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Innovation in the Pharmaceutical Industry: Some Preliminary Results

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I. Introduction

Numerous studies of the FDA Amendments of 1962 conclude that the output of new drugs and the return to investment in new drug development decreased dramatically in the years following those amendments[1]. Hansen (1979) and DiMasi, et al. (1991) point to the primary reason for these observed declines in output and productivity -- the lengthy lags and enormous costs associated with compliance with the provisions of the 1962 Amendments. DiMasi et al. estimate that the average time from initial FDA review to final approval has now increased to more than eight years. These studies have caused many researchers and politicians to take a critical view of the 1962 Amendments.

Most studies of the effects of regulation on innovation in the drug industry measure innovative output in a given year as the total number of new single chemical entities approved by the FDA for marketing in that year. While the number of drugs approved is certainly an important measure of innovative output, it is also clearly true that all drugs are not of equal importance. In particular, some drugs represent fundamental innovations of new scientific and therapeutic value while others are only minor advances over existing treatments. In assessing the consequences of the FDA amendments, this distinction is potentially of great importance. If regulation has prevented or delayed the introduction of only less important drugs, then regulation has been far less costly than previously thought. On the other hand, if drugs of fundamental importance have been kept from reaching patients then the costs may have been even greater than indicated by previous studies.

In fact, both the drug industry and the FDA are known to have made concerted efforts to accelerate the approval of more important drugs. Thus there is particular

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[1]For studies of new introductions see Peltzman, 1973; Wardell and Lasagna, 1975; and Wardell, et al., 1978. For studies of rates of return see Baily, 1972; Wiggins, 1981; and Jensen, 1987.

reason to suspect that more important drugs may be moving more rapidly to market. Although the efforts of the drug companies to accelerate the approval of more important drugs are thought to have increased over time, the precise pattern of these efforts is not well known. In contrast, the FDA is well known to have intensified its efforts to accelerate the approval of more important drugs beginning in the mid-1970s following a congressional mandate to do so (Kaitin, et al., 1991).

In this paper we ask whether drugs of different importance reach the market at different rates. To accomplish this, we develop multiple measures of the scientific and medical importance of drugs, identify the lag between the initial development of a drug and its approval for marketing by the FDA, and determine whether the lag to approval is different for drugs of different importance. Our results indicate that, beginning in 1970, more important drugs did in fact move from patent to FDA approval more quickly than did less important drugs. Despite this, the overall trend of increasing average lags since 1970 implies that even drugs in the 90th percentile of importance are taking longer and longer to reach the market. The fact that the tendency for more important drugs to reach the market more quickly seems to have begun before the FDA efforts of the mid-1970s suggests that the actions of firms may have been at least as important as the FDA initiative.

II. How a New Medical Entity reaches the market

The idea for a new drug product usually begins in the laboratory of a research scientist, often working within a university but increasingly working within the research laboratories of a pharmaceutical manufacturer. In either case, the discovery process begins with the identification of promising chemical and/or biological properties of a newly synthesized or previously known substance. If the scientist is directly employed by a pharmaceutical firm, the new medical entity (NME) may

immediately enter the development phase. If the scientist is employed by a university, pharmaceutical firms may become aware of his or her discovery through a variety of channels including research publications, presentations at scientific meetings or routine discussion with scientists.

The development phase of an NME begins when the pharmaceutical firm identifies a therapeutic use. At that time, the pharmaceutical firm usually applies for a patent in its home country. Under international patent agreements, it then has one year to initiate patent applications in other countries. Once the pharmaceutical firm decides that it wants to go ahead and market the NME, it files for approval with the regulatory agencies of each country.

In the United States, the Food and Drug Administration has responsibility for approving NMEs. Under the Food, Drug and Cosmetic Act of 1935, which created the FDA, all firms seeking to market an NME are required to file a New Drug Application (NDA) which includes proof of efficacy. In 1962, following revelations that several unsafe drugs had been approved by the FDA or were currently under review (most notably Thalidomide), Congress enacted amendments to the Food Drug and Cosmetic Act. Prior to 1962, the mean length of time from NDA filing to NDA approval was only about six months.

