. Nor can they readily judge the quality of medical services. These factors promote the physician's autonomy in setting prices and selecting treatments, and thus in boosting income.[13]

Objections have been raised to the target-income hypothesis (McGuire and Pauly, 1991; Rossiter and Wilensky, 1984). Why should the physician stop at any given target or reference point? One response is that the physician is constrained by his own conscience (McGuire and Pauly, 1991). Inducing demand is at best unpleasant. Dranove and White (1987) note that primary care physicians and their patients have long-term relationships with repeat purchases,

[7] For example, consumers consider it fair for firms to raise prices when faced with lower profits, but "unfair to exploit shifts in demand by raising prices" (p. 728).

[8] In particular, consumers do not appear to respond immediately to predicted future declines in income, so that they experience greater consumption declines when the income losses actually occur. In contrast, a much weaker relationship between consumption and expectations of increases in income was found.

[9] The relevance of these types of models for describing the behavior of physicians hinges upon the extent to which physicians know what their peers earn.

[10] The idea that RI affects well-being is related to the theory of relative deprivation, described by Samuel Stouffer and his colleagues in the first *American Soldier* volume in 1949. Soldiers with high school educations had better opportunities in the army, but were less satisfied with their status and jobs than less-educated men. The paradox was explained because better-educated men had higher levels of aspiration, based on their status expectations in civilian life. See Adams (1965) for further details.

[11] As Frank puts it: "Perhaps most economists believe that, when people say that their relative standing is important, what most of them really mean is that it would be nice to have high relative standing, but not at the expense of changing their behavior significantly" (p. 34). Our test of RI behavior does not depend on physicians' perceptions as to how relative income might affect their behavior; instead, we directly relate RI to actual behaviors and earnings.

[12] See Folland, Goodman, and Stano (1997, ch. 8) for an overview of this literature.

[13] Given greater cost control measures in recent years, however, actual fee reimbursement has become increasingly stringent. During the period of this analysis, 1986–1991, the self-employed physicians we examine had more discretion in setting prices than do physicians today.

and argue that such relationships curb agency losses because they enable patients to learn about their physicians and the appropriateness of their charges and care.

B. *Evidence from the Health Economics Literature*

Surveys of health care providers indicate that RIs significantly affect their pricing decisions. Becker and Kaldenberg (1991) report that almost half of 300 dentists surveyed indicated that meeting a target income was an important or very important consideration in their pricing decisions; less than 22% regarded target incomes as unimportant or very unimportant in those decisions.

Empirical tests of the target-income hypothesis typically flow from the counterintuitive prediction that greater competition (pressure) leads to higher prices. The principal finding of many such studies is that physicians respond to financial pressures by increasing prices or quantities of services provided.[14]

Regulation of physicians' fees also permits study of the target-income hypothesis. Several studies (Holahan & Scanlon, 1978; Rice, 1983, 1984; Gabel & Rice, 1985) find that the volume, complexity, or both of physician services increase when fee controls are instituted. Similarly, Krasnik et al. (1990) find that service volume increases substantially when insurance firms change their payment systems from a capitated system to a mixed fee-for-service and capitated system; the authors identify income targets as the explanation.

Rizzo and Blumenthal (1996) explain the pricing decisions of self-employed physicians using physician-specific measures of reference and actual incomes. Among fee-for-service primary care physicians, they find that price has an elasticity of about 0.3 with respect to the ratio of reference to actual income. However, among those not paid on a fee-for-service basis, whose income was not affected by their pricing, there was no response.

V. A Model of Loss Aversion and Reference Income Behavior (Theory L)

We develop a model to understand RI behavior by loss-averse physicians. It employs a traditional utility function, with income y and hours worked h as arguments.[15] Apart from working more hours, the physician can take a variety of actions to increase income. He can charge more per hour, cut contact time for office visits, tilt his practice toward high-profit procedures or induce demand for them, or switch work to a more lucrative setting. We call such practices, which yield a higher income per hour worked, *stimulation,* or s. Stimulation is an unattractive activity, and enters the utility function negatively. We normalize s in dollar units, and add it to the physician's base wage w, which is given exogenously. Therefore, we have $y = h(w + s)$.

The physician's RI r serves as a parameter in the utility function; it is the point from which the income excesses or shortfalls of loss aversion are measured.

Thus, we have the physician's utility level u as

$$u = U(y, h, s, r), \tag{1}$$

where y, h, and s are choice variables. We employ a separable and additive term for the reference income component of utility; thus

$$u = v + z, \tag{2}$$

where v is the normal utility function, with y, h, and s as arguments, and z is the separable reference income term, with $y - r$ as its argument. The normal utility component is represented in the usual way, where

$$v = V(y, h, s), \tag{3}$$

and $V_y > 0$, $V_{yy} < 0$, $V_h < 0$, $V_{hh} < 0$, $V_s < 0$, $V_{ss} < 0$.

The RI utility gain or loss is

$$z = Z(y - r). \tag{4}$$

We assume that $Z' > 0$. We posit the central condition of loss aversion, namely, a noticeable kink in Z at 0, implying a downward break in Z', as shown in Figure 2(a). That is,

$$Z'(0-) > Z'(0+). \tag{5}$$

In addition, $Z'' < 0$, except at 0. Thus, we have

$$u = U(y, h, s, r) = v + z = V(y, h, s) + Z(y - r). \tag{6}$$

Given that V and Z are concave, U is as well.[16]

Our principal interest is how r affects subsequent income. Given that $Z(y - r)$ is much more steeply sloped below 0, r will exert a much greater effect on below-RI than on above-RI physicians, and for the former, ceteris paribus, the higher the reference point, the more income will be raised.

