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Recessions and Ability Discrimination

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CENTRE OF PLANNING AND ECONOMIC RESEARCH

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Abstract

In the presence of agent haterogeneity and uncertainty about relative talents (type) the choice of activities may not completely match true comparative advantage. Recessions accelerate type revelation and hence reduce the probability and persistence of mismatches. A regime that permits cyclical fluctuations generates a more efficient long term allocation of resources compared to one that engages in stabilization if recessions affect disproportionately those operating in a field of absolute disadvantage. The empirical evidence from business failures offers some support to this scenario. Among other things, the present paper formalizes and qualifies the "Darwinian- Schumpeterian" view on the "cleansing" effects of recessions.

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Introduction

Most of the growth literature has been of the aggregative type, that it, it has emphasized the role played by the continuous accumulation of factors of production (Solow (1956), Romer (1986), Lucas (1988)). However, the mere availability of plentiful supplies of resources such as physical and human capital and technology may not in general be sufficient to achieve maximal growth. For that it may also be required that resources be allocated efficiently, in the sense that they get employed in their most productive use. The recent papers on the allocation of entrepreneurial activity (talent) by Baumol (1990) and Murphy, Shleifer and Vishny (1991) as well as the papers by Dellas (1991a), (1991b) on educational and occupational decisions have established the practical relevance of the allocation dimension for the process of economic growth.

In an environment where individual talents as well as the relative payoffs in alternative activities are fully known (as in the papers by Dellas or Murphy, Shleifer and Vishny), economic decisions are trivial. If there are no increasing returns then each resource exploits its comparative advantage. But in reality, both talents and payoffs are subject to considerable uncertainty. For instance, with the exception of child prodigies, individuals entering a profession or starting a business cannot know in advance how well suited they are for the activity they have chosen and how succesful they will prove to be *relative* to having selected an alternative one. It is true that training programs (for example, the formal educational system) offer a useful ground for testing one's relative and absolute abilities. But such tests are far from fully revealing and can only provide an indication of future performance. It usually takes a prolonged period of practice in the selected line of business to form a knowledgeable assessment of one's qualities. The presence of incomplete information about personal relative talents can then give rise to the possibility that individual mistakes in the selection of an occupation, of entrepreneurial endeavors etc. lead to allocations that violate true comparative advantage. An extremely important question then regards the existence of mechanisms that improve the efficiency of the selection process. And this question brings us to the fundamental theme of this paper, namely how business cycles (recessions) may provide a selection mechanism that limits the possibility and duration of resource misallocation. Recessions seem to be particularly suitable for aiding selection as they represent a common form of economic adversity; and it is well known from the Darwinian evolutionary theory that adversity induces more efficient selection in the natural world by favoring the survival of the fittest.

That economic fluctuations can be positively associated with economic efficiency and long term prospects is an idea originating with the pre depression era liquidationists and in particular with Schumpeter (1991). Schumpeter viewed business cycles as a manifestation of the evolutionary process of innovation, as a reflection of the replacement of the old (and inefficient) by the new (and efficient). These views, however, became unpopular after the experience of the great depression and the occurrence of the Keynesian revolution which preached the benefits of macroeconomic stability (viewing business cycles as the outcome of market failure). Only recently have there been some attempts to re-evaluate the role of recessions. Dellas (1991a), for instance, has suggested that the existence of macroeconomic adversity (recessions) -at least within some range- can encourage human capital accumulation and improve the average quality of labor[1]. Caballero and Hammour (1991) describe a cleansing model in which recessions tend to eliminate low productivity units[2].

In this paper we show how recessions *may* improve the efficiency of the allocation of resources by helping economic agents learn about their abilities (talents) faster and more accurately. A simple example can illustrate how this works. Consider a primitive society which engages in two types of activities, hunting and farming. Let the members of this community come -genetically- in two types; those who have a comparative advantage in hunting;

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[1]The main idea in Dellas is that recessions decrease the opportunity cost of investment in human capital; and due to their uneven impact on the low skilled, they reduce the relative employment opportunities of the low skilled and also encourage human capital accumulation as a hedge against cyclical risk.

[2]Aghion and St-Paul (1991) have suggested an alternative mechanism which also attributes a positive role to recessions from a growth point of view (related ideas can be found to Hall's (1991) paper of recessions as reorganizations). In a very interesting paper, St-Paul (1991) discusses how the amplitude of the business cycle affects technological choices.

and those who have a comparative advantage in farming. Furthermore, assume that the individuals do not know their type and only know the probability distribution of performance in hunting and farming for each type as a function of the state of nature. In each period, nature randomly dictates the availability of prey in hunting and of farm products in farming. Now consider the individuals who are starting out their careers as hunters. After repeated sampling, each new hunter will be able to -imperfectly in a finite sample- infer his type and make an occupational choice[3]. The misclassification error will also depend on the degree of difference in the parameters of the probability distributions of performance across the two types. The greater the difference, the smaller the likelihood of an occupational mistake. Now it seems reasonable to postulate that when prey is plentiful, the performance of both types will be comparable (shooting accuracy is not a big factor when you run into a large herd of animals or flock of birds). On the other hand, when prey is scarce, the "natural" hunters will likely greatly outperform the others. If the difference in expected performance is a *convex* function of the favorability of the state (that is, if the difference in relative performance across types widens *more* than proportionally with the degree of adversity) then adverse conditions can help improve the selection process (by reducing the probability of an occupational mistake) and consequently the allocation of resources. A special case of this obtains when severe adversity can immediately induce a separating equilibrium[4].

By replacing the hunters and farmers of this example with people with and without entrepreneurial (or managerial) skills respectively, one can clearly see the great importance and practical relevance of this mechanism for the accurate discrimination of the fit from the unfit in business. Recessions can then play an important role in achieving economic efficiency by contributing to the faster elimination of inefficient firms and thus helping resources be allocated according to their true comparative advantage. This, however, does

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[3]Whether this occupational choice will be irreversible or not depends on whether there exist costs to switching occupation after some period, on whether sampling also takes place in the new activity etc.