The 1962 Amendments required the FDA to establish both efficacy and safety of NMEs before granting approval to market[2]. Under the 1962 Amendments, the first step towards FDA approval is the filing of an Investigatory New Drug application (IND). The IND process is described in detail in DiMasi et al. (1991). Briefly, the process involves a number of phases, beginning with small scale testing for safety on healthy subjects and culminating with large scale testing for efficacy on sick patients. As discussed by Hansen (1979) and DiMasi et al. (1991), the length of the IND review

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[2]The same amendments also require the FDA to establish the efficacy and safety of new compounds, salts and esters as well as generic drugs.

process averaged about 5 years for drugs with IND filings in the period 1963-1975, and more than 6 years for drugs with IND filings in the period 1970-1982. After approval of the IND, the drug then goes through the traditional NDA review process, which now requires approximately three years.

In the mid-1970s, the FDA altered the approval process in order to accelerate the review of what it considered to be important drugs. Some of the steps it took were to work more closely with the pharmaceutical companies during the IND process and to identify drugs of particular promise in order to speed up final approval of the NDA. Kaitin et al. (1991) found that the FDA did successfully accelerate the NDA review of a few drugs which it had given high priority.

III. Measuring the length of time for an NME to reach the market.

The discussion above suggests that there are a number of potential measures of the length of time that it takes for an NME to reach the market.

The end date can be identified as either the first date that the drug is available or the date of NDA approval. New drugs generally reach the market quite soon after FDA approval so we use the date of approval as our end date since the approval date is far more readily available. We obtained the NDA approval date from the FDA for all NMEs approved since 1950.

Obtaining the date of discovery of an NME is somewhat more problematic. Researchers concerned with the effects of FDA regulation have examined the length of time from IND filing to NDA approval (Wiggins, 1981; Hansen, 1979; DiMasi et al., 1991) or from NDA filing to NDA approval (Kaitin et al., 1991). DiMasi et al. (1991) correctly point out that the new drug development process actually begins before the IND filing, and indeed find that roughly half of all pharmaceutical company R&D expenditures are made prior to the IND phase. This implies that the more appropriate measure of the

full time for development is the lag from initial identification of a drug's pharmacological action until NDA approval. This measure is particularly valuable for two additional reasons. The first is that changes in regulation could change incentives regarding when to file IND and NDA applications, making these deceptive measures of delay due to regulation. For example, more stringent regulation might provide a firm with an incentive to wait until it had more information concerning an NME before proceeding further with a costly approval process. Thus IND or NDA approval times might fall even though total times to approval were rising. The second advantage of using the date of identification is that IND dates are not available for drugs approved before 1962 since the IND filing requirement did not exist prior to the 1962 Amendments. Therefore any analysis using this variable would be confined to the period after 1962.

In order to approximate the full lag from identification of the NME to NDA approval we use the time from date of first worldwide patent application to the date of NDA approval. Patent applications usually require identification of the proposed medical use and, to protect patent rights, it is in the interest of the company to file an application as soon as it is practicable. Thus patent applications are an early indication of the discovery of a drug.

There are several problems with using patent application data, however. One problem is that for many NMEs, such as isotopes, the patents are "use patents," which are difficult to identify. A second problem is that patent application dates are not easily available for all NMEs, so that some application dates must be estimated from patent approval dates. We were able to get both patent application and patent approval dates from computerized patent data bases for about 400 drugs. For this sample, the mean lag from application to approval was 2 years, with a standard error of 3 years. [3] For an additional 200 drugs we obtained the first world-wide patent approval year from the

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[3]This data was obtained with the assistance of Robert Murawski, a patent specialist from Merck & Co.

Merck Index. For these drugs we estimated the application date by subtracting 2 years. Our key dependent variable, FPLAG, is the difference in years from the NDA approval date to the first worldwide patent application.

Although the changing demands of the FDA may have provided incentives to alter IND and NDA filing times within the process of drug development, they remain interesting milestones in the development process and may provide some insight into the causes of the changing delays. Therefore we also attempt to look at NDA and IND approval times. We were able to obtain NDA approval dates from the FDA however IND dates have turned out to be more difficult to locate and are not yet available.