Figure 2(b) gives U, V, and Z as functions of y, holding r fixed. Figure 2(c) gives the marginal utility of income, U_y,

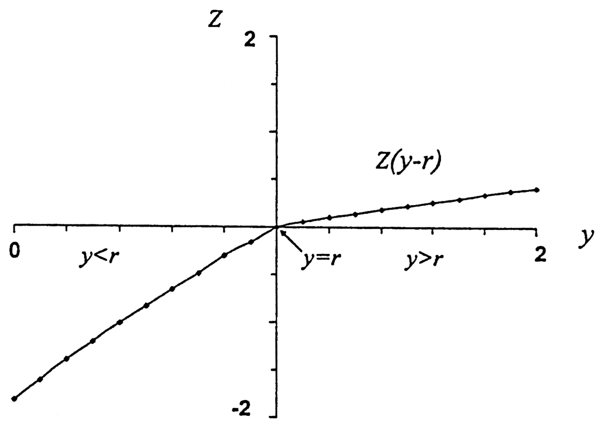
[14] See for example Fuchs (1978), Pauly and Satterthwaite (1981), Hemenway and Fallon (1985), Cromwell and Mitchell (1986), Tussing and Wojtowicz (1986), Tussing (1983), Evans, Parish, and Sully (1973), and Redisch, Gabel, and Blaxall (1981). Some studies (Wilensky & Rossiter, 1983; McCarthy, 1985) report weaker evidence. Rice and Labelle (1989) and Feldman and Sloan (1988) provide detailed critiques of this literature. Interestingly, Reinhardt (1985) argues that researchers' neoclassical orientation colors interpretations of the findings. A recent study by Dranove and Wehner (1994), finding a positive association between obstetricians/gynecologists per capita and the number of childbirths, shows the potential for biases (since physicians are unlikely to induce demand for childbirths). The authors attribute the relationship in part to border-crossing by mothers to physician-intensive jurisdictions.

[15] Hours worked is the complement of leisure.

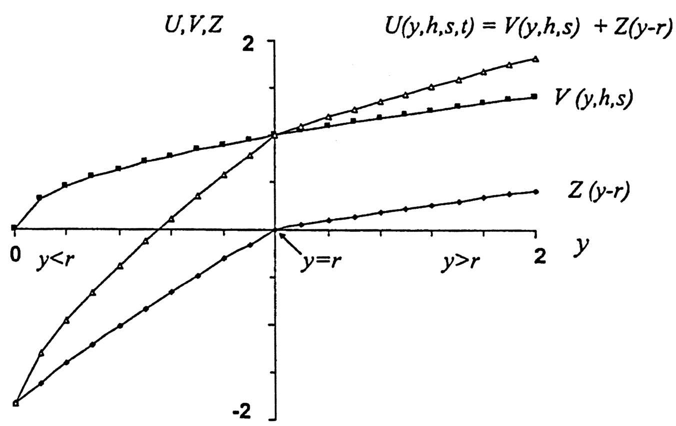
[16] Since the logarithm of a function preserves concavity, our posited form would also apply if the RI term multiplied normal utility, and logarithms were taken to produce the additive form. Less specialized but also less intuitive formulations would lead to the same relationships in partial derivatives, and the same predictions about the role of RIs.

FIGURE 2.—UTILITY AS A FUNCTION OF ACTUAL AND REFERENCE INCOME

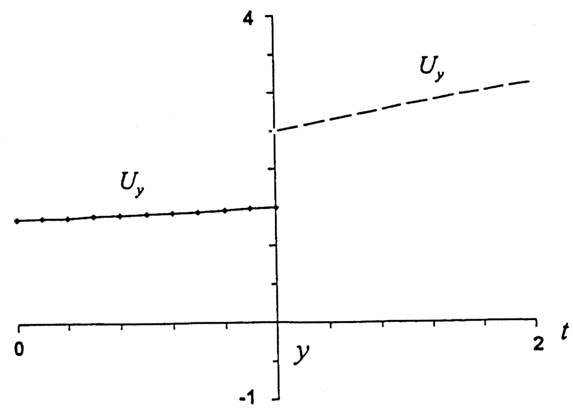
(a) Value of reference income term, Z, as a function of y, holding r fixed at 1



(b) Utility, U, and its components, V and Z, as a function of y, holding r fixed at 1



(c) Marginal utility of income, U_y, as a function of t, holding y fixed



as a function of r, holding y fixed.[17] Marginal utility jumps discontinuously at $y = r$. Moreover, U_y increases noticeably in r when $y < r$, implying that individuals have more powerful incentives to engage in RI behavior the further their actual income is below RI. In contrast, in the region $y > r$, U_y is nearly flat; RI incentives are much weaker. This leads to the following conjecture:

Loss-Aversion Conjecture. Differences in the marginal utility of income lead physicians whose incomes are below their RIs to make more significant attempts to raise their future incomes than will physicians with incomes above their RIs.

