המוסד לביטוח לאומי
האגף למחקר ותכנון

דמי אבטלה והיצע העבודה
של פרט מועסק

מאת: גדעון יניב

מחקר מס' 26

ירושלים, אייר התשמ"א
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מ ח ק ר י ם

(בעברית או באנגלית לפי המצויין)

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דמי אבטלה והיצע העבודה
של פרט מועסק

מאת: גדעון יניב

המחבר מודה לעובדי האגף למחקר ותכנון על עזרתם בהוצאת חוברת זו.

מחקרים תיאורטיים ואמפיריים מצביעים בעקשנות על ההשפעה השלילית שיש לתכנית ביטוח האבטלה על היצע העבודה. נטען לא אחת, כי תכנית הביטוח מאפשרת לפרט המובטל לדחות עבודה "לא מתאימה", תוך הקטנת מחיר הדחיה. היא פוגעת ביזמת החיפוש העצמי, ותורמת במישרין להמשך אבטלתו.* עם זאת, ניתן לייחס לתכנית ביטוח האבטלה גם השפעה "מיטיבה" על היצע העבודה, אם נזכור כי תשלומי האבטלה מכוונים, בעקרון, לפצות את הפרט המובטל על אבדן הכנסתו. מאחר וההכנסה האובדת מוערכת על בסיס הכנסות העבר, הרי שפרט הער לשיטת הפיצוי מחד, ולאפשרות התרחשותה של אבטלה מאידך, עשוי להגדיל את היקף עבודתו בתקופות שבהן הוא מועסק - בנסיון ל"בטח" את עצמו כנגד אבטלה אפשרית.

תשומת הלב הרבה שהוקדשה עד כה להשפעות היצע העבודה של תכנית ביטוח האבטלה, התמקדה כמעט לחלוטין בהשלכותיה של התכנית על התנהגותו של הפרט המובטל. התמריץ החיובי לעבודה שהיא מספקת לפרט המועסק לא נחקר כמעט כלל**. מטרת המחקר הנוכחי, איפוא, היא להכליל מספר מאפיינים בסיסיים של תכנית ביטוח האבטלה לתוך מודל החלטה רב-תקופתי, בכדי לנתח את התנהגות היצע העבודה של פרט שכיר, הנושא בנטל המימון של קרן האבטלה, והצופה הסתברות מסוימת לאבטלתו בעתיד. מאפיינים אלה כוללים, בין השאר, פיצוי שהוא יחסי להכנסה שקדמה לאבטלה, הגבלה על משך קבלת הפיצוי, ודרישה לתקופת המתנה (בלתי מפוצה) לפני קבלתו. הפרט פועל בתנאים של אי-ודאות לגבי מימוש זכאותו לפיצוי, מאחר שזו מותנית בפיטורין ממקום העבודה (ולא בהתפטרות מרצון), ובאי יכולתה של לשכת התעסוקה להציע לו משרה מתאימה אחרת (דחיית הצעה כזאת מבטלת את זכאותו).

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* ראה למשל: Feldstein (1974), Ehrenberg and Oaxaca (1976), Classen (1977), Holen (1977), ו- Nickell (1979).

**רק לאחרונה הצביע Hammermesh (1979a) על אפשרות קיומו של תמריץ כזה. במדגם של נשים נשואות שערך בארצות הברית מצא, בנוסף להשפעה השלילית הרגילה על היצע העבודה, גם "השפעת זכאות" חיובית ומובהקת. השפעה חיובית אחרת זוהתה על-ידי Mortensen (1977) ו- Burdett (1970): מובטלים שמסיבות שונות אינם זכאים לתשלומי אבטלה (נכנסים חדשים לכח העבודה, מתפטרים מרצון וכו') יטו למצא עבודה מהר יותר - על ידי חיפוש אינטנסיבי יותר, או הסכמה לשכר נמוך יותר - על מנת לבסס את זכאותם לפיצויים בעתיד.

ואמנם, ניתוח התנהגותו של הפרט מראה בבירור, כי קיומה של הסתברות כלשהי לזכות בעתיד בדמי אבטלה (בשעור נתון מהכנסת העבר) יוצר תמריץ חיובי לעבודה. בהשוואה למצב שבו תכנית הביטוח אינה קיימת, מוכן הפרט לוותר על חלק נוסף מזמנו הפנוי כדי "לרכוש ביטוח" כנגד התרחשותה של אבטלה. עם זאת, הנשיאה בנטל מימונה של התכנית עלולה (אם כי אינה חייבת) ליצור תמריץ הפוך, כך שרק אם "השפעת הזכאות" גוברת על "השפעת המימון" ניתן יהיה לקבוע במקרה כזה, שלתכנית בכללותה יש השפעה חיובית על היקף העבודה של פרט מועסק. עוד נמצא, כי עלייה בהסתברות התרחשותה של אבטלה מביאה, כשלעצמה, לעלייה בהיצע העבודה, בעוד שתגובתו של הפרט לעלייה בשעור הפיצוי אינה ברורה מראש, ותלוייה ביחסו לסיכון.

הסתכלות על פרט המתכנן לשהות בכח העבודה השכיר במשך מספר מגדר של תקופות (שלאחריהן הוא מתכוון להפוך לעצמאי, או לפרוש לגמלאות), מגלה שלשה שלבים בהתנהגות היצע העבודה עם הזמן: בתקופות מוקדמות יחסית, כאשר אופק התכנון הוא רחוק מספיק, יהיה היצע העבודה של הפרט קבוע על פני זמן. הסיבה לכך היא שמשך מתן הפיצוי (במקרה של אבטלה) יקבע, בשלב זה, על פי המגבלה שמטילה תכנית הביטוח, כך ש"השפעת הזכאות" תהיה בלתי תלוייה בזמן הקלנדרי שבו נמצא הפרט. אולם, במוקדם או במאוחר יהפוך אופק התכנון של הפרט למגבלה אפקטיבית על משך קבלת הפיצוי. כתוצאה, היצע העבודה יתחיל לרדת עם הזמן, מאחר שמספר התקופות הפוטנציאלירת שתיוותרנה לפרט לניצול דמי אבטלה על בסיס הכנסתו השוטפת - ילך ויפחת. הצורך בביטוח יקטן, איפוא, על פני זמן, כך ש"השפעת הזכאות" תהיה חלשה יותר ככל שיתקרב הפרט אל מועד פרישתו מעבודה שכירה. לבסוף, כאשר תקופת ההמתנה הנדרשת לפני קבלת הפיצוי, היא שתפריד בלבד בין הפרט לבין מועד פרישתו - יעלם הצורך בביטוח כליל. היצע העבודה יגיע אז לרמתו הנמוכה ביותר, שבה אף יתיצב בהמשך.