IV. Measuring the importance of NMEs

The "importance" of a drug is an elusive concept. Some drugs represent radical new breakthroughs in treatment. One example is propranolol, the first "Beta-blocker." Some drugs represent innovations in chemistry or biology that may be of long term research value but limited applicability in treatment. Alpha-blockers - which proved useful in developing our understanding of the sympathetic nervous system but were found to be of little use as a treatment for hypertension due to their unacceptable side-effects - are a good example. Some drugs, such as Zantac, represent marginal improvements in efficacy yet are successful in the marketplace, capture large market shares and are introduced worldwide.

In recognition of the multiple meanings of "importance," we have developed multiple measures. We use them individually and collectively in our analyses. Our measures are: 1) Citations in medical textbooks; 2) Citations in medical journals; 3) Citations in subsequent patent applications; 4) First entry into a new category of drugs as defined by the IMS Pharmaceutical Database Division; and 5) The extent of world wide introduction.

We describe each of these variables and discuss their advantages and disadvantages as measures of importance below.

1) Citations in Medical Textbooks

One measure of the clinical importance of a drug is the amount of space that medical textbooks devote to discussing that drug. To find a readily available measure for this, we examined the index to Harrison's Principles of Internal Medicine, 1987 Edition. We tabulated the number of page references for each NME, which we call TEXT87. We chose Harrison's Principles because it is a widely used text for internal medicine, the specialty which encounters the widest array of illnesses. We believe that the total number of page references is a good objective measure of the clinical importance of the drug. Although some references may not relate directly to the value of the drug in treating a specific disease (e.g. some references may refer to side-effects), identifying such inapplicable references would be quite cumbersome, and would introduce unwanted subjectivity. (Additionally, references to side effects might even be considered a measure of importance since the more widely a drug is used, the more important it would be to inform readers of potential side-effects.)

Since a drug which was of great importance in an earlier period may no longer be of importance, we are also in the process of assembling similar data from earlier editions of Harrison's Principles of Internal Medicine. Since Harrison's has been published approximately every three years since 1950, it will allow us address this problem quite well.

2) Citations in Medical Journals

It seems reasonable that more important drugs will receive greater attention by medical researchers. Studies of efficacy and side effects are more valuable when a drug has greater potential benefits to patients. The number of articles may also reflect

funding priorities by agencies such as the NIH. The subjects of articles appearing in medical journals are indexed in Index Medicus. Listings in Index Medicus since 1962 have been computerized and may be searched using a data retrieval system called MEDLINE. Given the name of a drug, MEDLINE will identify all articles about that drug indexed in Index Medicus since 1962. We tabulated the total number of articles indexed between 1962 and 1990 for each NME, and we call this variable MEDLINE. There are typically hundreds of articles per drug. Thus, we did not take on the task of reading each article and determining a measure of importance per article. For NMEs that were preparations of a compound (e.g., acebutolol HCL, acetophenazine maleate) we searched under the associated Merck Index heading (e.g., acebutolol, acetophenazine).

3) Citations in Subsequent Patent Applications

Researchers will often refer to one NME when describing the properties of another drug. The drugs may be chemically similar, or may treat the same illnesses. Patent applications in particular are likely to be thorough when identifying related drugs. Patent applications often compare the efficacy and toxicity of one drug with other drugs currently in use. If a drug is frequently cited in patent applications for other drugs, it stands to reason that it is a standard for comparison. The texts of all US patent applications for patents approved since 1975 may be searched through a data retrieval system known as LEXUS. We tabulated the number of patent applications between 1975 and 1990 that cite each NME, which we call PATCITE.

4) First entry into an IMS category

Many sources of information about drugs categorize them according to their therapeutic use or biological action. IMS, a private consulting firm which specializes in collecting data concerning the pharmaceutical industry, provides one useful categorization which seeks to identify roughly 80 broad "two-digit" categories and

hundreds of narrow "five-digit" categories within the broad categories. IMS attempts to divide the broad categories according to therapeutic area. The narrow categories then tend to be divided by chemical properties or biological mechanism. The earliest drug in a narrow category thus tends to represent a novel treatment for diseases within the broad category. We define INNOVCAT to be an indicator variable which equals 1 if the drug was the first introduced into its five-digit category and 0 otherwise.

5) Worldwide Introductions

Grabowski (1988) argues that more important drugs will be introduced into more countries. Grabowski defined "important" drugs as those introduced into six of eleven major pharmaceutical markets: Australia, Canada, France, Germany, Italy, Japan, Norway, Sweden, Switzerland, the UK and the US.