Basically, below-RI physicians value increased income more. This can lead them to increase income in two ways. First, it can push them to increase stimulation, holding hours worked constant. Second, it can lead them to increase hours worked, holding hourly rates $w + s$ fixed.

Consider r and stimulation. Hold h constant for two doctors with identical utility functions but different RIs one high, the other low. The low-RI doctor optimally engages in stimulation s, earns y, and ends up above his RI. Substitute $h(w + s)$ for y in the utility function. Differentiate with respect to s; the physician's optimization satisfies

$$\frac{dy}{ds}(V_y + Z_y) + V_s = 0, \tag{7}$$

implying that

$$\frac{dy}{ds}(V_y + Z_y) = -V_s. \tag{8}$$

If the high-RI physician engaged in the same amount of stimulation, he would earn the same income but still have income below his reference point. His marginal utility of stimulation would be the same as for the physician with the low RI, but by equation (5) above, his marginal utility of income, $V_y + Z_y$, would be significantly higher; hence at this income the left-hand side of (8) would exceed the right. To achieve equality, he would stimulate more and earn more. Other factors equal, high-RI physicians will choose to earn more than their low-RI counterparts. Similarly, holding $w + s$ fixed, high-RI physicians will work more hours.[18]

Theory L leads to three empirical predictions: (1) RIs will predict gains in income. (2) RIs will have a stronger positive association with income gains for physicians below than above RI. (3) Assuming other factors roughly equal in the two cohorts, the rate of growth of income will be greater in the below-RI cohort.

VI. Hypotheses, Simple Tests, and Specification of Regression Models

The Young Physicians Survey queried self-employed physicians about their actual income during the previous year, and what they regarded as adequate (or reference) income for the current year; that is, actual income for period t and RI for year $t + 1$ are reported in period $t + 1$. Using this information, we estimate the effects of RI on future earnings of self-employed physicians, and subsequently on their hourly wages and hours worked.

We measure the hours worked, wage, and income variables in natural logarithms. This is fairly standard treatment, and reflects the belief that relationships are constant in percentage changes—the underlying assumption for computing elasticities—and not in absolute values. Other explanatory variables include measures of physicians' income in 1986, as well as other physician, practice, and regional characteristics. Table 2 describes the variables used in this study.

A. *Hypotheses*

We turn now to hypotheses that seek to explain our central findings. Why did below-RI physicians experience much greater income growth from 1986 to 1990 than above-RI physicians? Theories A and B provide explanations that depend solely on the properties of the income distributions. We evaluate null hypotheses A and B, which are drawn from these theories.

Null Hypothesis A. The superior income growth of the below-RI cohort is due to a tightening of the income distribution between 1986 and 1990.

[17] These figures are drawn using explicit functional forms for V and Z, and hence for U. For V, we use the Cobb-Douglas function: $V = y^{\alpha}h^{\beta}s^{\delta}$. To illustrate, we set $\alpha = 0.5$ and $h = s = 1$, so that $V = y^{1/2}$. For Z, we assume the functional form

$$Z = \begin{cases} -(r - y + 1)^{3/2} + 1 & \text{when } y < r, \\ (y - r + 1)^{1/2} - 1 & \text{when } y > r. \end{cases}$$

[18] If wages among similarly qualified doctors differ, those with incomes below their reference levels will tend to have lower wages. Thus, there is a substitution effect that works to lower their hours. Of course, hours worked and stimulation are chosen simultaneously. Thus, r may indirectly affect stimulation through its influence on hours worked, and may affect hours worked through its influence on stimulation. These indirect effects render the results of the comparative-statics analysis on s and h individually ambiguous, though higher r still raises y. Note a final possible difference between situations where y is above and below r. Stimulation is an unattractive activity, but the utility loss from stimulation may depend on whether y is greater than or less than r. Through rationalization, or perhaps to overcome cognitive dissonance, physicians might feel less uncomfortable with high values of s than they would if their incomes were above RI.

A central proposition of equity theory is that individuals who discover they are in an inequitable relationship will attempt to eliminate distress by restoring equity. Moreover, the greater the inequity, the greater the distress, and the harder they try to restore equity. Experiments in which subjects were hired as interviewers paid on a piece-rate basis found that underpaid interviewers did more interviews per hour. In effect, underpaid subjects engaged in what we label stimulation. See Walster, Walster, and Berscheid (1978, pp. 6, 122) for further details.