תכנית ביטוח האבטלה נוטה, בסיכום, להקטין את גודלו של כח העבודה האפקטיבי מצד אחד (דרך הארכת משך האבטלה של מקבלי הפיצוי), אך להגדיל את מאמציהם של העובדים בפועל מצד שני (במטרה להבטיח פיצוי גבוה יותר במקרה של אבטלה עתידית). השפעתה השלילית של התכנית על מקבלי הפיצוי נחקרה בהרחבה בספרות הקיימת, בעוד שהמחקר הנוכחי מתמקד בהשפעתה החיובית על אלה העתידים לקבלו אם יובטלו מעבודתם. יש ענין, איפוא, לנסות ולהכליל את שתי ההשפעות לתוך מסגרת ניתוח רחבה יותר, שבאמצעותה ניתן יהיה לבחון את השפעתה הנקייה של התכנית על רמת התעסוקה והרווחה במשק כולו. נסיון כזה יעשה בהמשך, יחד עם בדיקה אמפירית של מערכת יחסי הגומלין שבין תכנית ביטוח האבטלה להיצע העבודה בישראל.

THE NATIONAL INSURANCE INSTITUTE
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UNEMPLOYMENT INSURANCE BENEFITS AND THE SUPPLY OF LABOR OF AN EMPLOYED WORKER

BY

GIDEON YANIV

DISCUSSION PAPER 26

JERUSALEM, MAY 1981

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(In English or Hebrew as stated)

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I. INTRODUCTION

The disincentive effects that unemployment insurance (UI) benefits may have on the supply of labor are well recognized. It has been argued extensively that by reducing the cost to a worker of turning down a job offer below his skill level, the UI program contributes directly to the continuation of his unemployment.[1] Yet, recalling that unemployment benefits are aimed to compensate the unemployed worker for earings loss, a favorable impact on the supply of labor can also be attributed to the UI program. This is so, because being aware of the fact that past earnings serve as a practical measure of earnings loss, a rational worker might choose to increase his work efforts *when employed*, so as to help insure himself against the realization of unemployment. Still, the potential incentive for work provided by an earnings-related benefits scheme has nearly escaped any of the attention that has been devoted in the literature to the labor supply effects of the UI program.[2]

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1) See, for example, Feldstein (1974), Ehrenberg and Oaxaca (1976), Classen (1977), Holen (1977), and Nickell (1979).

2) Hammermesh (1979a) points out the possible existence of this incentive, refering to it as an "entitlement effect." Using data on a sample of married women for 1971, he finds it to be positive and significant. Another source of a favorable effect on the supply of labor is identified by both Mortensen (1977) and Burdett (1979): Unemployed workers who are currently not eligible for UI benefits (new entrants, exhaustees, etc.) would tend to find work more quickly by lowering their reservation wages or searching more intensively in order to qualify for future benefits. The discussion which follows does not relate to the latter impact, however.

The purpose of this paper is to incorporate some basic features of the UI program into a framework of a multi-period decision model, so as to analyse the labor supply behavior of an insured worker over time. The past earinings compensation criterion is naturally one of these features. The others include a requirement to serve a waiting period before receiving any benefits,and a limitation on the duration of payments. The model is probabilistic in nature, as an unemployed worker is eligible for compensation only if he is involuntarilly separated from his place of work, and providing that the Employment Service is unable to furnish him with a suitable job offer.[3)] The existence of uncertainty arising from the possible occurrence of unemployment in future periods would play a crucial role in determining the optimal supply of labor of the employed worker.

Abstracting first from the existence of a waiting period and a limitation on benefit duration, the main properties of labor supply behavior over time are derived in Section II. In Section III a comparative statics analysis is carried out with regard to the effects that changes in the rate of compensation and the probability of unemployment may have on the optimal choice of the employed worker. A limit on benefit duration and a waiting period requirement are incorporated in Section IV, as a result of which a three-stage path of labor supply over time is finally identified. The possible effects of financing UI costs are then discussed in Section V, and a summary of main results is provided in Section VI.

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3) Failure to accept a suitable job if offered, would disqualify the individual for receiving any benefits.

II. THE MODEL

Consider an individual who intends to offer his labor services in the market over several periods of time. He joins the wage-earners force at the beginning of period 0, and remains there until the end of period T when he plans to become self-employed or to retire altogether. Suppose also that workers are recruited through an official employment bureau, and that employment is provided on a one-period basis only. At the beginning of each period the individual must thus report at the bureau for subsequent employment.

Let us assume now that at the beginning of each period the bureau faces a fixed probability 1-p of finding the individual a job for which he his "reasonably fitted." If, with a probability of p, the bureau fails to provide him with such a job, he will be eligible for unemployment payments. Yet, only if he were previously employed would the individual qualify for UI benefits.[4] If he were not, income support might be provided by some other public-aid program.

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4) The main objective of this requirement in most of UI programs is to help assure that benefit funds are reserved for payment to those who are genuinely attached to the covered labor force and would be working were it not for involuntary job separation and the unavailability of other suitable jobs. To qualify for benefits a claimant must have worked a certain number of periods in covered employment, or gained a specified amount of earnings, or must have met some combination of earnings and employment requirements. The crucial issue yet is the extent of past employment or earnings that should be required as an evidence of genuine attachment. For simplicity we assume here that one period of past employment is sufficient to qualify for benefits, regardless of the amount of earnings received.

In the first case the individual would receive a proportion $0 < g < 1$ of his last period of work earnings.[5] In the latter, he would receive $\bar{G} \geq 0$ as a flat rate transfer.

Suppose further that UI costs are not borne by the employees[6], and that in each period of employment the individual receives a fixed wage w per hour of work. Labor is his only source of income, and he does not anticipate or postpone income by borrowing or saving[7]. Utility, U, of each period is defined on income and leisure, and is assumed to be twice differentiable, increasing in both arguments, and exhibiting decreasing marginal utility of income.

At the time of planning, the beginning of period 0, the individual is unable of knowing which period would serve as a basis for compensations if he becomes unemployed in some future period t[8]. Expected utility of

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5) In practice benefits may be calculated on the basis of the average (or highest) amount of earnings received over a specified number of periods which preceded unemployment. The present analysis abstracts also from the possible existence of a maximum amount beyond which additional earnings produce no increase in benefits.

6) This assumption is relaxed later in Section V. It allows the analysis to focus first on the impact of earnings-related benefits per se on labor supply, in separation from the costs aspect of the UI program.

7) One of the justifications for establishing a UI system is that private savings cannot be relied upon to tide workers over periods of unemployment. Using data of sample studies of UI beneficiaries made in six states during 1954-58, Haber and Murray (1966) evaluate that about 45 to 80 percent of the household heads surveyed had no savings at all.

8) This information is of course evident at the beginning of period t. Yet, it is too late then to affect the amount of benefits received.

period t, EU_t, should thus be evaluated on the ground that each of the preceding periods might be his last period of employment. Taking the weighted sum, by respective probabilities, of all the utility levels possible in period t, we obtain (Appendix A):

$$EU_t = (1-p)U(wN_t,\bar{H}-N_t) + (1-p) \sum_{i=1}^{t} p^i U(gwN_{t-i},\bar{H}) + p^{t+1}U(\bar{G},\bar{H}) \tag{1}$$

where N_t denotes hours of work in period t, and $\bar{H}$ is an exogenously given time constraint.