[4]According to the popular saying "when the going gets tough the tough get going". In our story, toughness corresponds to absolute advantage.

not imply that an economy which allows for economic fluctuations will have a type-revelation (learning) advantage (and hence a more efficient long term allocation of resources) compared to an economy which successfully stabilizes the business cycle. This is due to the existence of offsetting effects during the expansionary phase of the cycle. During expansions, ability discrimination is lower. Whether the net sum over the business cycle is greater than that achieved under some or perfect stabilization is ambiguous. In particular, it depends on the form of skewness in relative performance across the two types over the business cycle. Stabilization can actually improve the allocation of resources when the difference in relative performance is a concave function of the favorability of the business cycle. This will be the case when an *increase* in macroeconomic adversity affects disproportionately the performance of the more productive agents (in whatever activity they happen to be more productive).

Determining empirically the shape of the cyclical function of relative performance is difficult because types are not directly observable; and also because there may be no good *exogenous* measures of the degree of cyclical adversity (the state of the business cycle). Nonetheless, we have examined two important economic variables whose cyclical performance can supply useful information about the question at hand. The first one is the rate of business closures. We show in section 1 that there exists a one to one correspondence between the behavior of business shut downs as a function of aggregate adversity and the shape of the function of relative performance. In particular, relative cyclical performance is convex if and only if business closures are a convex function of the business cycle. The study of business closures from 1947 to 1983 produced some evidence of increasing countercyclicality; that is, it suggested convexity. The pattern of closures during mild recessions resembled that obtained during expansions but differed significantly from that during more severe slumps. Convexity was also suggested by the response of business failures to oil price changes. A significantly asymmetric pattern was obtained for oil price increases and decreases.

The second variable examined is the growth rate of sales of the firms contained in the Compustat data base. We calculated the empirical distribution for each year and used the estimated rank statistics to study whether the dispersion of the distribution was systematically related to the average growth rate of sales. Some of the tests indicated that the bottom and the top of the distributions grew apart as adversity increased (average sales decreased). Davis and Haltiwanger (1991) report similar results for the distribution of employment for Bureau of Census establishments. However, we were not able to uncover any nonlinearities (curvature) in this relationship. We also administered a battery of nonparametric tests based on both order statistics and the empirical distribution function tests without much success either. Note, however, that our sample may contain a strong bias against finding a convex (or generally, a nonlinear) function even if one exists because it does not include the bottom of the population, that is the firms that fail.

We interpret the findings of the second set of empirical tests as indicating that while recessions do enhance the ability to discriminate among types, the relative cyclical behavior in the upper tail of the distribution of firms (those included in the Compustat data base) does not contain much information regarding the effects of cyclical fluctuations on the average quality of type revealing information.

SECTION 1. A simple model

Consider an economy where in each period t, M individuals become professionally active. For simplicity it can be assumed that each individual works for exactly T periods. Let those entrants to the job market come in two types. One type, denoted by h, is characterized by high (latent) ability and the other, denoted by l, by low ability. The type is unobservable. Let there also be two possible career choices, one being an entrepreneur (denoted by e) and the other being a worker (denoted by w). Furthermore, assume that the payoff to being in either activity depends on type as well as two other random variables; s which is exogenous and observable ex post; and u which is a -possibly- type specific i.i.d. variable with zero mean and constant variance. The variable s is intended to capture the favorability of the state of nature, or alternatively, the state of the business cycle; while u represents the effects of sheer luck. The payoff structure is given by

$$q_{he}(s, u_e),\ q_{le}(s, u_e),\ q_{hw}(s, u_w),\ q_{lw}(s, u_w)$$

with (: denotes conditional on)

$$d(Eq_{ij})/ds > 0,\ d^2(Eq_{ij})/ds^2 < 0, \quad i = h, l \qquad j = e, w$$

$$E(q_{he}(s) : s) > E(q_{le}(s) : s), \qquad d[Eq_{he}(s) - Eq_{le}(s)]/ds < 0$$

$$E(q_{hw}(s) : s) > E(q_{lw}(s) : s) \qquad d[Eq_{he}(s) - Eq_{le}(s)]/ds < 0$$

$$Eq_{he}(s)) > Eq_{hw}(s)\ , \qquad Eq_{le}(s) < Eq_{lw}(Es)$$

The first condition says that one's return is a positive but concave function of the state of the business cycle for both types[5]. The other conditions assign absolute and comparative advantage: absolute in both activities and comparative in entrepreneurship all go to the high type[6]; they also stipulate that the difference in expected returns between the two types is a decreasing function of the favorability of the state of nature. In other words, the consequences of adversity in each activity are skewed against the type who has an absolute disadvantage in that activity (the low ability type in our case). This seems to be a very plausible assumption (and quite critical for our results) and will be the subject of empirical investigation.

Let us for the time being brush aside some important issues such as who starts out as what and how long sampling continues for and concentrate on the

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[5]The assumption that the function of (absolute) performance is a concave function of the business cycle seems plausible but is not critical for the results. As it will be shown later, the important factor is the shape of the function of the difference in performance between the two types over the business cycle.

[6]We have arbitrarily chosen this assignment of absolute advantage because it allows stabilization policy to have symmetric effects on return differentials across activities. The analysis can be conducted in a similar fashion when absolute and comparative advantage coincide.

simplest possible case involving a new entrant to the job market who is starting out as an entrepreneur. Let us also endow him with a simple ad hoc rule that says that he will sample for n periods, and at the end of this time interval he will draw an inference about his type and make an irreversible career decision. If he infers that he is of the low ability type then he permanently switches career (becomes a worker). If he infers that he is of the able type he remains a businessman. While such a decision will in general be suboptimal because sampling always continues in entrepreneurship, we adopt it here for the sake of simplicity and can justify it by invoking the presence of time dependence in career switching costs (otherwise, given a sufficiently long T, the low ability individual will eventually drop out from business).

Let us now introduce some notation. Let z_i be the observation of performance in entrepreneurship in period i with

$$z_i \sim \text{i.i.d. } N(\mu_h(s_i), \sigma^2) \quad \text{if sampled from the h-population}$$
$$z_i \sim \text{i.i.d. } N(\mu_l(s_i), \sigma^2) \quad \text{if sampled from the l-population}$$

Assuming the same support for both distributions guarantees that no single observation can help to perfectly discriminate between the two types. We will later in this section allow for differences in the domain of the distribution that allow for such perfect discrimination.