TABLE 2.—VARIABLE NAMES AND DESCRIPTIVE STATISTICS

Variable Name	Description	Mean (Std. Dev.)
ln INCOME90	Natural log of physician income ($1000s) in 1990	5.06 (0.62)
ln WAGE90	Natural log of hourly wage in 1990	4.01 (0.64)
ln HOURS90	Natural log of annual hours worked in 1990	7.99 (0.27)
ln WAGE86	Natural log of hourly wage in 1986	3.40 (0.66)
ln HOURS86	Natural log of annual hours worked in 1986	7.99 (0.31)
ln REFINC87	Natural log of reference income ($1000s) in 1987	4.71 (0.48)
ln INCOME86	Natural log of physician income ($1000s) in 1986	4.48 (0.65)
ABOVERI	Dummy variable (DV) = 1 if physician at or above reference income, else = 0	0.36 (0.48)
PRACSIZE	Number of physicians in practice	8.60 (25.41)
PRACYEAR	Years of practice experience	2.85 (1.38)
GENIM[a]	DV = 1 if physician is general internist, else = 0	0.15 (0.35)
PED[a]	DV = 1 if pediatrician	0.09 (0.28)
SPECIM[a]	DV = 1 if specialized internist	0.14 (0.34)
GENSURG[a]	DV = 1 if general surgeon	0.07 (0.25)
SPECSURG[a]	DV = 1 if specialized surgeon	0.23 (0.42)
PSYCH[a]	DV = 1 if psychiatrist	0.05 (0.22)
OBGYN[a]	DV = 1 if obstetrician/gynecologist	0.08 (0.27)
BLACK	DV = 1 if black	0.09 (0.28)
BDCERT	DV = 1 if board-certified	0.72 (0.45)
FMG	DV = 1 if graduate of foreign medical school	0.09 (0.29)
RURAL[b]	DV = 1 if practice located in rural area	0.05 (0.22)
NONSMSA[b]	DV = 1 if located in nonrural non-SMSA	0.16 (0.37)
SMALSMSA[b]	DV = 1 if located in small SMSA	0.22 (0.41)
BIGSMSA[b]	DV = 1 if located in large SMSA	0.14 (0.34)
MIDWEST[c]	DV = 1 if located in Midwest Census Region	0.18 (0.39)
SOUTH[c]	DV = 1 if located in South Census Region	0.36 (0.48)
WEST[c]	DV = 1 if located in West Census Region	0.23 (0.42)

Unless otherwise specified, all data are for 1987.
[a] Excluded reference specialty is general/family practice.
[b] Excluded reference location is largest SMSAs (>1 million population).
[c] Excluded reference Census region is the Northeast.

Null Hypothesis B. The superior income growth of the below-RI cohort is due to regression toward the mean in the income distribution.

If either (or both) of these null hypotheses is confirmed, it (or they) could explain part or all of the substantially larger income gains by the below-RI cohort. Theories A and B are silent on the striking relationship between income growth and RI, after controlling for 1986 income. To explain that relationship, we consider two additional null hypotheses, 1 and C/C′. Null hypothesis 1 rejects the importance of RI reports, asserting that they do not predict behavior.

Null Hypothesis 1: Reference income will not affect gains in income for either cohort, after controlling for initial income.

Theories C and C′, which state that RIs contain information about earnings expectations, allow RIs to play a role, but dismiss the possibility of the asymmetric response above and below RI. Thus:

Null Hypothesis C/C′. Reference income will have substantially the same positive association with income gains in the two cohorts, after controlling for initial income.

Our alternative hypothesis, which is predicted by Theory L, conjoins RI with its parent concept of loss aversion. It predicts a significant difference in the role of RIs for the above-RI and below-RI cohorts.

Alternative Hypothesis L. RI will have a much stronger positive association with income gains for physicians who are below their RIs than for those who are above their RIs. This hypothesis has important implications for differential income growth. Holding other facts roughly constant in the two cohorts, it yields:

Implication of Alternative Hypothesis L. Together, RI behavior and loss aversion imply that the rate of growth of income for below-RI physicians will be substantially greater than for above-RI physicians, after controlling for initial income.

B. *Simple Tests of the Null Hypotheses: RI and Income Data*

We employ two types of tests, those that look solely at RIs and actual incomes, and regression analyses. To evaluate theory A and the possible effect of a change in income distribution, we first applied an F-test to the variances in the logarithms of income. There was no significant difference between the years. Second, we computed the decile points in the income distribution for the two years, standardizing to a median equal to 100. Theory A posits a looser distribution in 1986 than in 1990. The results are given in Table 3A. At seven of the eight decile cutoffs, the 1990 distribution is more dispersed (further from the median) than the 1986

TABLE 3.—INCOME DISTRIBUTION, GROWTH, AND CORRELATIONS WITH REFERENCE INCOME ($n = 641$)

A. Decile Cutoffs of the Income Distribution by Year[a]										
Percentile	10	20	30	40	50	60	70	80	90	
1986	46.7	66.7	74.4	88.9	100.0	111.1	133.3	161.1	216.7	
1990	52.7	63.3	73.3	86.7	100.0	120.0	143.3	183.3	233.3	
B. Percent Increasing in Income Rank by Income Decile and RI Status, 1986–1990[b]										
Decile	Bottom	2nd	3rd	4th	5th	6th	7th	8th	9th	Top
Below RI	86.4	72.1	57.7	49.0	53.3	40.0	52.6	37.0	52.2	14.3
At or above RI	40.0	33.3	41.7	46.2	31.6	10.5	26.9	35.1	31.7	15.5
C. Percentage Growth in Income by Income Decile and RI Status, 1986–1990[c]										
	Bottom	2nd	3rd	4th	5th	6th	7th	8th	9th	Top
Below RI	328.8	138.7	120.6	100.3	110.3	81.0	97.3	74.5	111.0	46.1
At or above RI	267.1	55.4	101.7	78.5	55.9	67.1	83.4	77.7	74.7	36.3
D. Correlations between the Ratio of 1987 Reference to 1991 Actual Income (REFRATIO) and the Ratio of 1991 Actual Income to 1987 Actual Income (INCRATIO) by RI Status										
Below RI	0.82***									
At or above RI	0.14***									

[a] Median income = 100 in each year.
[b] The overall t-statistic is 9.40, which is statistically significant at well beyond the 1% level.
[c] The overall t-statistic is 8.87, which is statistically significant at well beyond the 1% level.
*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.

distribution, which suggests that ceteris paribus, above-RI physicians would gain more.