Using $0 < a < 1$ as a time preference factor, the individual now chooses $N_0^*,\ldots,N_T^*$ so as to maximize the discounted sum of his expected utilities over time:

$$\sum_{t=0}^{T} EU_t = (1-p) \left[\sum_{t=0}^{T} a^t\, U(wN_t,\bar{H}-N_t) + \sum_{t=1}^{T} a^t \sum_{i=1}^{t} p^i\, U(gwN_{t-i},\bar{H}) \right] + \bar{U} \tag{2}$$

where $$\bar{U} = \sum_{t=0}^{T} a^t\, p^{t+1}\, U(\bar{G},\bar{H})$$

We begin to investigate the individual's labor supply behavior by first deriving his preferred amount of work in some arbitrary period k. Differntiating (2) with respect to N_k, equating to zero and rearranging terms (Appendix B), the individual's optimum condition is stated as

$$\frac{1-(ap)^{T-k}}{1-ap}\, ap\, U_1\left(gwN_k,\bar{H}\right) gw = U_2\left(wN_k,\bar{H}-N_k\right) - U_1\left(wN_k,\bar{H}-N_k\right) w \tag{3}$$

where U_1 and U_2 denote marginal utilities of income and leisure, respectively.

In the traditional full-certainty model of labor supply, the possibility of involuntary unemployment is not accounted for ($p=0$). Thus, the right -hand side value of Eq.(3) is zero at the optimum. The existence of uncertainty ($p > 0$), and of an earnings-related compensation provision in the UI program ($g > 0$), imply now that the R.H.S. value of the optimum equation should be positive for each $k < T$. We also notice that the R.H.S. value varies directly with N_k[9]. It thus follows that under a UI program an employed worker would devote more hours to work in each of the periods that precede period T, providing, of course, that he attributes some value to his future satisfaction ($a > 0$).

Increasing the supply of labor beyond the full-certainity solution involves a loss of utility in period k. The R.H.S. of the optimum condition (3) can thus be interpreted as the marginal cost to a worker of acquring insurance through the allocation of an additional hour to work, in terms of utility forgone in period k. The L.H.S. of the optimum condition is the discounted value of the marginal benefit expected in the future from an hour devoted to work in period k, if k happens to be the last period of employment. It is inversely related to N_k, and exceeds the marginal cost at the full-certainty solution.

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[9] The derivative of the R.H.S. of Equation (3) with respect to N_k is $-D > 0$, where $D < 0$ is the second-order condition for a maximum of (2) when no uncertainty is involved (See Appendix B).

Hence, an employed worker would increase his supply of labor in period k until the marginal cost of acquiring insurance equates its marginal benefit. He would be willing to give up some utility in the present, to help insure himself against possible unemployment in the future.[10]

A further examination of the optimum condition reveals that the higher the value of k, the lower would be the marginal benefit expected in the future from an hour allocated to work in the present. As the individual progresses in time he is left with less of potential periods for which present earnings might serve as a basis for unemployment payments. The optimal supply of labor would thus fall over time, reaching its full-certainty level in the last period of planning.

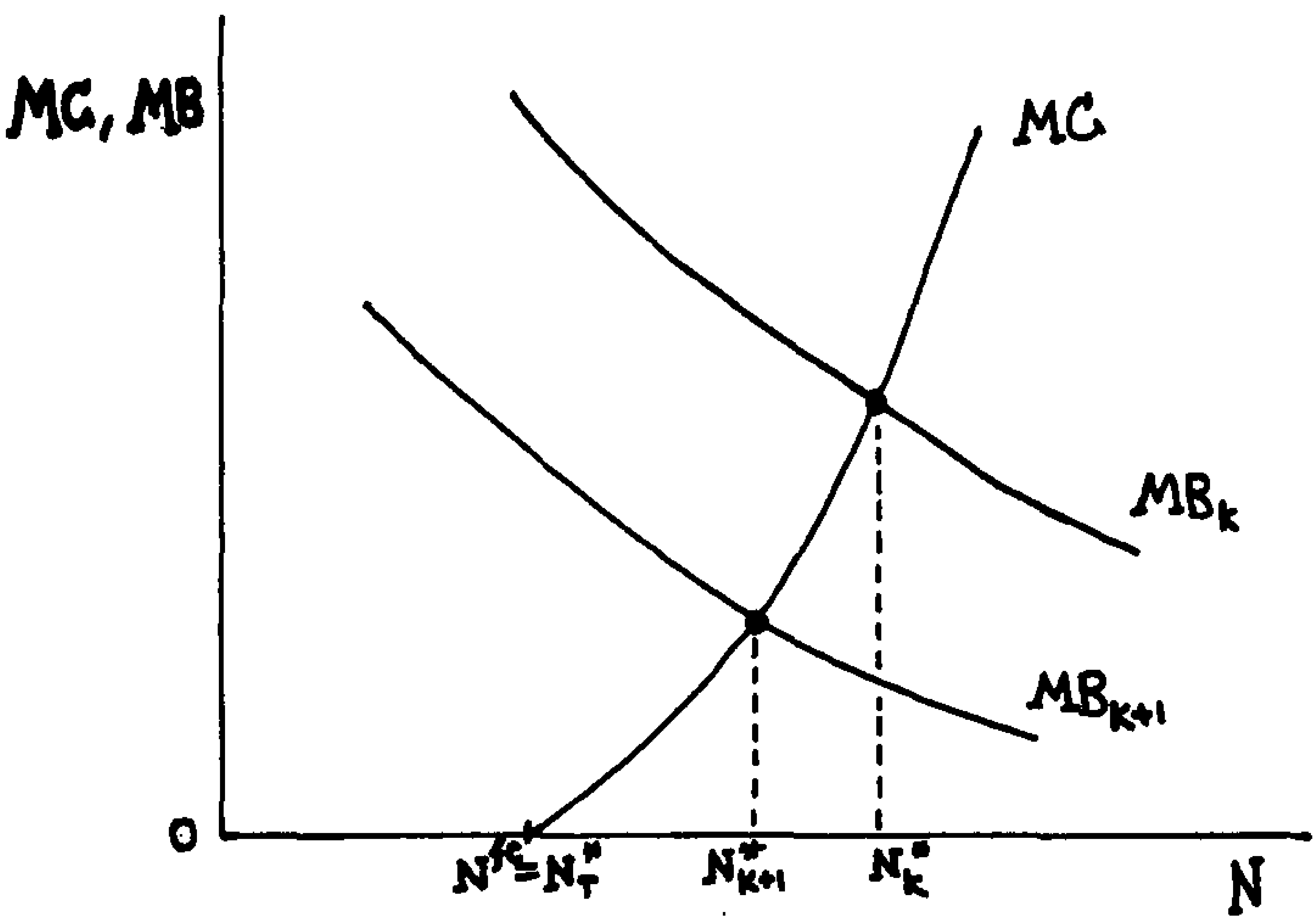

FIGURE 1.

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10) Notice that the value of N_k^* does not depend on the actual history from period 0 to period k (although it could if, for example, workers expectations of the probability of unemployment depended on their experience of actual events). Thus, by the time he reaches period k the worker would be willing to supply the exact amount of labor that he planned.