Let $z^* = n^{-1}\Sigma_{i=1}^{n} z_i$

Consequently,

$$z^* \sim N(\mu_h^*, \sigma^2/n) \quad \text{if sampled from the h-population}$$

$$z^* \sim N(\mu_l^*, \sigma^2/n) \quad \text{if sampled from the l-population}$$

where $\mu_h^* = n^{-1}\Sigma_{i=1}^{n}\mu_h(s_i)$ and $\mu_l^* = n^{-1}\Sigma_{i=1}^{n}\mu_l(s_i)$, $\mu_h^* > \mu_l^*$

The above assumptions together with a symmetric[7] loss function for misclassification imply that the optimal rule for career selection at time n entails the individual inferring that he is of the h-type (l-type) if z* is closer to μ_h^* (closer to μ_l^*), that is if $|z^* - \mu_h^*| < |z^* - \mu_l^*|$ (>).

The probability of misclassification (see Anderson (1958)) is then given by

$$p = \text{prob}(|z^* - \mu_h^*| < |z^* - \mu_l^*| \;\vdots\; \text{True ability} = l) +$$

$$\text{prob}(|z^* - \mu_h^*| > |z^* - \mu_l^*| \;\vdots\; \text{True ability} = h)$$

$$= \text{prob}(z^* > \frac{\mu_h^* + \mu_l^*}{2} \;\vdots\; \text{Tr ab} = l) + \text{prob}(z^* < \frac{\mu_h^* + \mu_l^*}{2} \;\vdots\; \text{Tr ab} = h)$$

$$= \text{prob}(\frac{z^* - \mu_l^*}{\sigma/\sqrt{n}} > \frac{\mu_h^* - \mu_l^*}{2\sigma/\sqrt{n}} \;\vdots\; \text{Tr ab} = l) + \text{prob}(\frac{z^* - \mu_l^*}{\sigma/\sqrt{n}} < -\frac{\mu_h^* - \mu_l^*}{2\sigma/\sqrt{n}} \;\vdots\; \text{Tr ab} = h)$$

(1) $$= 2[\,1 - F(\frac{\mu_h^* - \mu_l^*}{2\sigma/\sqrt{n}})$$

where F is the probability distribution function of performance (profits).

We are interested in comparing the probability of making the wrong career decision (job mismatch) at time N across two different regimes. Under one regime, business cycles do occur, that is s varies exogenously (and randomly) over time. In this case, the numerator of F in (1) is given by

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[7]The analysis can be conducted in a straightforward manner under the assumption of an asymmetric loss function.

(2) $\mu_h^* - \mu_l^* = n^{-1}\Sigma_{i=1}^{n}[\mu_h(s_i) - \mu_l(s_i)] = n^{-1}\Sigma g(s_i)$

Under the other regime, the government stabilizes s at its average value s* (the business cycle is completely eliminated). In this case the numerator of Fis simply

(3) $\mu_h^* - \mu_l^* = \mu_h(s^*) - \mu_l(s^*)$

The comparison of the probability of misclassification under the two alternatives depends then on the properties of g. F is increasing; if g is convex then the the RHS in (2) is greater than that in (3) -from Jensen's inequality- and a career mistake is more likely under stabilization. The intuition behind this result is simple. Convexity in g obtains if, for instance, the fortune of the low ability (inefficient) entrepreneur is more sensitive to the state of the business cycle than that of the high ability one and this sensitivity becomes more pronounced as the recessions become more severe. In general, convexity means that the difference in *relative* performance in entrepreneurship between the two types (say, the ratio of profits, the ratio of sales, the ratio of employment losses etc.) is greater when times for entrepreneurs are bad. Subsequently, the elimination of recessions shuts down a mechanism that carries the most informative pieces of evidence that can be used by aspiring businessmen to infer their true type. Of course they learn even when the business cycle is stabilized but the information they receive in good times is not as revealing as that during bad times. This is because the contribution of noise tends to be large relative to that of ability during good times.

If, on the other hand, relative performance is a concave function of the business cycle then stabilization policy contributes to better revelation and leads to a more efficient long term allocation of resources While one can speculate on which shape seems more plausible, we feel that this is an issue that needs to be settled by the empirical evidence. We turn to this in section 2.

The analysis so far has been conducted under the assumption that the entrepreneurs sample for a fixed length of time, n, before they decide -on the basis of the sample mean- whether they will continue with entrepreneurship or drop out to become workers. An alternative but equivalent way of thinking about the career decision is to postulate that a new entrepreneur makes up his mind about whether he is fit to compete once the probability of an error is below some critical, reservation level; and then ask whether the expected duration of sampling (and hence the persistence of a mismatch) varies across the two macroeconomic policy regimes we discussed above. Solving (1) for the sample size gives

$$(4) \qquad \sqrt{n} = \frac{2\sigma}{\mu_h^* - \mu_l^*} F^{-1}(1 - p/2)$$

where p is the probability of misclassification. It is apparent from (4) that convexity in the relative performance of the two types with regard to the business cycle implies that on average it takes *longer* to bring the probability of a wrong selection down to any particular value. For any required level of confidence in career choice the persistence of occupational errors is smaller in the absence of economic stabilization.

It is worthwhile pointing out that the analysis generates a well known feature of the real world. Namely, that business closures (failures) are countercyclical. The easiest way to see this is by modifying the assumption we have made on the support of the distribution of performance which, as it stands, does not allow for perfect discrimination in finite samples. Suppose instead, that we restrict the set of possible realizations of the chance factor to be bounded so that some values of profits unambiguously reveal one's type (usually "very" high in good and "very" low in bad times). Convexity in relative performance over the business cycle will now suffice to make business closures countercyclical as the overlap in the support of the distributions of performance of the two types is increasing in s. That is, it is more likely that perfect revelation and the associated exit of the low ability entrepreneur will occur during bad rather than during good times. Business closures do occur even during favorable times (by the firms which have too poor of a luck) but they are much rarer than those during recessions.