Third, we conducted a more formal test. We examined what income gains the two cohorts would reap if every physician had kept his relative position in the income distribution across the two years. Thus, we assumed the individual with the 234th highest income in 1986 achieved the 234th highest income in 1990, the 235th received the 235th, and so on. This formulation would on average have led below-RI physicians to gain 82.3%, and above-RI physicians to gain 82.1%, in income from 1986 to 1990. These virtually identical numbers compare to the 142% and 64% the below-RI and above-RI cohorts actually gained, suggesting that being below RI did have a significant effect.[19]

Theory B, regression toward the mean, posits that once we control for rank in the income distribution, RI status should not affect income growth. We broke physicians into income deciles to see whether the experience of below- and above-RI physicians differed. We looked at two indicators, the percentage of physicians gaining in rank, and the average gain in income for above- and below-RI physicians in each decile. The results are presented in Table 3B and 3C. Using either indicator, the superior gains of the below-RI cohort, controlling for income decile, are extremely significant. This is not to dismiss regression toward the mean—it alone would lead the below-RI cohort to gain 51% more than the above-RI cohort.[20] Nevertheless, the below-RI cohort gains 142%, far more than regression toward the mean can account for.

After allowing for regression toward the mean, below-RI physicians gain dramatically more and more frequently. This leaves substantial room for theories C/C′ and L, which begin with assertions about the relationship between RI and income growth (INCRATIO). Table 3D repeats the correlations between REFRATIO and INCRATIO given in Table 2. There is a selective significant relationship. The relationship is 6 times stronger in the below-RI cohort. Theories C and C′ would predict the same relationship in the two cohorts. By contrast, the strong-below, much-weaker-above pattern is predicted only by Theory L.

C. *Specification of Regression Models*

To further test null hypothesis 1, null hypothesis C/C′, our alternative hypothesis L, and the implication of alternative hypothesis L, we turn to regression analysis. Alternative hypothesis L specifies that the relationship between reference incomes and future earnings will differ according to whether physicians are initially above or below their RIs. Accordingly, we estimate an income equation that allows the relationship between target income and subsequent

[19] If theory L is correct, and below-RI physicians do gain a lot more, the bottom tail should shrink a bit, which it does.

[20] At a referee's suggestion, we made the following back-of-the-envelope calculation of the contribution of regression toward the mean to the differential gains of our two cohorts. We asked: What percentage of the differential income gain between below- and above-RI physicians is attributable to the fact that below-RI physicians are differentially in the lower deciles? To answer, we first computed the average gain of below- and above-RI physicians in each decile. We then computed an expected gain for each decile, assuming that it had the same proportion of below- and above-RI physicians as the entire sample. We then assigned this expected gain in an income decile to all physicians within it. Finally, we computed the weighted average gain that below- and above-RI physicians would reap if they got their expected decile gains. The below-RI cohort would gain 127%, and the above-RI 84%, which contrasts with the 142% and 64% we observed (table 2B). The regression toward the mean leads below-RI physicians to gain 51% (127/84 − 1) more than those above. This number should be compared with their greater actual gain, which was 122% (142/64 − 1). In a rough sense, regression toward the mean explains 51/122, or 42%, of the differential gain of below-RI physicians.

income to vary according to whether physicians are above or below their reference incomes:[21]

$$\ln \text{INCOME90} = \alpha_1 + \alpha_2 \ln \text{REFINC87} + \alpha_3 \times (\ln \text{REFINC87}) \times \text{ABOVERI} + \alpha_4 \ln \text{INCOME86} + \alpha_5 \times (\ln \text{INCOME86}) \times \text{ABOVERI} + \alpha_6 \text{ABOVERI} + \beta \boldsymbol{X} + e, \quad (10)$$

where

ln INCOME90 = natural logarithm of actual physician income in 1990,
ln REFINC87 = natural logarithm of reference physician income in 1987,
ln INCOME86 = natural logarithm of actual physician income in 1986,
ABOVERI = dummy variable = 1 for physicians whose 1986 actual incomes are at or above their 1987 RIs, and 0 otherwise,
$\boldsymbol{X}$ = vector of physician specialty dummies, practice characteristics, and demographic factors,
$\alpha_1, \alpha_2, \ldots \alpha_6, \beta$ = coefficients to be estimated, and
e = error term.

The coefficient on ln REFINC87, α_2, gives the estimated effect of RI on subsequent income for physicians who are below RI. For such physicians, we hypothesize (as does null hypothesis 2 but not null hypothesis 1) that α_2 will be positive and statistically significant. That is, controlling for actual income in 1986 and other physician and demographic characteristics, the value of α_2 tests the hypothesis that a higher RI in 1987 leads to higher income in 1990 for this cohort.