These results are diagramatically summerized in Figure 1. The marginal cost (MC) and benefit (MB) are drawn with respect to N, where N^{fc} is the full-certainty level for which MC = 0.[11] As k rises, the MB curve slides down over a stationary MC curve, such that smaller optimal levels of labor supply are successively determined. In period T the MB curve would coincide with the horizontal axis, determining N^{fc} as an optimal solution. The need for insurance diminishes over time and disappears entirely as the planning horizon is terminated.[12]

III. COMPARATIVE STATICS

We now turn to examine the way in which an insured worker would respond to changes in the compensation rate or in the probability of becoming unemployed. A rise in g or P would not affect the MC curve, but would change the position of the MB curve for each $k < T$. Also, inspection of Figure 1 reveals that

$$\text{sign}\ \frac{dN_k^*}{d\lambda} = \text{sign}\ \frac{d(MB_k)}{d\lambda} \tag{4}$$

where λ stands for any parameter that affects the MB alone

---

11) Notice that the MC and MB curves do not refer to the marginal cost and benefit of supplying work efforts as a whole. Rather, the MB curve reflects the marginal benefit from insurance only, while the MC curve relates to the marginal cost of acquiring insurance beyond the amount provided as a by-product of the full-certainty maximization.

12) The declining path of labor supply over time is a direct result of the finite planning horizon assumption. If the planning horizon were infinite, the optimum condition (3) would reduce to

$$\frac{ap}{1-ap} U_1(gwN_k,\bar{H})gw = U_2(wN_k,\bar{H}-N_k)-U_1(wN_k,\bar{H}-N_k)w \tag{3'}$$

Hence, the MB curve would become independent of k, implying a stationary optimal level of labor supply over time.

Differentiating MB_k with respect to g we obtain

$$\frac{d(MB_k)}{dg} = \frac{MB_k}{g} \left[1 - R(gwN_k,\bar{H}) \right] \tag{5}$$

where $R(gwN_k,\bar{H}) = -\frac{U_{11}(gwN_k,\bar{H})}{U_1(gwN_k,\bar{H})} gwN_k$ is the Arrow-Pratt relative risk aversion measure. It thus follows from (4) and (5) that for any g and k < T

$$R(gwN_k,\bar{H}) \gtreqless 1 \Longleftrightarrow \frac{dN_k^*}{dg} \lesseqgtr 0 \tag{6}$$

Hence, the way by which an employed worker responds to changes in the compensation rate depends on the nature of his risk aversion. There seems to be a general presumption that relative risk aversion is a non -decreasing function of income. Thus, if it is constant, the optimal supply of labor in each of the periods that precede period T would respond in the same direction (depending on the value of R) to a rise in g. However, if relative risk aversion increases with income, the supply of labor in different periods might respond in opposite directions. To see that, suppose that for a given $\hat{g}$ there exists some period $\hat{k}$ such that $R(\hat{g}wN_{\hat{k}}^*,\bar{H})=1$. It then follows from (6) that a rise in g would reduce the optimal supply of labor in each of the periods that precede period $\hat{k}$, but would increase it in each of the periods thereafter (excluding period T). Still when the value of g is sufficiently high such that R reaches unity at some $N \leq N^{fc}$, a rise in g would reduce the optimal supply of labor in all k < T. Sufficiently low values of g would clearly reverse this result.

Differentiating now MB_k with respect to P we obtain

$$\frac{d(MB_k)}{dp} = \frac{MB_k}{p(1-ap)} \left[1 - \frac{(1-ap)(T-k)(ap)^{T-k}}{1-(ap)^{T-k}} \right] \qquad (7)$$

which can be shown to be positive for each $T - k > 0$ [13]. An increase in the probability of unemployment would thus raise the value of the marginal benefit expected in the future from an hour allocated to work in period k, regardless of the nature of risk aversion. It then follows from (4) that a higher optimal level of labor supply would be determined in each $k < T$. By offering more hours of work when employed, The worker insures himself partially against the increased risk of becoming unemployed in the future.[14]

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13) The proof is by induction: The sign of (7) is obviously positive for T-k=1. Assuming that it is also positive for some T-k-1>0, we can show it to be positive for T-k. By assumption:

$$\frac{(1-ap)(T-k-1)(ap)^{T-k-1}}{1-(ap)^{T-k-1}} < 1$$

Multiplying both sides by $ap\left[1-(ap)^{T-k-1}\right]$, adding $(1-ap)(ap)^{T-k}$ and rearranging terms:

$$\frac{(1-ap)(T-k)(ap)^{T-k}}{1-(ap)^{T-k}} < ap < 1$$

Q.E.D.

14) Notice that the time preference factor, a, plays a similiar role to the probability of unemployment in determining the optimal supply of labor. A rise in P,"compensated" by a same percentage fall in the value imputed on future utility, would clearly leave the supply of labor unchanged.

IV. RESTRICTIONS ON THE PAYMENT OF BENFFITS

The basic aim of UI is to prevent the unemployed from falling into poverty and need during periods of involuntary unemployment. Yet, the "moral hazard" phenomenon associated with the operation of any insurance program[15], and the anticipated cost of implementing a long-term compensation system would usually deter any intention of providing adequate benefits indefinitely. Thus, most UI programs are found to limit the duration of unemployment benefits, serving mainly as a means of sustaining workers through relatively short-term unemployment. The very-long-term unemployed who exhust their UI benefits are often supplied with some other form of income maintenance until more direct measures are brought into action.

Suppose now that the duration of benefits is limited to $\hat{n}$ consecutive periods of unemployment.[16] The individual's optimum condition would then be given by (Appendix C):

$$\frac{1-(ap)^{\rho}}{1-ap}\, a\, p\, U_1\left(gwN_k,\bar{H}\right) gw = U_2\left(wN_k,\bar{H}-N_k\right) - U_1\left(wN_k,\bar{H}-N_k\right) w \qquad (8)$$

where $\rho = \min(\hat{n},T-k)$

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15) For a detailed analysis applying the concept of "moral hazard" to the operation of a UI system see Grubel and Walker (1978).

16) Under some UI schemes, the limit on the duration of benefits may vary, up to a specified maximum, with the length of previous employment or the total amount of past earnings.

That is, as long as $k \leq T-\hat{n}$ the MB curve, and thus the supply of labor, would stay constant over time ($\rho = \hat{n}$), as the individual is bound to exhaust his benefits prior to the termination of his planning horizon. Only thereafter would the supply of labor begin to fall with time (ρ = T-k) as T becomes the effective constraint on benefit duration.

These results are represented in Figure 2, where ab denotes the no-limit path of labor supply over time.[17] Imposing a limit of $\hat{n}$ periods on the duration of benefits would determine a path of cdb for the supply of labor. If benefit duration is raised to $\hat{n}'$ periods, the optimal path would change to c'd'b. That is, the supply of labor would increase for all $k < T-\hat{n}$ as the MB curve shifts upwards, beginning to fall at an earlier time than before. An increase of benefit duration up to T periods and more would turn the worker back to the ab path, as $\hat{n}$ ceases to be an effective constraint on planned behavior. At the other extreme, reducing benefit duration down to zero would leave the supply of labor at the fixed N^{fc} level for each k. That is, $\hat{n} = 0$ would clearly eliminate any incentive for increasing the supply of labor beyond the full-certainty solution, as would also do zero values of p, g or a.

Another restriction on the payment of benefits which exists in most of UI programs is the requirement to serve a noncompensable waiting period

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17) This path may not, of course, be smooth and concave as drawn, for simplicity, in the following figures.