Grabowski's data is for a limited time period (1970-1985), so we use a somewhat different measure of world-wide introductions that is available using data from DeHaen Inc. Specifically, DeHaen Inc. reports the first marketing date in each of the seven major drug producing countries for all currently available single chemical entities. We have these dates of introduction from DeHaen as of 1980, and again as of 1988. These two volumes provide worldwide introduction dates for roughly half of the NMEs approved by the FDA. We define WORLD to be the total number of nations in which a given NME is marketed. If the drug does not appear in a DeHaen book, we let WORLD =0.

In addition to the above measures, we would also like to be able to use sales data. Unfortunately this data appears to be available only at a prohibitive cost.

Each of our measures of importance may be time dependent. For example, very old and very recent drugs may have fewer PATCITES and MEDLINE citations than drugs developed in the sixties and seventies. Old drugs may not appear in DeHaen or in medical textbooks due to obsolescence. We control for this time dependence in two ways. First, we try to reduce biases associated with new drugs by focusing only on drugs

approved no later than 1987. Second, we regress our measures of importance on a vector of "period" year dummies -- each dummy corresponding to a period of six or seven years. In one regression, we use period dummies corresponding to the period in which the drug was approved by the FDA. In another set of regressions, we use dummies corresponding to the period in which the first relevant patent application was filed. The results are not significantly different from those reported below.

The residuals in these regressions identify the highest scoring drugs in each respective time period. The residuals are not comparable across periods, nor can we identify any defensible way to standardize the residuals to make them comparable across time. Thus, we cannot determine whether innovative output is increasing or decreasing over time. The residuals are also not directly comparable across measures however we address this by standardizing each residual by its respective standard error. Thus, if a drug scores +2 on the measure PATCITE, then patent citations for that drug were two standard deviations higher than the average number of patent citations for other drugs approved (or patented) in its time period. In addition to calculating standardized residuals for each individual importance measure, we calculated the sum of standardized residuals across importance measures. We call this variable SUMSCORE.

V. Results

Table 1 provides the basic sample statistics for both the whole sample and for each period. The table clearly shows the time dependence of our unadjusted measures of importance. The mean of sumscore is zero in each period as a result of our standardization procedure. The variance of SUMSCORE differs across periods, however, because the components which make up SUMSCORE are not equally correlated across periods. The means of FPLAG by period show declining lags from patent to FDA approval prior to the 1962 Amendments as well as the well recognized pattern of increasing lags since that time. Despite the decline in lag times from the early 1950s to the early

1960s, the average lag for a drug increases to over six years by the middle 1960s and continues to rise until reaching almost fourteen years by the middle 1980s. It is interesting to note that although lags continued to increase during 1980s, by far the greatest increases in lags took place during the 1970s when the average lag increased by almost six years.

Table 2 shows the correlations of the standardized importance measures. Note that the measures are all significantly positively correlated at $p < .01$ with the exception of WORLDRES and CATRES, which are correlated at $p < .03$.

Table 3 shows the six drugs in each period with the highest values for SUMSCORE[4]. Although it would almost surely be impossible to develop a consensus from a group of health professionals on any single list of the most important drugs, this is clearly a collection of drugs which individuals knowledgable about pharmaceuticals would consider extremely important. It is interesting to note that these drugs represent a variety of therapeutic categories both within periods and across periods. The presence of Glucagon in the list points out one shortcoming of our measure of importance. It scores highly on our list not because of its therapeutic importance but rather because it is a substance which occurs naturally in the body and is being frequently cited on account of its role in normal metabolism. A few other naturally occurring biological compounds - for example Calcitonin and Trypsin - were eliminated from our analysis to avoid this problem. Glucagon remained due to an oversight.

Table 4 contains the results for the effects of our measures of importance on the dependent variable FPLAG, which measures the time from patent application to FDA approval. P2 through P6 are dummies for periods two through six and are included to control for changes in the delay of an average drug over time. Period 1 is the omitted dummy. When the effect of the intercept is included, the coefficients on these period

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[4] This list is restricted to drugs for which we have patent and NDA approval dates as well as all our measures of importance.

dummies simply indicate the delay of a drug which is of average importance within its time period and thus replicate the means of FPLAG by period included in Table 1. (The coefficients on these dummies do not change across the regressions with different measures of importance since the time dummies are orthogonal to the measures of importance by construction.) The period dummies are then interacted with the importance measures in order to determine whether more important drugs approved within each period experienced greater or lesser lags from patent to approval than did less important drugs.