The sum of the coefficients $\alpha_2 + \alpha_3$ is the estimated effect of RI on subsequent income for physicians who are above their RIs. Null hypothesis 2 predicts that $\alpha_2 + \alpha_3$ will be roughly equal to α_2, or that $\alpha_3 = 0$. The alternative hypothesis predicts a significant negative value for α_3. That is, it predicts a positive and significant effect of ln REFINC87 on future income for the below-RI cohort of physicians, but a significantly weaker effect of ln REFINC87 on 1990 earnings among the cohort of physicians for whom ln INCOME86 ≥ ln REFINC87.[22] In sum, the theories predict:

Theories: Hypothesis:	A, B Null 1	C, C′ Null C/C′	L Alternative L
α_2	0	+	+
α_3	0	0	−

[21] In preliminary work, we estimated separate income equations for physicians whose incomes were below and above their RIs, respectively. These results, available from the authors on request, were very similar to those reported in the text. The single-equation approach with interactions is more parsimonious.

[22] In our major analysis we regress 1990 income on 1986 income and other explanatory variables. When we used the change in income between 1990 and 1986 as the dependent variable, none of the coefficients or significance levels for the explanatory variables changed, except for the coefficient on 1986 income (see footnote 24). In view of the noisier dependent variable, the R^2 is lower as well.

TABLE 4.—INCOME ESTIMATES

Independent Variable	Parameter Estimate	t-Statistic
(Intercept)	1.43***	6.00
ln REFINC87	0.59***	8.44
(ln REFINC87) × ABOVERI	−0.46***	3.52
ln INCOME86	0.17***	3.05
(ln INCOME86) × ABOVERI	0.37***	3.13
ABOVERI	0.56	1.63
PRACSIZE	−0.001	1.15
PRACYEAR	−0.04***	3.09
GENIM	0.07	1.25
PED	0.16**	2.32
SPECIM	0.17***	2.59
GENSURG	0.19**	2.44
SPECSURG	0.34***	5.82
PSYCH	0.10	1.23
OBGYN	0.50***	6.50
BLACK	−0.15	2.37
BDCERT	0.02	0.48
FMG	−0.01	0.17
RURAL	−0.01	0.10
NONSMSA	0.01	0.19
SMALSMSA	0.04	0.89
BIGSMSA	0.03	0.48
MIDWEST	−0.004	0.07
SOUTH	−0.04	0.76
WEST	−0.14***	2.81

N = 641, adjusted R^2 = 0.54, F = 32.86. Dependent variable: ln INCOME90.
*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.

VII. Evidence from Multivariate Regressions

Table 4 presents our results. The coefficients α_2 and α_3 are given by the second and third entries in the first column. Because α_2 is strongly significantly positive, null hypothesis 1 is disproved. Correcting for other variables, RI strongly predicts income gains, contrary to theories A and B.

A. *Tests of Theories C, C′, and L*

What of theories C and C′, namely that RI contains information about earnings expectations, possibly because it is some measure of permanent income or because RI and actual incomes are jointly determined, and hence RI predicts income gains? If theory C or theory C′ were correct, being below or above RI would not affect the correlation between RI and income gains. That is, RI would "pull" income, down from above or up from below, but the strength of the pull would be the same for the above- and below-RI physicians: the correlations in table 3D would be roughly the same for the two cohorts. Theory L predicts a much stronger correlation in the below-RI cohort, which is what we find.

Theories C and C′ posit that α_3 would be roughly 0, and that null hypothesis 2 would be confirmed. In fact, α_3 is strongly significantly negative.[23] Null hypothesis 2 and theories C and C′ are rejected. RIs are much less predictive of income gains for individuals above RI, as theory L predicts. Indeed, an F-test for $\alpha_2 + \alpha_3$—the net effect of RIs for above-RI physicians—reveals that these two coefficients are jointly insignificant. Controlling for other factors, RI is not associated with income growth for the above-RI cohort.

This combination of regression results strongly supports Theory L, which rejects both null hypotheses 1 and C/C′. The signs on both α_2 and α_3 are as alternative hypothesis L predicts.[24] Does this relationship persist for a broad range of reference to actual income ratios? To answer, we ran additional regressions, including [ln (REFINC87/INCOME86)]^2 and the interaction of this variable with ABOVERI. Its coefficient would be negative if, for example, the RI effect diminished as RI rose further. This squared term was not significant in any of our regressions, suggesting that elasticities differ little over a broad range.

To see the predictive import of our regression results, we apply our estimated coefficients to an individual with the mean value for all of our variables (Table 1), except for RI, which will take on two hypothetical values. If his RI were 54% higher than his actual income in 1986—the mean for below-RI physicians—he would experience an income gain of 70%. If his RI were 14% lower than his actual income in 1986—the mean for above-RI physicians—he would merely experience an income gain of 42%. His income gain is two-thirds greater [(70 − 42)/42] due to the differences in RIs and the responses to them in the below- and above-RI cohorts.

B. *Econometric Issues*

Before turning to how below-target physicians raised their incomes, we comment on four econometric issues: measurement errors, omitted variables, selection effects, and simultaneity. Though each is worthy of attention, we believe that none poses a serious problem for our central contention that physicians respond differently to RIs depending on whether their actual incomes fall below or above them.

Measurement Errors: If RI is measured with error, that will reduce its estimated effect on subsequent incomes. This tilts against demonstrating $\alpha_2 > 0$ in equation (10), which we found strongly, but in favor of finding $\alpha_2 - \alpha_3 = 0$. Fortunately, there is no reason to suspect serious measurement errors. Even if there were, they should not differ systematically according to whether physicians are above or below their RIs.