One can make things even more realistic by allowing for serial correlation in the realizations of s. In addition to capturing the persistence of business cycles in the real world, the presence of auto correlation can generate a realistic cyclical pattern of firm entry and exit. For instance, it is immediately obvious that the rate of exit will be higher during recessions (because of better discrimination), and that entry will more likely take place during an expansion (because of the lower opportunity cost of a mismatch during good times).

Note that s needs to be of fairly high frequency in order for the theory to have a reasonable empirical content. Monthly or quarterly observations of performance seem appropriate. Lower frequencies will make switches in occupational-entrepreneurial decisions to take years to materialize. Interestingly, and this can serve as an important empirical test of the theory, there is a one to one correspondence between the properties of the function of performance differential and the rate of business closures. Convexity in relative performance is associated with convexity in business closures (as a function of the business cycle). The proof to this claim can be established via the following example. Let

$$\mu_h(s_i) = \mu + u_i \qquad \mu_l(s_i) = \mu(s_i) + u_i$$

$$u_i \sim \text{uniformly on } [u_1, u_2], \qquad d\mu(s_i)/ds_i > 0,\ d^2\mu(s_i)/ds_i^2 < 0$$

Performance for the high ability entrepreneur is assumed to be independent of the business cycle[8] (it is a constant plus noise) while that of the low ability a concave function of the cycle. The probability of the low ability entrepreneur discovering accidentally his type is given by the probability of the lack of overlap in the two distributions at low levels of performance, that is by

$$k = \text{prob}[\ \mu(s_i) + u_i < \mu - u_L)\ ] = \text{prob}[\ u_i < \mu - u_L - \mu(s_i)\ ]$$

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[8]Davis and Haltiwanger have found in their study of cyclical employment patterns for Bureau of Census establishments that most of the employment losses occur to a small group of firms.

Due to the convexity of $-\mu(s_i)$, the probability of a business closure is a convex function of the business cycle. Consequently, one might be able to test the theory by relating data on business failures to an *exogenous* measure of the state of the business cycle (we discuss this issue at the end of the section). Note, however, that there may be some problems in carrying out such a test when the shape of the function of relative performance may not be invariant to either monotonic transformations of the same business cycle variable or to different measures of cyclical variability. Without precise knowledge of how each business cycle variable under consideration (and its monotonic transformations) affect the shape of the function of absolute performance it is difficult to draw any conclusions.

Optimal decision rules

A conceptual shortcoming of the analysis so far has been that it has studied only the late stage of the allocation problem, taking as given two other -and prior- considerations. Namely, the decision faced by new entrants to the job market regarding the choice of activity to engage in as well as the length of sampling before a possible career switch is contemplated. Both of these decisions affect the degree and persistence of occupational mismatches and hence the rate of economic growth. The important question is whether individual choices differ across the two policy regimes.

To gain a better understanding it is useful to examine separately the individual parts of the problem. We first examine the choice of activity assuming a fixed sampling interval, n, after which one's choice of activity becomes permanent. This setup can be rationalized by attaching an appropriate extra cost to late career switching.

Let the population shares of the two ability types be m and 1 - m respectively. Continue to assume that the reward structure is independent of the distribution of agents across the activities (that is, consider a small open economy with both entrepreneurs and workers being perfectly mobile internationally). This assumption implies that all entrants to the job market will start out in the same activity[9]. If entrepreneurship is the activity of choice then after n periods some people will drop out to become workers while other remain in business. For the sake of tractability we will also make the assumption that the occupational switching costs are such that if one becomes a worker he can never switch to entrepreneurship. The question of interest is whether any particular policy regime works in favor of entering any particular activity. Depending on each activity's relative contribution to growth one can then attempt to assess the value of stabilization policy. For instance, if only able entrepreneurs influence the growth rate and their share in the population is small then stabilization policy can be growth enhancing if it provides an environment that is more encouraging of entry into entrepreneurship than that in the absence of stabilization.

The incentive to go into business depends on the sign of the following expression

No stabilization

$$(5) \qquad G_{Ns}(n) = m\{nE\mu_{he}(s_i) + (T-n)[(1-p_{Ns})E\mu_{he}(s_i) + p_{Ns}Eq_{hw}(s)]\}$$
$$+ (1-m)\{nE\mu_{le}(s_i) + (T-n)[p_{Ns}E\mu_{le}(s_i) + (1-p_{Ns})Eq_{lw}(s)]\} - TEq(s)$$

Under stabilization $(s = s^*)$

$$(6) \qquad G_s(n) = m\{n\mu_{he}(s^*) + (T-n)[(1-p_s)E\mu_{he}(s^*) + p_sEq_{hw}(s^*)]\}$$
$$+ (1-m)\{nE\mu_{le}(s^*) + (T-n)[p_sE\mu_{le}(s^*) + (1-p_s)Eq_{lw}(s^*)]\} - TEq(s^*)$$

where $q(s) = mq_{hw}(s) + (1-m)q_{lw}(s)$ and $q(s^*)$ is calculated similarly.

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[9] An interior solution would obtain if different people held different priors about their types. Such differences could be due to educational and professional experience, family background etc.

The interpretation of (5) is as follows. A new entrant samples for n periods. If he is a high ability agent (which occurs with probability m) then he is expected to earn during sampling the first term inside the first pair of curly brackets. After n periods, he may either mistakenly form the opinion that he is of the low ability type (which happens with probability p_{Ns} = 1 - F()), in which case he drops out of business and earns the third term in the first line of (5); or he may correctly infer that he is of the high ability type, remain in business and earn the second term inside the first pair of curly brackets. The second line in (5) applies to a low ability entrant. For an individual to undertake entrepreneurial activities at all, it is necessary that the return to entrepreneurship -that is, the sum of the terms in the curly brackets in (5)- exceeds the very last term, TEq(s), which is the expected return to being a worker. It is then necessary that $G_{Ns}(n) > 0$ for some $n > 0$.

A similar reasoning applies to (6) with p_s now being the probability of misclassification under stabilization (= 1 - F()). It is clear from the comparison of (5) and (6) that one cannot in general tell which one is more likely to be positive. This comparison depends on the difference of the effects of stabilization on the returns of the same type in the two activities, the difference in the probability of miscalculation and so forth.