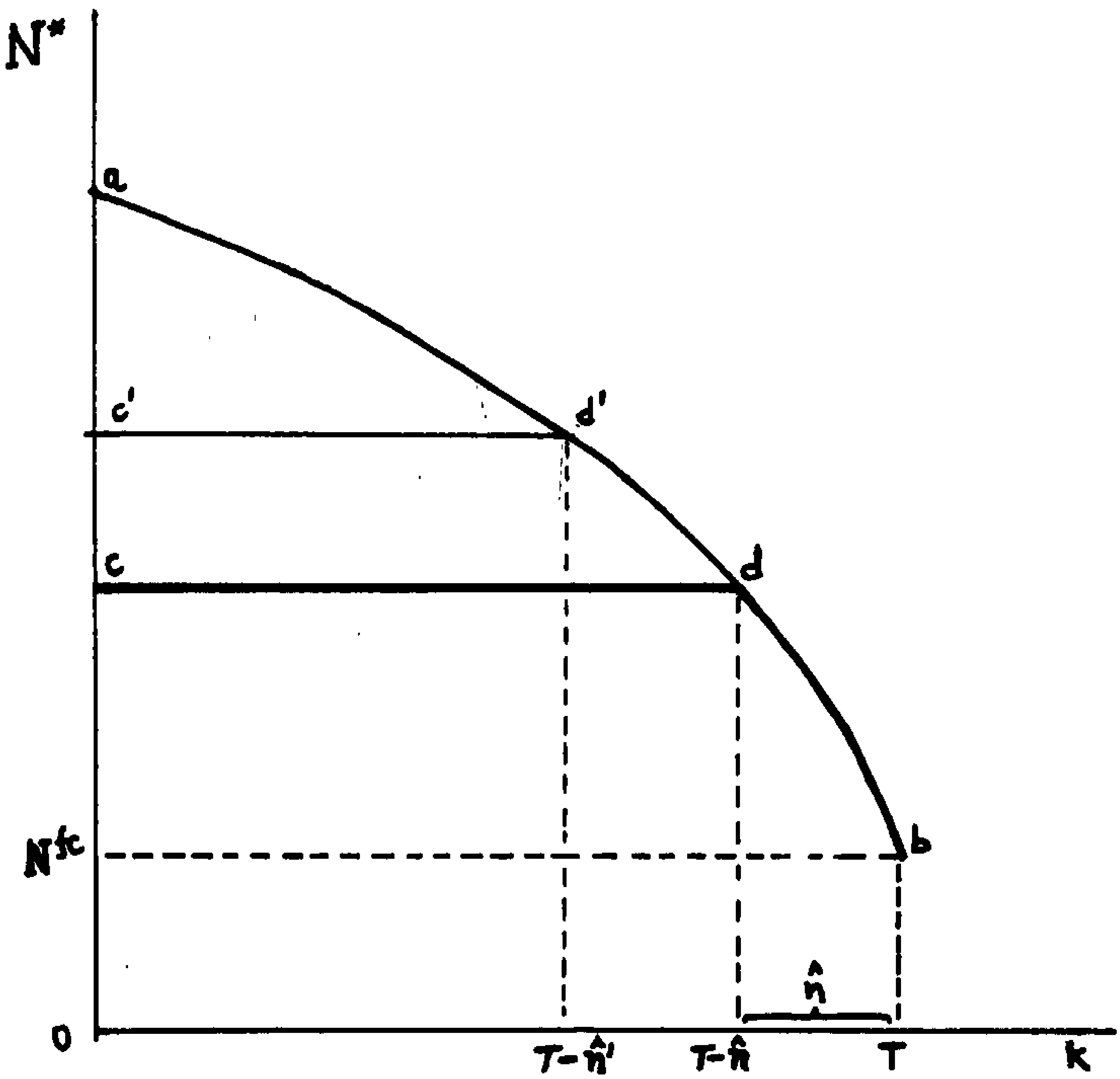

FIGURE 2

before receiving any benefits. The imposition of a waiting period serves two main purposes: First, it allows the administration time to verify that the unemployed worker does satisfy the qualifying requirements of involuntary job separation, sufficient past employment and non-refusal of suitable job offers, before having to make payments. Second, it elmininates the payment of benefits for very short interruptions of employment, thus saving benefit costs, or making possible longer benefit duration for the same costs.

Suppose first that no limit is imposed on the duration of benefits, but that an unemployed worker must wait $\tilde{n}$ consecutive periods before receiving any payment. His optimum condition would then be given by (Appendix D)

$$\frac{1-(ap)^{\gamma}}{1-ap}(ap)^{\tilde{n}+1}\; U_1(gwN_k,\bar{H})\; gw = U_2(wN_k,\bar{H}-N_k) - U_1(wN_k,\bar{H}-N_k)w \quad (9)$$

where $\gamma = \max(0, T-\tilde{n}-k)$

That is, for each $k < T-\tilde{n}$ expected marginal benefit would fall in value ($\gamma = T-\tilde{n}-k$), as payments based on period's k earnings would begin to be paid only $\tilde{n}+1$ periods later.[18] The MB curve would thus shift downwards, so that lower optimal levels of labor supply would be determined. However, for $k \geq T-\tilde{n}$, as only the waiting period is left until the end of planning, there would be no reason to supply more than the N^{fc} level ($\gamma = 0$).

These results are represented in Figure 3, where efb denotes the optimal path of labor supply under a waiting period constraint. Increasing waiting to $\tilde{n}'$ periods would determine e'f'b as an optimal path, while having to wait up to T and more periods would obviously establish the level of N^{fc} as the optimal solution over time. On the other hand, reducing $\tilde{n}$ down to zero would turn the worker back to the

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18) The term $\frac{1-(ap)^{T-\tilde{n}-k}}{1-ap}$ of Eq.(9) implies that $\tilde{n}$ periods of unemployment are not compensable. The term $(ap)^{\tilde{n}+1}$ on the other hand indicates that these would be <u>the first</u> $\tilde{n}$ periods.

no-constraint ab path.