Column 1 shows the results for SUMSCORE and columns 2 through 6 show the results for its component measures. The interaction terms indicate the extent to which more important drugs achieved more rapid approval during each time period. For the first three periods there is no evidence that more important drugs progressed more rapidly from patent to approval. In contrast, the interaction terms for the last two periods are highly significant and imply that a drug one standard deviation above the mean in importance as measured by SUMSCORE reached approval approximately one and one half years faster than a drug of average importance. For period 4 there is some suggestion that more important drugs came to market more quickly than less important ones, although the effect is not significantly different from zero at the ten percent level.

Table 5 combines these findings with the results on changing lags over time to calculate the changing lags for drugs one standard deviation above and below the mean in importance and for drugs in the 90th percentile of importance. The results indicate that although more important drugs have reached approval somewhat faster than drugs of average importance since 1970, the advantage has remained nearly constant at about one and one half years and has not come close to compensating for the overall trend towards increasing lags.

Tables 4B and 5B repeat the analysis using SUMSCORE2 which is equivalent to SUMSCORE except for the omission of the INNOVCAT component. Since INNOVCAT takes on

only values of zero or one and since its standard deviation is relatively small, the standardized residuals can rather easily dominate the other components within SUMSCORE. Likewise, INNOVCAT is suspect as a measure of importance since the first drug will receive a one and all others zero even if additional drugs follow within a few days of the first. Thus the binary nature of INNOVCAT is likely to make it a rather noisy measure of importance. Indeed comparing Tables 4B and 5B to Tables 4 and 5 suggests that this is the case. The estimated effects of importance are almost unchanged but the significance levels improve. The effect of importance in Period 4 now becomes significantly different from zero at the 10% level.

The fact that any tendency for important drugs to be approved more rapidly has been nearly constant since 1970 draws into question whether there were any significant gains from the changes in FDA policy during the mid-1970s. The results seem to suggest instead that the actions of firms may have been more important. Although we do not yet have data on IND application and approval dates, the data we have on NDA application and approval dates tend to confirm this by indicating that the FDA has had no particular success in accelerating the passage of more important drugs through the NDA approval process. These results are shown in Table 6. Due to the specific changes which were made by the FDA during the mid-1970s, however, the IND approval times are probably a more sensitive measure of any effect of regulatory reforms. It should therefore be interesting to see these results when they become available.

VI. Conclusion

Although our results indicate that more important drugs are reaching the market somewhat more rapidly than less important ones, the magnitude of this advantage in approval time has not changed since the early 1970s despite increasing overall lags and despite FDA efforts to accelerate important drugs. The fact that more important drugs do

tend to reach the market somewhat faster than less important drugs does suggest, however, that there is at least some ability on the part of either drug companies or the FDA to identify particularly promising new medical entities at an early stage and expedite their approval. The process by which important drugs are identified and their approval accelerated therefore seems a potentially valuable area for research.

TABLE 1

SAMPLE STATISTICS

MEAN
(SDEV)

	N	PATCITE	MEDLINE	TEXT	INNOVCAT	WORLD	FPLAG	SUMSCORE
Full Sample 1950-1987	569	107 (184)	1323 (2716)	1.69 (3.15)	0.13 (0.34)	2.97 (2.54)	7.96 (6.57)	0.00 (3.35)
Period 1 1950-1955	91	83 (198)	894 (2296)	1.29 (3.19)	0.24 (0.43)	0.92 (1.16)	4.28 (4.76)	0.00 (3.48)
Period 2 1956-1961	141	98 (138)	1138 (2888)	1.13 (2.84)	0.17 (0.38)	1.77 (1.85)	3.50 (3.93)	0.00 (3.13)
Period 3 1962-1968	78	207 (331)	2406 (4361)	2.77 (4.8)	0.14 (0.35)	3.15 (2.24)	6.42 (4.93)	0.00 (5.38)
Period 4 1969-1975	72	128 (169)	1518 (2573)	1.74 (2.59)	0.06 (0.23)	4.24 (2.77)	9.58 (4.80)	0.00 (3.09)
Period 5 1976-1981	97	92 (97)	1556 (2087)	2.31 (2.83)	0.09 (0.29)	4.99 (2.1)	12.58 (5.94)	0.00 (2.51)
Period 6 1982-1987	90	57 (70)	698 (652)	1.37 (2.03)	0.06 (0.23)	3.57 (2.56)	13.73 (6.63)	0.00 (2.11)