Having assumed entry into entrepreneurship, we can turn to the second part of the decision process, that of the optimal choice of n. The simplest way to study this problem is by requiring the individual to choose in the beginning of time rather than allowing for a period by period decision[10]. A perspective businessman then selects (ignoring integer constraints) a sampling length, $n = \tilde{n}$, in order to maximize the return to being an entrepreneur. In the absence of stabilization he sets $G'_{Ns}(\tilde{n}) = 0$ where a prime denotes derivative. After some manipulation this condition can be written as

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[10]Modeling the sampling decision as a sequential one rather than asking people to decide (and commit to) on the length of the sampling interval before sampling starts seems a more natural specification. However, as both produce identical results regarding the initial choice of occupation as well as the average duration of sampling and the former is more involved technically we opted for the latter specification.

(7) $$p - (T-n)\frac{dp}{dn} = - \frac{(1-m)(E\mu_{le}(s)-Eq_{lw}(s))}{m(E\mu_{he}(s)-Eq_{hw}(s)) - (1-m)(E\mu_{le}(s)-Eq_{lw}(s))}$$

Equation (7) determines the optimal duration of sampling[11].

We can now combine the two aspects of the decision problem (the initial choice of career and the subsequent choice of the length of the sampling interval). An individual will select to enter entrepreneurship if there exists a non empty subset of n, say A, such as $G(n) > 0$ for $n \varepsilon A$. He will then sample for $\tilde{n}$ periods before making a permanent career choice. For an interior solution to exist it is also necessary that $\tilde{n} \varepsilon A$ and $\tilde{n} < T$.

The optimal choice of n under stabilization policy, n*, satisfies $G'_s(\tilde{n}) =$ 0and is given by (7') (which is identical to (7) with s replaced by its mean value s*)

(7') $$p^* - (T-n^*)\frac{dp^*}{dn^*} = - \frac{(1-m)(\mu_{le}(s^*)-q_{lw}(s^*))}{m(\mu_{he}(s^*)-q_{hw}(s^*)) - (1-m)(\mu_{le}(s^*)-q_{lw}(s^*))}$$

The LHS of (7) (or (7') is a decreasing function of n. Subsequently, the optimal choice of n under stabilization will exceed that obtained in the absence of stabilization if the RHS of (7) is greater than the RHS of (7'). The comparison of n to n* will in general be ambiguous and it will depend on how stabilization policy affects the relative rate of return between the two activities for each type. For instance, n* > n if stabilization policy decreases the opportunity cost of further sampling in entrepreneurship (e.g.

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[11]The second derivative of G with regard to n is given by

$[2p'-(T-n)p'']$

which is negative because $p'' > 0$ ($p' < 0$ and p'' are the first and second derivatives of p with respect to n). This guarantees that if an interior solution exists it is unique.

if the return to workmanship were invariant to the business cycle so that entrepreneurship were the sole beneficiary of stabilization).

We have not been able to establish whether the sign of $n - n^*$ implies a unique sign for $p - p^*$. This is important because a negative correlation between them implies the existence of an intertemporal trade off between short and long run misallocations. For example, if $n - n^* < 0$ (sampling continues longer under stabilization) but $p - p^* > 0$, then the exercise of stabilization policy leads to greater transitory inefficiencies but the long run record is better as fewer people end up in an occupation of comparative disadvantage.

We take an agnostic view on how the relative rates of return across activities are affected by the exercise of stabilization policy and choose to focus attention on two interesting possible cases which produce unambiguous results. One case involves a perfectly symmetric set up with the functions of returns for each type across the two activities differing only by a constant ($d^j\mu_{ie}(s)/ds^j = d^jq_{iw}(s)/ds^i$, $Eq_{iv}(s) = Eq_{iv}(s) + \text{constant}_i$ $i = h, l$, $j = 1, 2$, $v = e, w$). In this case the RHSs of (7) and (7') are the same, hence $n = n^*$ which implies that $p_s > p_{Ns}$. The other case arises when, due to direct costs of career switching, a permanent occupational decision has to be made in some period ahead of the period dictated by optimal choice under either regime. Again this leads to $n = n^*$. What is interesting about these two cases[12] is that the transitional inefficiencies are the same under either regime but stabilization policy generates a worse long term outlook because it is accompanied by a higher probability of misclassification at the time of the decision to switch.

Before concluding this section it may be worthwhile -following current practices- to suggest plausible mechanisms that link comparative advantage in the allocation of resources to the rate of economic growth (the effects on the

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[12] A third interesting case is one that assumes symmetry across the two activities but with the low type now having the absolute advantage in workmanship. Now there are two conflicting forces as far as the effect of stabilization on the incentive to continue sampling is concerned; the high type's opportunity cost of sampling increases and the low type's decreases (recall that a more concave performance function implies greater benefits from stabilization).

level of performance -profits- can be calculated in a straightforward manner using the assumed payoffs as well as the difference between the succesful matches of types to the two activities across the two regimes). One possibility is to postulate -somewhat similar to Murphy, Shleifer and Vishny (1991)- that the evolution of technology depends on the share of high ability individuals who operate business establishments (supposedly, those are the only ones who have the capacity to generate organizational and technological innovations, new products etc.). In this case only part of the misclassification error slows growth down, namely that part (1 - F()) that causes some able individuals to switch to workers.

Another possibility is to argue that both types of misclassification are costly in terms of growth. Allocating able persons to work as workers deprives the economy from potential innovations in the way described above. But having inefficient firms can also be costly if these firms, which are not capable of growth enhancing innovations are competing against the efficient firms for resources (such as researchers, engineers etc.) who would otherwise be employed in more efficient organizations and support higher growth in those enterprises. Getting the inefficient firms out of business then has both a direct and indirect effect on productivity growth.

A simple formal model to link comparative advantage and growth is as follows. Think of the individuals under consideration as researchers involved in the production of innovations (such as new product designs or processes). Let each individual produce an innovation in each and every period of his working life. Let also the probability that an innovation in a particular area will prove to be of lasting value to future research (ideas that survive, i.e. an intertemporal externality which can generate sustained growth) be higher when the innovation has been produced by a person who has a comparative advantage in innovation production in that same area; for simplicity, assume that the probability is unity in such a case and zero otherwise. Let this probability measure the external effect on the success of future research. In the absence of policy stabilization, the size of the external effect bequest by each cohort to the next is given by A, where A is

$$(8)\quad A = [nm + (T-n)m(1-p/2) + (T-n)(1-m)(1-p/2)]/T = [nm + (T-n)(1-p/2)]/T$$

The first term in (8) gives the high ability population that samples in entrepreneurship, the second its fraction that remains there and the third the low types that move to their area of comparative advantage.