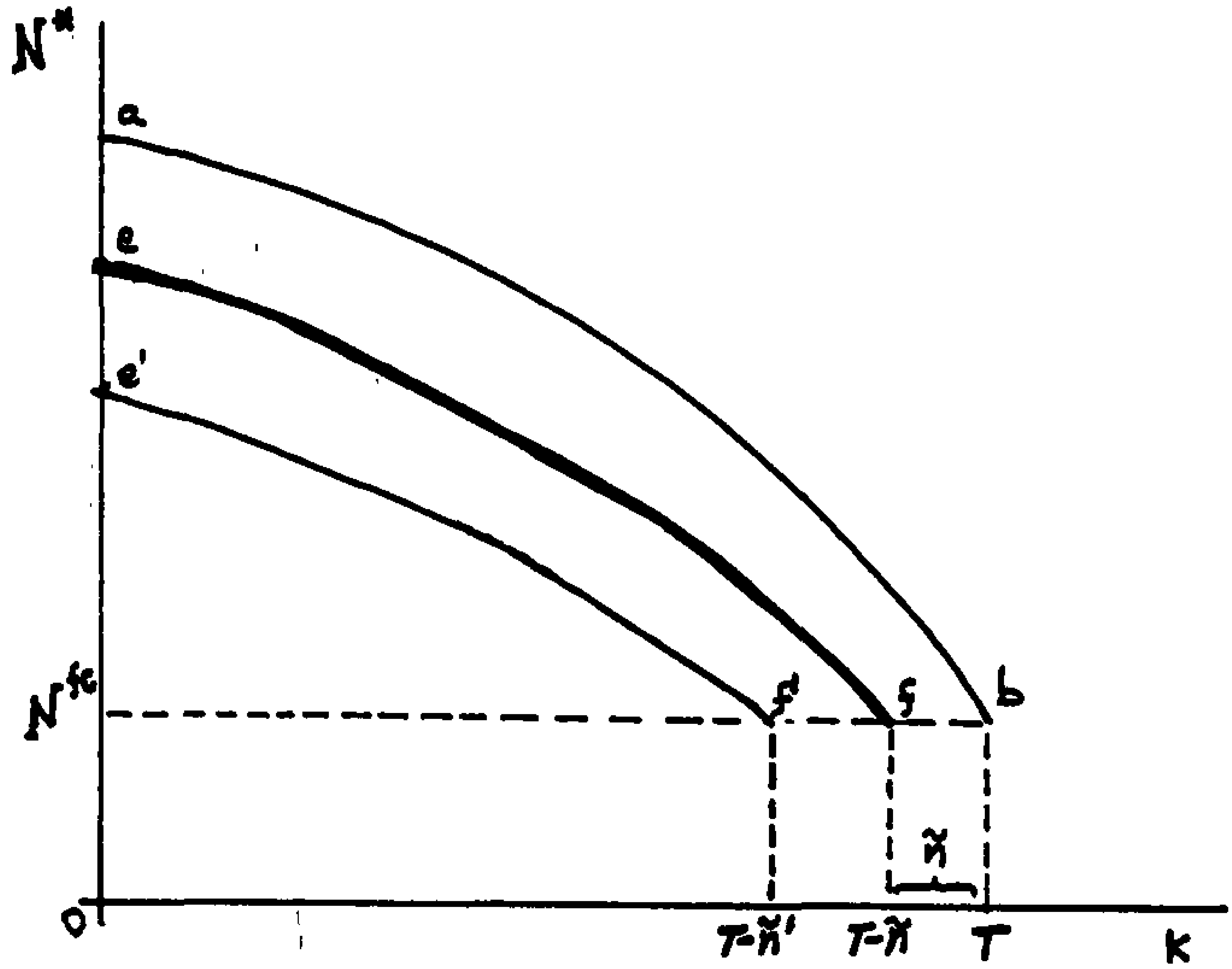

FIGURE 3.

We are now able to identify three stages in the individual's labor supply behavior over time when both a waiting period and a limitation on the duration of benefits are taken into account: In sufficiently early periods, when benefit duration, after a waiting period is served, still holds as an effective constraint on the length of payments ($0 \leq k \leq T-(\tilde{n}+\hat{n})$), the supply of labor would stay constant over time but at a higher than the full-certainty level. As the planning horizon shortens, replacing the duration of benefits as the effective constraint on payments $\left(T-(\tilde{n}+\hat{n}) < k < T-\tilde{n}\right)$, the supply of labor would gradually fall with time. When only the waiting period is left until the planning horizon terminates, the supply of labor would reach the full-certainty solution, remaining at that level thereafter $\left(T-\tilde{n} \leq k \leq T\right)$.

Integrating Figures 2 and 3 into Figure 4 this three-stage path of labor supply is diagramatically represented by the segments gh, hf, and fb, respectively.[19]

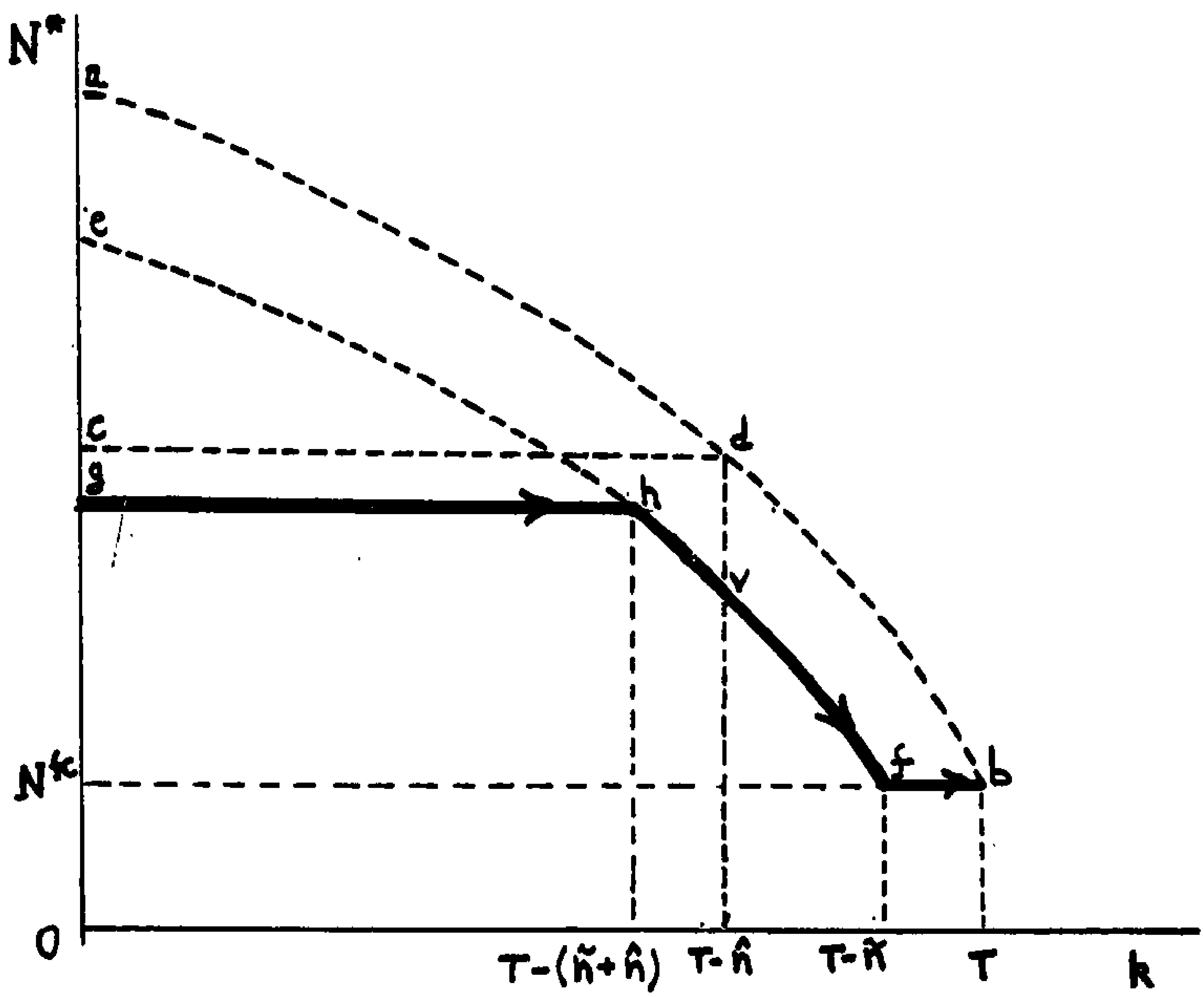

FIGURE 4.