TABLE 2

CORRELATION MATRIX

(SIGNIFICANCE LEVELS IN PARENTHESES)

	PATRES	TEXTRES	MEDRES	WORLDRES	CATRES
PATRES	1.00	0.55	0.62	0.24	0.15
	(.00)	(.00)	(.00)	(.00)	(.00)
TEXTRES	0.55	1.00	0.67	0.26	0.20
	(.00)	(.00)	(.00)	(.00)	(.00)
MEDRES	0.62	0.67	1.00	0.21	0.19
	(.00)	(.00)	(.00)	(.00)	(.00)
WORLDRES	0.24	0.26	0.21	1.00	0.08
	(.00)	(.00)	(.00)	(.00)	(.03)
CATRES	0.15	0.20	0.19	0.08	1.00
	(.00)	(.00)	(.00)	(.03)	(.00)

TABLE 3

MOST IMPORTANT DRUGS BY PERIOD

	SUMSCORE	Drug	Therapeutic Category
PERIOD 1			
	21.89	Chloramphenicol	Antibiotic
	10.84	Phenylbutazone	Anti-inflammatory
	8.15	Chlorpromazine (Thorazine)	Antipsychotic
	7.45	Phentolamine	Alpha-Blocker
	6.08	Aminopterin	Antineoplastic
	5.03	Warfarin	Anticoagulant
PERIOD 2			
	16.20	Cyclophosphamide	Antineoplastic
	12.89	Glucagon	Insulin OD Tx./DiagnosticAid
	8.34	Chlordiazepoxide (Librium)	Anxiolytic
	8.18	Amitryptyline (Elavil)	Tricyclic Antidepressant
	7.96	Liothyronine	Thyroid Hormone Replacement
	7.69	Spironolactone	Diuretic
PERIOD 3			
	23.08	Propranolol	Cardiovascular(Beta-Blocker)
	19.54	Indomethacin	Anti-inflammatory
	12.99	Gentamicin	Antibiotic
	10.03	Furosemide	Diuretic
	9.89	Diazepam (Valium)	Anxiolytic
	8.53	Aminocaproic Acid	Hemostatic
PERIOD 4			
	7.48	Naloxone	Opioid Antagonist
	7.16	Amoxicillin	Antibiotic
	6.96	Rifampin	Antibiotic/Antiviral
	6.65	Levodopa	Anti-Parkinson
	5.86	Ibuprofen (Advil, Motrin)	Anti-inflammatory
	5.33	Tobramycin	Antibiotic
PERIOD 5			
	7.50	Cimetidine (Tagamet)	Antisecretory (Peptic Ulcer)
	6.76	Verapamil	Cardiovascular
	6.28	Captopril	Cardiovascular
	5.30	Nifedipine	Cardiovascular
	4.89	Cisplatin	Antineoplastic
	4.73	Bromocriptine	Anti-Parkinson/ Endocrine Disturbances
PERIOD 6			
	8.96	Acyclovir	Antiviral
	5.61	Labetolol	Cardiovascular
	4.10	Ranitidine (Zantac)	Antisecretory (Peptic Ulcer)
	4.06	Pentoxifylline	Antiasthmatic
	4.01	Aztreonam	Antibiotic
	3.70	Pindolol	Cardiovascular