A similar equation (call it (8')) with n^* and p^* in place of n and p respectively describes the external effect under stabilization. While the sign of (8)-(8') is ambiguous, in the two cases described above ($n = n^*$) the difference in intertemporal contribution is simply $p^* - p$ in favor of the non activist regime[13].

Section 2. Empirical considerations

We tried to deduce the curvature of the function of relative performance by pursuing two distinct strategies. The first is based on the direct implication of the model of section 1 that business closures are both countercyclical and a convex (concave) function of the state of the business cycle when the difference in relative performance is a convex (concave) function. The second strategy is based on the calculation of the empirical distribution function of one common measure of performance, namely sales.

As mentioned earlier, the first strategy suffers from the shortcoming that the curvature of the function of relative performance may not be invariant to monotonic transformations of the macroeconomic adversity variable (for instance, the results may differ depending on whether one uses levels, log-levels, growth rates etc.). Unfortunately, there exists no "natural" unit of measurement of the business cycle. We made use of two measures: a dummy variable that takes non zero values during recessions as identified by the NBER; and the real price of oil.

The data on business failures are monthly, seasonally adjusted and extend

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[13]Note that the existing empirical evidence uniformely points in the direction of a positive association between recessions and long term productivity (Bean (1991), Gali and Hammour (1991), Saint-Paul (1993)).

from 1947:01 to 1983:12. They were compiled by Dun and Bradstreet and measure the number of failures per 10,000[14] concerns (the failure rate). They were taken from Business Statistics of the Survey of Current Business. From figure 1, it can be seen that the failure rate was continuously increasing up to 1961, decreasing from 1961 to 1979 and then increasing again from 1979 and on. The sharp change in 1979 is due to the passage of the 1978 Bankruptcy Reform Act which changed the requirements for reorganization under bankruptcy laws (it is not clear what precipitated the 1961 change). We fitted a piece-wise linear trend to capture the differences in behavior across these three phases. The BF variable in table 1 measures deviations from trend.

The first business cycle variable used is based on the NBER chronology. Let $D_t = 1$ if t falls in a recession and $D_t = 0$ otherwise. In order to allow the length of the recession to play a role -as suggested by our theory- we constructed the variable ALL as the sum of the D_t's over the previous six months. In order to investigate the presence of a curvature in the cyclical pattern of failures we drew a distinction, following Zarnowitz (1985), between mild and severe recessions[15]. The corresponding to ALL duration variables for mild and severe recessions are MIL and SEV. Table 1 reports the results. The regression results ought to be interpreted with caution because of the possibility of endogeneity problems that would arise if the underlying exogenous shocks were persistent. The picture that emerges from table 1 is that business failures are indeed countercyclical; and from the comparison of failure rates across expansions, mild and severe recessions that there exists disproportionality in the effects of the business cycle suggesting convexity. The z-statistic for testing the equality of the average failure rate between expansions and mild recessions is only 0.77 while that for testing the

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[14]A failure is defined as "a concern that is involved in a court proceeding or a voluntary action that is likely to end in a loss to creditors." The failures data exclude railroads, banks, financial companies, holding companies real estate and insurance brokers, amusement enterprises, shopping agents tourist companies and transportation terminals.

[15]In the post war era, the dates of the severe recessions are 11/1948-10/1949, 7/1953-5/1954, 8/1957-4/1958, 11/1973-3/1975 and 7/1981-11/1982. The dates of the mild recessions are 4/1960-2/1961, 12/1969-11/1970 and 1/1980-7/1980.

equality between expansions and severe recessions is 3.64 (p = 0.001). A similar pattern can be inferred from the comparison of the correlation (or the regression) coefficients. It seems that the effects of economic fluctuations on economic performance as reflected in the rate of business failures are mostly felt during very bad times.

The other business cycle variable used is the real price of oil because it has been suggested by Hamilton as being truly exogenous (the price used here incorporates a correction for price controls as suggested by Mork[16] (1989)). Table 2 reports the results for 1947 to 1983; OIL is the average growth of the real oil price over the previous four quarters (the data are quarterly). Again a countercyclical pattern emerges. To test the presence of asymmetries in the effects of the business cycle on the rate of business failure, we constructed two dummy variables: DUMI which takes the value of one in periods in which there was an increase in the real price of oil and zero otherwise; and DUMD which takes the value of one in periods in which there was a decrease in the price of oil and zero otherwise. As can be seen from table 2, increases in the price of oil increase significantly the rate of failures while decreases do not have any noticeable effect (Mork (1989) reports similar results for the rate of output growth). While this piece of evidence regarding the dominance of recessions is not completely uncorrelated with that derived above for severe and mild recessions (oil price increases are known to cause economic downturns) it does have some independent value added.

The second empirical strategy is based on the calculation of the empirical distribution function of the growth rate in annual sales for the companies contained in the Compustat data base. This data set is far from ideal for our purposes because it includes only large firms. And we know from the work of Davis and Haltiwanger (1990) as well as many others (see the references in Davis and Haltiwanger) that establishment turnover and employment volatility is a sharply declining function of establishment size. This implies that the cross variation of sales within the sample of companies over the business cycle may be significantly understated. A similar problem arises from the fact that the sample leaves out the bottom of the distribution, that is, firms that failed. Both of these shortcomings of the sample may bias our results

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[16] We are grateful to Knut Mork for providing the data.

against showing a significant increase in the spread of the distribution of sales during recessions; and against finding a convex pattern in the difference of performance between the top and the bottom of the distribution.

The annual sales growth variable used in the analysis is a symmetric, bounded variable, and is a monotonic transformation of the standard growth rate (so that increases and decreases in sales are treated symmetrically). It was constructed as

$$g_t = \frac{x_t - x_{t-1}}{.5(x_t + x_{t-1})}$$

where x_t is real sales in period t for the firm under consideration (nominal sales divided by the GDP deflator).