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[19] Notice that the segment gh lies below cd, but by less than the distance dv. This is so because as long as $\hat{n}$ serves as an effective constraint on benefit duration, only the latter effect described in footnote 18 holds. Also, point h must lie on the ef path, since

$$\frac{1-(ap)^{\hat{n}}}{1-ap}\,(ap)^{\tilde{n}+1} = \frac{1-(ap)^{T-k-\tilde{n}}}{1-ap}\,(ap)^{\tilde{n}+1} \text{ at } k=T-(\tilde{n}+\hat{n}).$$

IV. THE EFFECTS OF UI COSTS

Throughout the analysis it has been assumed that UI costs are not borne by the employees. Yet, most of the funds needed to finance UI costs are usually raised from compulsory contributions paid by covered workers or their employers or both. Moreover, even though they may not participate directly in the finance of UI costs, as is generally the case in the US, employees could still share the burden in the form of lower wages or higher product prices.[20]

Setting up a UI system would thus produce a fall in the real net wage of an employed worker. Whatever the exact source of this fall, it can be restricted analytically, without loss of generality, to the imposition of a proportional tax on employees' income. Denoting the tax rate by t, the marginal cost of acquiring insurance in period k, in terms of utility forgone, would become $U_2[(1-t)wN_k,\bar{H}-N_k] - U_1[(1-t)wN_k,\bar{H}-N_k](1-t)w$.

Thus, the MC cruve would no longer cut the horizontal axis at the full-certainty solution, but at a higher or a lower level, depending on the magnitudes of the income and substitution effects that the imposition of a tax would have on the supply of labor. A domination of the income effect (a shift of the MC curve rightwards) would clearly intensify

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20) Evidence on who actually bears the costs is ambiguous. Hammermesh (1979b), for example, finds that less than 1/3 of employers' payroll tax is shifted on to workers.

the favorable impact of the UI program on the supply of labor.However, a domination of the substitution effect (a shift of the MC curve leftwards) would push in the opposite direction. In particular, the optimal supply of labor would reach the N^{fc} level earlier than before (period k' in Figure 5), and strictly lie below it in subsequent periods. Thus, although sharing the burden of UI costs would not distort the three -stage pattern of labor supply over time, it might still act to offset the incentives for work provided by an earnings-related benefits scheme. As the need for insurance diminishes sufficiently, the UI program as a whole might adversely affect the willingness to work of the employed worker as well.

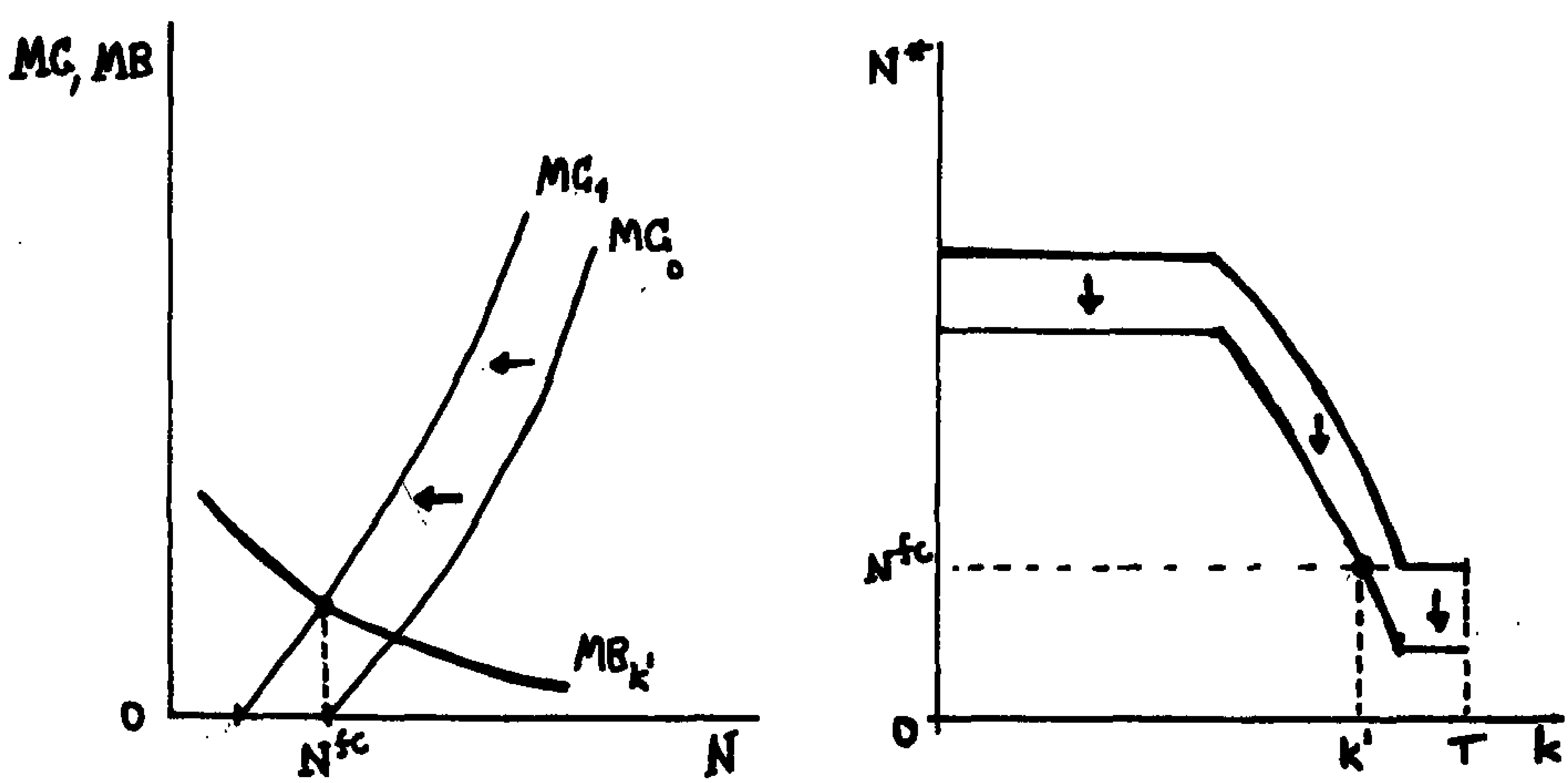

FIGURE 5

VI. SUMMARY

We have applied some basic features of the UI system into a work-leisure choice model, to analyse the labor supply behavior of an employed worker under uncertainty that results from the possible occurrence of involuntary unemployment. Using an earnings-related benefits scheme, an insured worker is shown to supply more hours to work than he would in the absence of UI, providing that he expects to qualify for future payments over a sufficiently long duration[21]. A rise in the probability of unemployment is found to increase his supply of labor, whereas a rise in the compensation rate (benefits to earnings ratio) is proved to be ambiguous, depending on the nature of his risk aversion.

Over time the optimal path of labor supply would conform to a three-stage pattern. In sufficiently early periods, as the limit imposed on benefit duration would not allow UI payments to carry an unemployed worker beyond a specified term, the supply of labor would stay constant with time. As time progresses, the worker's planning horizon is bound to become the effective constraint on the duration of payments. Consequently, labor supply would begin to fall with time, as less of potential periods are left for the possible utilization of UI benefits. Finally, when only the waiting period is left until the termination of

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21) Sharing the burden of UI costs might produce an adverse effect on labor supply which could more than offset a very weak entitlement effect.

planning horizon, the supply of labor would reach its lowest level, remaining at that solution thereafter.