Omitted Variables: Omitting important but unavailable variables biases any empirical assessment. For example, suppose that physicians with high RIs are merely more productive. If the right-hand side (RHS) variables in equation (10) do not adequately capture physicians' productivities, then omitted variable bias will afflict the resulting estimates, boosting the estimated relationship between RI and subsequent income. Fortunately, the RHS variables in (10)—for example, type of physician, medical practice, and demographic characteristics (see Table 1)—control reasonably well for productivity. Moreover, each equation controls for actual 1986 income, itself a strong indicator of productivity. Even if RI proxies for omitted productivity effects (null hypothesis C), we'd expect to observe a positive relationship between RI and subsequent income, whether physicians are above or below RI.

We tested directly whether RI proxies for predicted income. If so, reference and actual future income would bear little relation after controlling for predicted income. First, we predicted 1990 income.[25] RI still strongly affects subsequent income, even after controlling for predicted income.[26] Clearly, RI is not merely an income forecast. We also note that the Young Physicians Survey asked "What do you consider adequate?" not "What do you expect to earn?"

Selection Effects: Some important omitted factors may differ according to whether physicians are above or below their RIs. We have little evidence on what such factors are, or how they could account for the strongly asymmetric

[23] The coefficient on (ln INCOME86) × ABOVERI is positive and significant. As a referee phrased it: "In medicine, as in many other careers, there is path dependence in professional development: fortune smiles on those who get off to a good start but is less friendly to those who are slow off the line." Frank and Cook (1995, p. 88), using census data, find this good-start–good-finish effect is particularly large in medicine. The positive coefficient on (ln INCOME86) × ABOVERI is consistent with this momentum theory of income growth discussed.

[24] Alternative specifications yield similar results. In particular, we substituted the log of the change in 1990 and 1986 income for 1990 income as the dependent variable in equation (10). This yielded identical coefficient estimates and tests of significance levels for all variables except for 1986 income. Using this alternative specification, the coefficient on 1986 income was −0.83 (t = 15.31) for below-RI physicians, and the joint effect of ln INCOME86 and its interaction with ABOVERI was −0.46 (F = 19.56) for physicians above their RIs. Secondly, we substituted the ratio of the log of reference to actual income for the log of RI in equation (10). This also left all variables unaffected with the exception of 1986 income. Using this specification, the coefficient estimate on 1986 income was 0.76 (t = 14.93) in the below-RI cohort and 0.67 (F = 124.74) in the above-RI cohort. The significant effect of RI on subsequent income is not produced by a small number of physicians for whom RIs greatly exceed actual incomes. We examined this issue in preliminary statistical analysis, eliminating physicians whose reference incomes were more than twice their actual incomes. These exclusions reduced the below-RI sample by 11%, to 561 observations, and the estimated effect of RI remained strongly positive, with a coefficient estimate of 0.46 (t = 3.11).

[25] Our predicted-income approach employs all of the explanatory variables used in the income equations reported below, except RI, to predict 1990 income (see Table 4), and then adds RI as an additional explanatory variable.

[26] A regression performed on the pooled sample of 641 physicians yielded the following results:

$$\ln \text{INCOME90} = \underset{(1.14)}{-0.22} + \underset{(6.96)}{0.36} \ln \text{REFINC87} + \underset{(12.60)}{0.71}\ \text{PREDINC},$$

where ln INCOME90 is the natural log of income in 1990, PREDINC is the predicted value of the natural log of 1990 income, ln REFINC87 is the natural log of 1987 target income, and t-statistics are in parentheses.

response to reference income that we observe. In terms of terms of observable factors—such as years of practice experience, practice size, gender, specialization, and geographic distribution—the two cohorts are similar.

Simultaneity Effects: Some simultaneous determination of RI and actual income, such as a common shock, could bias the estimated relationship upward.[27] Unfortunately, our data set did not provide ideal instruments for RI. Hence, we cannot rule out simultaneity—endogenous determination of RI—as a partial explanation for the RI–income-growth relationship in the below-RI cohort.[28] Fortunately, however, our principal empirical result—namely, the great disparity in response to RI between the below- and above-RI cohorts—stands up. Indeed, if RI and subsequent actual income were substantially jointly determined, the finding of a nonsignificant relationship between the two in the above-RI cohort would be extremely unlikely. The disparity in behavior between cohorts must be due to a factor other than simultaneity.

C. *Effects on Hourly Wages and Annual Hours Worked*

How did below-RI physicians raise their incomes? Did they increase hours worked, h, or earnings per hour, $w + s$? Since the base wage is exogenously given, the hourly rate can only be boosted by increasing s, say by increasing prices or shortening appointments. Pricing behavior has become increasingly restricted by third-party payers; moreover, the services for which pricing information is available to us (fees for an office visit with an established patient) are not an important source of revenue for many of the specialists in our sample, particularly surgical specialists. Hence, we focus on changes that are important for all physicians in our sample and for which we have reasonable measures: changes in hours worked, and changes in hourly earnings.[29]