Table 4 reports the results from regressions of the -annual- differences between various percentiles of the empirical distribution on the average growth rate of sales in three samples consisting respectively of: all stock exchange listed firms; its subset of manufacturing companies; and all companies whose stock is traded over the counter (OTC). The t-statistics ought to be interpreted with great caution and only as indicative because the properties of the estimated coefficients are not known. Nonetheless, it is worthwhile noting that the results uniformely indicate that the difference in relative performance across the percentiles is countercyclical. Decreases in average "aggregate" performance are associated with a spread out of the empirical distribution. No nonlinear pattern was, however, detected when the regressions were augmented to include higher order polynomial terms of the average growth rate.

Figure 2 gives the histogram of g_t. Table 4 reports two nonparametric tests of the equality of the empirical distributions for three subgroups of years for all listed companies (similar results were obtained in the other samples). We classified each year in the sample according to the average rate of growth of sales growth and constructed three categories, namely "high" (top), "average" (mid) and "low" (bot) growth years (we also compared the three years corresponding to the highest, lowest and mean annual performance during the sample period). We then calculated the empirical distribution function for each group of years. The tests that were based on various linear rank statistics (not reported in the table) did not reject the hypothesis that the location parameters of the distributions for different groups were the same. Of the two tests that were based on the estimated empirical distribution function -the Kolmogorov-Smirnov and the Kuiper tests- only the Kuiper test indicated that relative performance differed across groups. But unlike our earlier findings that suggested that it was recessions that seemed to be distinct, the Kuiper statistic suggests the opposite; namely that it is expansions that give rise to significant differences in relative performance. Overall, we think that the results from the nonparametric tests -which tend to have low power- suggest that relative behavior within the top tail of the distribution of performance does not seem to vary systematically over the business cycle.

Conclusions

An economy can achieve a more efficient long term allocation of resources when economic agents can find out early and accurately whether they have made the right occupational or entrepreneurial choices. One important way of learning about who is what and where one belongs in is by observing relative performance in the selected activity. The larger the variation in performance across individuals with different ability levels the more succesful discrimination will be. In this paper we have argued that recessions carry valuable information for type revelation because they tend to be associated with a widening of the gap between high and low talent individuals. This informational contribution of the low end of the business cycle, however, tends to be negated by the high end (expansions). Subsequently, whether the occurrence of recessions has positive or negative effects on long term productivity depends on which of the two effects dominates. If relative performance is a convex function of the favorability of aggregate conditions then allowing for economic fluctuations improves long term prospects; if it is concave, then the perfect stabilization of the business cycle maximizes long term efficiency.

We carried out a number of tests in order to deduce the shape of the function of cyclical relative performance. The tests conducted are supportive of the view that aggregate "bad" times possess greater revelation properties than "good" times. One can also interpret other findings in the literature -such as those reported[17] by Davis and Haltiwanger (1991) on the distribution of growth rates of employment across US manufacturing firms- as pointing in the same direction. While we feel that we can claim with a fair amount of confidence that the first derivative of the relative performance function is indeed negative, we feel less confident making a claim regarding the sign of the second derivative. It seems that there is some evidence in favor of convexity -from the study of the cyclical pattern of the rate of business failures- but the overall results to the are not strong enough to rule out the possibility of a linear or a concave function. The nature of data available may be the reason for the inability to deduce the curvature of the function of relative performance. Given the importance of uncovering the links between macroeconomic fluctuations (stabilization policy) and long term growth we hope that this line of work will be extended to examine other measures of performance (or construct more suitable data sets).

It is also worth mentioning that the informational implications of macroeconomic policy for real economic activity which are at the heart of our argument have been emphasized before in a very different context by Dotsey and King (1986). Dotsey and King examine how interest rate targeting rules alter the information content of market prices and subsequently the magnitude of fluctuations in real economic activity. Our emphasis is on the effects of stabilization on efficiency and the long term allocation of resources but the spirit of the analysis is similar.

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[17] Davis and Haltiwanger conclude that "...Thus, years of relatively rapid contraction in the manufacturing sector exhibit growth rate densities that are more elongated, especially in the negative direction."

Table 1

Business failures (deviations from trend)

	Severe recessions	Mild recessions	Expansions
Mean	3.06	0.11	-0.59
Stand. Dev.	7.8	4.7	5.4
# observations	66	30	347

$$BF_t = -\,0.73 + 0.45\,BF_{t-1} + 0.90\,SEV_t \qquad R^2 = 0.27$$
$$\quad (0.48) \quad (0.04) \quad (0.22) \qquad DW = 2.2$$

$$BF_t = -\,0.05 + 0.50\,BF_{t-1} + 0.31\,MIL_t \qquad R^2 = 0.25$$
$$\quad (0.5) \quad (0.04) \quad (0.35) \qquad DW = 2.23$$

$$BF_t = -\,0.51 + 0.48\,BF_{t-1} + 2.35\,NBER_t \qquad R^2 = 0.26$$
$$\quad (0.52) \quad (0.04) \quad (0.97) \qquad DW = 2.2$$

BF = Business failure rate (deviations from trend); NBER = 1 if recession according to NBER chronology and zero otherwise; SEV = Sum of severe NBER over the previous six months; MIL = Sum of mild NBER over the previous six months. Standard errors in parentheses.

Table 2

Oil price changes and business failures

$$BFG = 0.013 + 0.35\,OIL \qquad R^2 = 0.03$$
$$\quad (0.007) \quad (0.15) \qquad DW = 1.6$$

$$BFG = 3.86\,DUMI + 0.07\,DUMD + 6.87\,YEARDUM \qquad R^2 = 0.12$$
$$\quad (1.4) \quad (0.8) \quad (2.0) \qquad DW = 1.7$$

BFG = Growth rate of business failures; OIL = average growth rate of real price of oil over the previous four quarters; DUMI = 1 if growth rate of real oil price is positive and zero otherwise; DUMD = 1 if growth rate of real oil price is negative and zero otherwise; YEARDUM = 1 if Year > 1978:12 (year of Bunkruptcy Reform Act). Standard errors in parentheses.