Although the present paper does not attempt to extend in this direction, it might be useful to explore the general equilibrium implications of earnings-related benefits, as they tend to reduce the size of the effective labor force on the one hand, but to increase the efforts of those actually working on the other. The welfare aspects of these effects seem worth examining, particularly in the light of the continuing controversy over the adequacy of extending the duration of UI benefits to cover the long-term unemployed as well.

APPENDIX

(A) Expected utility of period 2, for example, is

$$EU_2 = (1-p)U(wN_2,\bar{H}-N_2) + p\{(1-p)U(gwN_1,\bar{H}) +$$

$$+ p[(1-p)U(gwN_0,\bar{H}) + pU(\bar{G},\bar{H})]\}$$

This is so because if, with a probability of p, the individual is unemployed in period 2, his utility level will depend on his past employment record: If he last worked in period 1, the probability of which is $p(1-p)$, he would receive the sum of gwN_1 as unemployment payments. If he did not, then, with a probability of $pp(1-p)$, period 0 might be his last period of employment, entitling him to a compensation of gwN_0. Notice also that in case of unemployment the individual is allowed to devote the whole of $\bar{H}$ to leisure activities.

Rearranging terms now we have

$$EU_2 = (1-p)U(wN_2,\bar{H}-N_2) + (1-p)\sum_{i=1}^{2} p^i\, U(gwN_{2-i},\bar{H}) + p^3U(\bar{G},\bar{H})$$

from which EU_t follows.

(B) To differentiate the second term of (2) with respect to N_k one has to relate to all t and i that yield $N_{t-i} = N_k$. That is, $t = k+1,\dots,T$ and $i = 1,\dots,T-k$, respectively. It thus follows that $U_1(gwN_k,\bar{H})$ should be multiplied by

$$a^{k+1}p + a^{k+2}p^2 + \dots + a^T p^{T-k} =$$

$$= a^{k+1}p\left[1 + ap + (ap)^2 + \dots + (ap)^{T-k-1}\right] =$$

$$= a^{k+1}p\,\frac{1-(ap)^{T-k}}{1-ap}$$

Hence, the first-order condition for a maximum of (2) is given by

$$\frac{d\left(\sum_{t=0}^{T} EU_t\right)}{dN_k} = (1-p)\left[a^k U_1(wN_k,\bar{H}-N_k)w - a^k U_2(wN_k,\bar{H}-N_k) + \right.$$

$$\left. + a^{k+1}p\,\frac{1-(ap)^{T-k}}{1-ap}\,U_1(gwN_k,\bar{H})gw\right] = 0$$

so that dividing through by $(1-p)a^k$ yields the optimum condition (3).

The second-order condition for a maximum would be

$$\frac{d^2\left(\sum_{t=0}^{T} EU_t\right)}{dN_k^2} = (1-p)\left[a^k D + a^{k+1}p\,\frac{1-(ap)^{T-k}}{1-ap}U_{11}(gwN_k,\bar{H})g^2w^2\right] < 0$$

where $D = U_{11}(wN_k,\bar{H}-N_k)w^2 - 2U_{12}(wN_k,\bar{H}-N_k)w + U_{22}(wN_k,\bar{H}-N_k) < 0$ is the familiar second-order condition of the full-certainty problem $(p=0)$. Assuming this to hold insures a maximum in the present model as well.

<u>(C)</u> Under a limit of $\hat{n}$ periods on benefit duration expected utility in period t becomes

$$EU_t = (1-p)U(wN_t,\overline{H}-N_t) + (1-p)\sum_{i=1}^{t} p^i\, U(gwN_{t-i},\overline{H}) + p^{t+1}\, U(\overline{G},\overline{H})$$

$$\text{for} \quad t \leq \hat{t} = \hat{n}-1$$

as unemployment in this period would still entitle the individual to benefits even if he was last employed in period 0, or

$$EU_t = (1-p)\, U(wN_t,\overline{H}-N_t) + (1-p)\sum_{i=1}^{\hat{n}} p^i\, U(gwN_{t-i},\overline{H}) + p^{\hat{n}+1}\, U(\overline{G},\overline{H})$$

$$\text{for} \quad t > \hat{t} = \hat{n}-1$$

as the constraint on benefit duration becomes effective. Assuming that $T > \hat{n}$, the individual now maximizes

$$\sum_{t=0}^{T} EU_t = (1-p)\left[\sum_{t=0}^{T} a^t\, U(wN_t,\overline{H}-N_t) + \sum_{t=1}^{\hat{t}} a^t \sum_{i=1}^{t} p^i\, U(gwN_{t-i},\overline{H}) + \right.$$

$$\left. + \sum_{t=\hat{t}+1}^{T} a^t \sum_{i=1}^{\hat{n}} p^i\, U(gwN_{t-i},\overline{H})\right] + \hat{U}$$

where $\hat{U} = \sum_{t=0}^{\hat{t}} a^t\, p^{t+1}\, U(\overline{G},\overline{H}) + \sum_{t=\hat{t}+1}^{T} a^t\, p^{\hat{n}+1}\, U(\overline{G},\overline{H})$

Differentiating with respect to N_k, following Appendix B, would yield Equation (8). For small values of k one would sum expected marginal benefits up to $t = k+\hat{n}$, $i = \hat{n}$. For sufficiently high values of k summation would end at $t = T$, $i = T-k$ as before.

(D). Having to wait $\tilde{n}$ periods before the receiving of UI benefits, expected utility in period t becomes

$$EU_t = (1-p)\ U(wN_t, \bar{H}-N_t) + (1-p) \sum_{i=1}^{\tilde{n}} p^i\ U(\bar{G},\bar{H}) +$$

$$+ (1-p) \sum_{i=\tilde{n}+1}^{t} p^i\ U(gwN_{t-i},\bar{H}) + p^{t+1}\ U(\bar{G},\bar{H}) \qquad \text{for} \quad t > \tilde{t}=\tilde{n}$$

or

$$EU_t = (1-p)\ U(wN_t, \bar{H}-N_t) + p\ U(\bar{G},\bar{H}) \qquad \text{for} \quad t \leq \tilde{t}=\tilde{n}$$

Thus, the individual maximizes

$$\sum_{t=0}^{T} EU_t = (1-p) \left[\sum_{t=0}^{T} a^t\ U(wN_t, \bar{H}-N_t) + \sum_{t=\tilde{t}+1}^{T} a^t \sum_{i=\tilde{n}+1}^{t} p^i\ U(gwN_{t-i},\bar{H}) \right] + \tilde{U}$$

where $\tilde{U} = (1-p) \sum_{t=1}^{\tilde{t}} a^t \sum_{i=1}^{\tilde{n}} p^i\ U(\bar{G},\bar{H}) + \sum_{t=\tilde{t}+1}^{T} a^t\ p^{t+1}\ U(\bar{G},\bar{H}) + p \sum_{t=0}^{\tilde{t}} U(\bar{G},\bar{H})$

Differentiation with respect to N_k would yield Equation (9).

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