TABLE 5.—HOURLY WAGE ESTIMATES

Independent Variable	Parameter Estimate	t-Statistic
(Intercept)	0.93***	3.23
ln REFINC87 (α_2)	0.50***	5.95
(ln REFINC87) × ABOVERI (α_3)	−0.37***	2.43
ln INCOME86	0.05	0.57
(ln INCOME86) × ABOVERI	0.29**	2.19
ABOVERI	0.47	1.16
ln WAGE86	0.13	1.90
PRACSIZE	−0.001	0.99
PRACYEAR	−0.04***	2.65
GENIM	0.05	0.78
PED	0.16	1.87
SPECIM	0.18**	2.28
GENSURG	0.13	1.40
SPECSURG	0.38***	5.41
PSYCH	0.31***	2.86
OBGYN	0.45***	4.87
BLACK	−0.18	2.41
BDCERT	0.03	0.60
FMG	0.01	0.08
RURAL	−0.12	1.24
NONSMSA	−0.08	1.32
SMALSMSA	−0.02	0.28
BIGSMSA	0.0004	0.01
MIDWEST	−0.004	0.05
SOUTH	−0.09	0.76
WEST	−0.14**	2.25

$N = 571$, adjusted $R^2 = 0.46$, $F = 20.19$. Dependent variable: ln WAGE90.
*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.

The equations we estimate to study these hours and wage effects are similar to that specified in (10), but with income in 1990 replaced with hours and wages, respectively. In addition, we add hours in 1986 to the RHS for the hours equation so that the RI effects estimated by this equation will capture effects on *changes* in hours; we do the same for wages in its equation.

Table 5 provides multivariate evidence on the effects of reference incomes on hourly earnings.[30] RI has a positive and highly significant effect on subsequent hourly earnings, with an elasticity of 0.50, which is consistent with our earlier speculations about stimulation. In contrast, results for the above-RI group suggest that reference incomes bear no significant relationship to subsequent hourly earnings.[31]

An equivalent calculation (available from the authors) for annual hours worked found no effect in the above-RI cohort, and an insignificant but modestly positive effect in the below-RI cohort. Income growth in the below-RI cohort is

[27] Any such bias is reduced because a predetermined RI is related to subsequent income. However, the bias will not be eliminated, due to serial correlation between lagged and concurrent RI. As a crude correction, we appended the log of 1991 reference income (ln REFINC91) and the interaction between this variable and ABOVERI to the RHS of equation (10) to net out the influence of correlations between 1987 and 1991 RIs on the estimated effect of ln REFINC87 on subsequent income. The results indicate a positive and highly significant relationship between RI and subsequent income among below-RI physicians, but no relation in the above-RI cohort.

[28] We did however test for the endogeneity of RI using a Hausman test. To implement the test, we used the physician's medical education indebtedness to predict RI. We hypothesized that, ceteris paribus, physicians with greater educational indebtedness would set higher RIs. We performed separate endogeneity tests for the below- and above-RI cohorts (we thank James Stock for recommending this approach, which allows for greater parsimony in selection of instruments). In each case, we reject the endogeneity of RI (these results are available from the authors on request). In neither cohort could we find any evidence that educational indebtedness affected 1991 income directly, independent of indirect effects working through the effect of educational debt on RI. Moreover, in the below-RI cohort, we found that educational debt had a strongly positive and significant effect on RI, as hypothesized. Thus, empirically at least, education debt performed as a reasonable instrument for testing for endogeneity in the below-RI cohort. Educational debt had a weak effect on RI in the above RI cohort, however, so we have less confidence in the Hausman test applied to that group. We thank Robert Pindyck for recommending that we investigate these issues.

[29] Calculations available from the authors show that both hourly earnings and hours worked correlate significantly with REFRATIO in the below-RI cohort, but hourly earnings much more strongly. Neither is significant in the above-RI cohort.

[30] Doiron and Barrett (1996), studying male and female earnings inequality in Canada, revealed the importance of distinguishing between hourly wages and hours worked as explanations. They found that the greater inequality in female incomes is due to greater inequality in the number of hours they work.

[31] A joint test of significance of the ln REFINC87 and (ln REFINC87) × ABOVERI variables gave $F = 1.10$, with $p = 0.29$.

largely the result of increasing hourly earnings, not hours worked.

VIII. Summary and Future Directions

This study examines how young male physicians' incomes grew from 1986 to 1990. Physicians in the below-RI cohort increased their incomes much more significantly than those in the above-RI cohort. More telling, their incomes responded significantly to their RIs; those for the above-RI cohort did not. A theory of loss aversion and reference points, Theory L, predicts this pattern. Prominent competing theories, which make other predictions, are refuted.

From a policy perspective, these results suggest that physicians exercise discretion in adjusting their incomes to offset perceived shortfalls, say due to greater regulatory efforts by government and third-party payers. Managed care and tight budgets may be limiting such discretion. However, if it becomes harder for physicians to boost their incomes with readily observable changes, such as increasing prices, they may compensate in ways that are more difficult to monitor, such as shortening appointments. Our loss-aversion model predicts that such responses will be asymmetric, and much stronger among physicians who perceive their incomes to be inadequate.

These findings have implications for theoretical models of physician behavior and possibly for models of the firm more generally. In particular, the results suggest that whether a firm is above or below its RI may strongly affect its subsequent behavior and earnings. Further progress requires a theory that explains how RIs are set, and provides additional evidence on why physicians or firms strive to meet them. Physicians are quite successful at boosting their earnings if their actual incomes are below their RIs: a 10% greater RI is associated with a 5.9% increase in subsequent income. Despite the "tsk tsks" of economists, physicians behave as if RIs matter.

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