Table 3
Rank statistics and average growth

ALL COMPANIES

$$DP90\text{-}10(t) = \underset{(0.02)}{3.58} - \underset{(0.2)}{0.57}\ AVG(t) \qquad R^2 = 0.27$$

$$DP95\text{-}5(t) = \underset{(0.01)}{3.81} - \underset{(0.1)}{0.19}\ AVG(t) \qquad R^2 = 0.12$$

$$DPQ3\text{-}Q1(t) = \underset{(0.04)}{2.46} - \underset{(0.36)}{0.94}\ AVG(t) \qquad R^2 = 0.23$$

MANUFACTURING COMPANIES

$$DP90\text{-}10(t) = \underset{(0.01)}{3.59} - \underset{(0.06)}{0.27}\ AVG(t) \qquad R^2 = 0.14$$

$$DP95\text{-}5(t) = \underset{(0.06)}{3.80} - \underset{(0.06)}{0.16}\ AVG(t) \qquad R^2 = 0.26$$

$$DPQ3\text{-}Q1(t) = \underset{(0.03)}{2.53} - \underset{(0.27)}{0.84}\ AVG(t) \qquad R^2 = 0.31$$

ALL OTC COMPANIES

$$DP90\text{-}10(t) = \underset{(0.04)}{3.20} - \underset{(0.20)}{0.26}\ AVG(t) \qquad R^2 = 0.04$$

$$DP95\text{-}5(t) = \underset{(0.04)}{3.58} - \underset{(0.21)}{0.003}\ AVG(t) \qquad R^2 = 0.00$$

$$DPQ3\text{-}Q1(t) = \underset{(0.07)}{2.20} - \underset{(0.30)}{0.99}\ AVG(t) \qquad R^2 = 0.29$$

DPi-j = Difference between i-th and j-th percentile; DPQ3-Q1 = Difference between the upper and lower quartiles; AVG(t) = "average" cross sectional growth rate of real sales in year t.

Table 4
Tests of the equality of distributions

All companies

	Kolmogorov-Smirnov Top-Mid	Kolmogorov-Smirnov Bot-Mid		Kuiper Top-Mid	Kuiper Bot-Mid
KS(asympt)	1.11	0.79	K(asympt)	1.9	1.25
Prob > KSa	0.16	0.64	Prob > Ka	0.02	0.45

KSa and Ka are the asymptotic Kolmogorov-Smirnov and Kuiper statistics respectively.

Business Failures 1947-1983

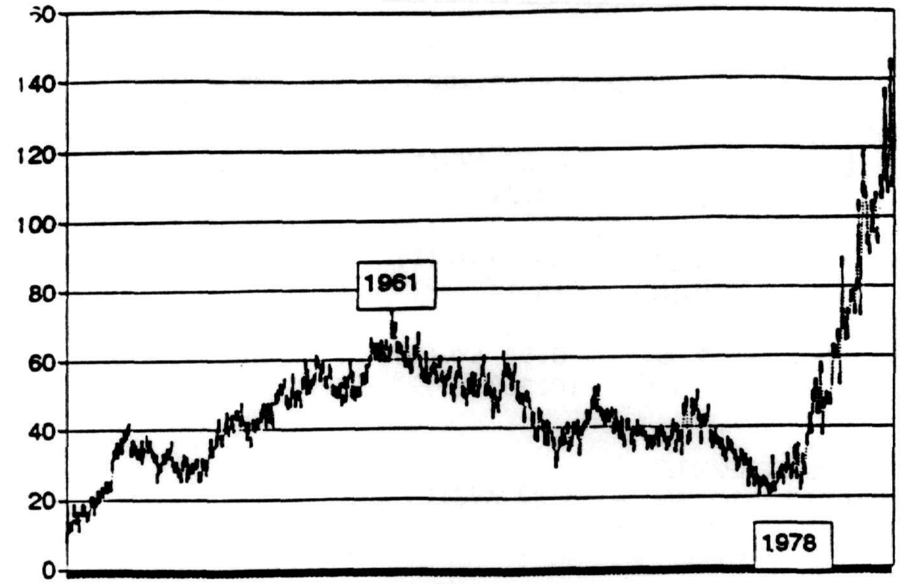
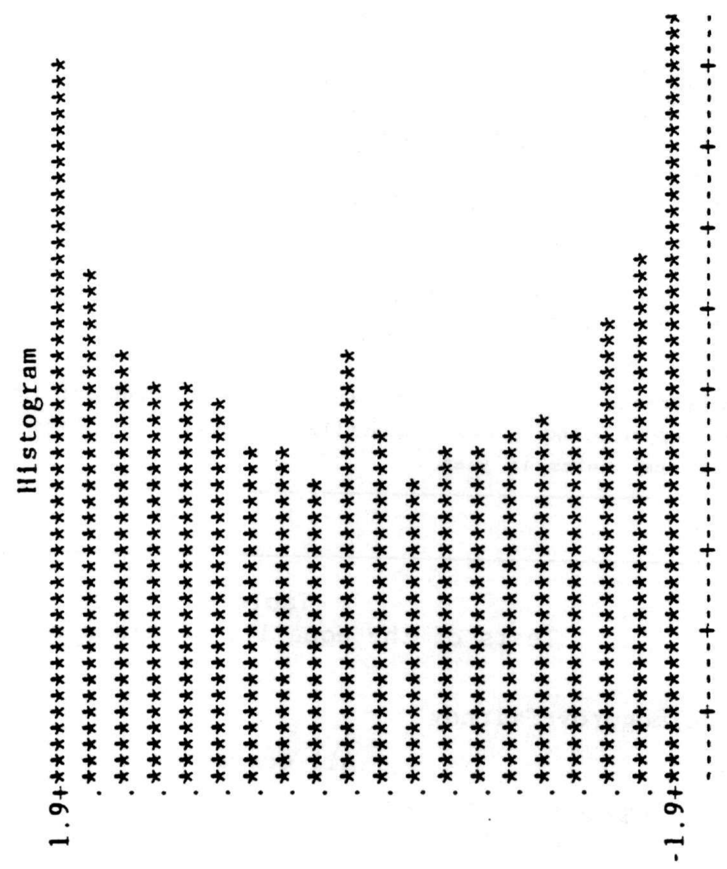


Figure 1



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