TABLE 4

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Dep. Variable	FPLAG	FPLAG	FPLAG	FPLAG	FPLAG	FPLAG
Importance Measure(=IM)	SUMSCORE	PATRES	TEXTRES	MEDRES	WORLDRES	CATRES
Constant	4.28 (.53)	4.28 (.54)	4.28 (.53)	4.28 (.54)	4.28 (.53)	4.28 (.54)
IM	-0.06 (.15)	-0.27 (.49)	-0.12 (.52)	-0.01 (.64)	.30 (.97)	-0.24 (.42)
IM*P2	0.01 (.21)	-0.23 (.75)	-0.23 (.70)	0.12 (.75)	-0.75 (1.09)	0.41 (.57)
IM*P3	-0.01 (.19)	0.24 (.58)	-0.17 (.64)	-0.31 (.73)	-1.02 (1.11)	0.64 (.70)
IM*P4	-0.38 (.25)	-0.22 (.81)	-1.59# (.89)	-0.64 (.90)	-1.5 (1.07)	0.25 (.99)
IM*P5	-0.61** (.26)	-2.31* (1.08)	-0.85 (.77)	-0.95 (.92)	-2.59** (1.10)	0.41 (.74)
IM*P6	-0.75** (.30)	-0.24 (1.48)	-2.86*** (.98)	-1.48 (2.34)	-1.58 (1.07)	-0.48 (.90)
P2	-0.78 (.68)					
P3	2.14*** (.78)					
P4	5.3*** (.80)					
P5	8.31*** (.74)					
P6	9.45*** (.75)					
R-SQUARED	0.42	.40	0.41	0.39	0.43	0.39

Significance Level '#' = .1 '*' = .05 '**' = .02 '***' = .01

TABLE 5

LAG TO APPROVAL BY IMPORTANCE (SUMSCORE) AND PERIOD

	1 sdev below Mean SUMSCORE	Mean SUMSCORE	1 sdev above Mean SUMSCORE	90th Percentile SUMSCORE
Period 1 1950-1955	4.5	4.3	4.1	4.1
Period 2 1956-1961	3.5	3.5	3.5	3.5
Period 3 1962-1968	6.5	6.4	6.4	6.4
Period 4 1969-1975	10.8	9.6	8.4	7.9
Period 5 1976-1981	14.1	12.6	11.0	10.9
Period 6 1982-1987	15.3	13.7	12.1	11.9

TABLE 4B

	SDEV SUMSCORE2
Full Sample 1950-1987	3.00
Period 1 1950-1955	2.86
Period 2 1956-1961	2.80
Period 3 1962-1968	4.93
Period 4 1969-1975	2.86
Period 5 1976-1981	2.19
Period 6 1982-1987	1.78

Dep. Variable	FPLAG
Importance Measure(=IM)	SUMSCORE2
Constant	4.29 (.53)
IM	-0.05 (.18)
IM*P2	-0.05 (.24)
IM*P3	-0.05 (.22)
IM*P4	-0.47# (.28)
IM*P5	-0.83*** (.29)
IM*P6	-0.98*** (.35)
P2	-0.79 (.67)
P3	2.13*** (.78)
P4	5.29*** (.79)
P5	8.30*** (.73)
P6	9.44*** (.75)
R-SQUARED	0.65

Significance Level '#' = .1 '*' = .05 '**' = .02 '***' = .01

TABLE 5B

LAG TO APPROVAL BY IMPORTANCE (SUMSCORE2) AND PERIOD

	1 sdev below Mean SUMSCORE2	Mean SUMSCORE2	1 sdev above Mean SUMSCORE2	90th Percentile SUMSCORE2
Period 1 1950-1955	4.4	4.3	4.2	4.2
Period 2 1956-1961	3.6	3.5	3.4	3.3
Period 3 1962-1968	6.7	6.4	6.1	6.1
Period 4 1969-1975	10.9	9.6	8.3	7.7
Period 5 1976-1981	14.4	12.6	10.8	10.6
Period 6 1982-1987	15.5	13.7	11.9	11.4

TABLE 6

Dep. Variable	NDAAPPLAG
Importance Measure(=IM)	SUMSCORE
Constant	0.45 (.18)
IM	-0.02 (.08)
IM*P2	0.03 (.09)
IM*P3	-0.05 (.09)
IM*P4	-0.18 (.12)
IM*P5	-0.06 (.12)
IM*P6	-0.16 (.11)
P2	0.24 (.24)
P3	1.81*** (.30)
P4	1.81*** (.30)
P5	2.49*** (.30)
P6	2.53*** (.26)
R-SQUARED	0.53

Significance Level '#' = .1 '*' = .05 '**' = .02 '***' = .01

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