WORKERS
COMPENSATION
REINSURANCE
BUREAU

1993

Workers Compensation Excess Reinsurance

The Longest Tail?

TWO HUDSON PLACE, HOBOKEN, NJ 07030 • TELEPHONE 201/795-1700 • FAX 201/795-4441

Workers Compensation Excess Reinsurance
The Longest Tail?

by
Gary G. Venter
President, Workers Compensation Reinsurance Bureau

Casualty insurers are used to the idea that it may take 20 years to pay out the claims and close the books on the policies they are writing today. But they may not be aware that in workers compensation this will take the better part of a century, and that for excess comp writers it may take over 30 years just to pay half the ultimate losses.

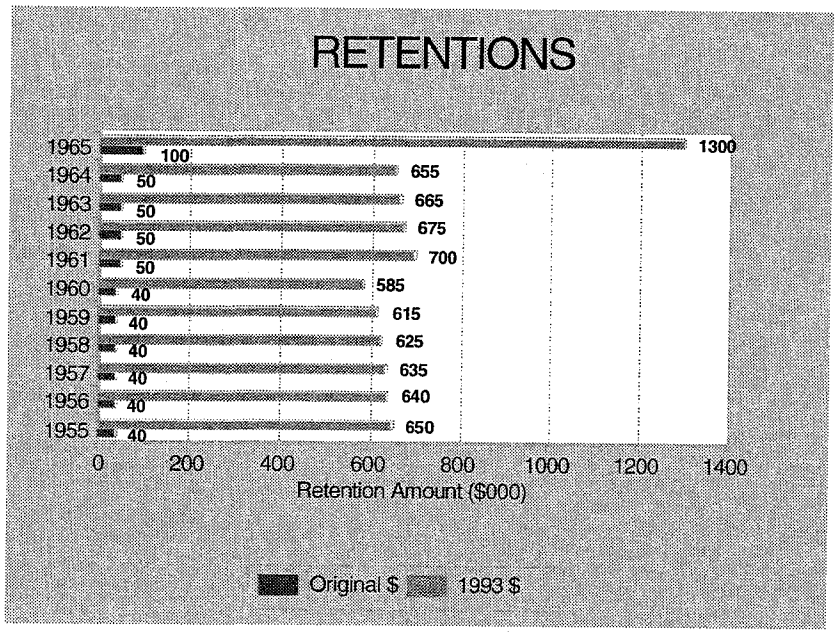
Evidence on the long tail severity and payout pattern fornical, and up until now confidential, data base of the Workers Compensation Reinsurance Bureau (WCRB). This contains complete loss histories on all claims reinsured by the Bureau since the early 1950's, as well as current data on all recently open claims, some as old as 1916. As WCRB has had a significant share of the compensation reinsurance market since 1912, this is an extensive data base.

Data

To review the tail it is useful to look at some fairly mature data, so the claims reviewed are from accident years 1955 to 1965. For the first 10 of these years the WCRB retention was fairly constant, ranging from $40,000 to $50,000. In 1965 it jumped to $100,000. The payment and reporting patterns for a book of excess claims is quite dependent on the retention. One advantage of this data base is that WCRB reinsureds all have the same retention for any given year. For consistency of this study the years 1955-1964 will usually be combined, and 1965 will be shown separately, to illustrate the retention effect.

Another advantage of this data set is that there is no upper limit to the reinsurance provided. In contrast, the limits provided by other reinsurers in this period may have been exhausted, with the loss payments reverting to the ceding

companies, before the full extent of excess losses could be measured. Because of this and the fairly high retentions, the tail may be longer than that found in other studies.



An attempt will be made to adjust dollar figures for inflation when noted, but this task is not straightforward. Compensation benefits have changed as well as wages and medical costs. Moreover, the inflation rate on large claims may be significantly different from that for normal claims. Primary insurance average cost per case is used to adjust for inflation, but the adjustments should be regarded as very rough. Factors to the 1993 level used range from about 13.0 for 1965 to 16.3 for 1955.

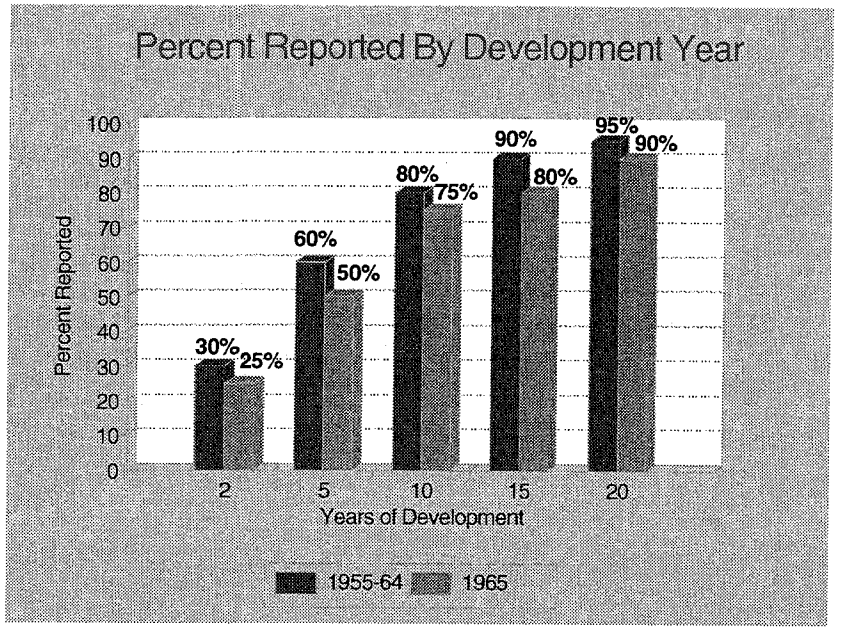
Reporting Pattern

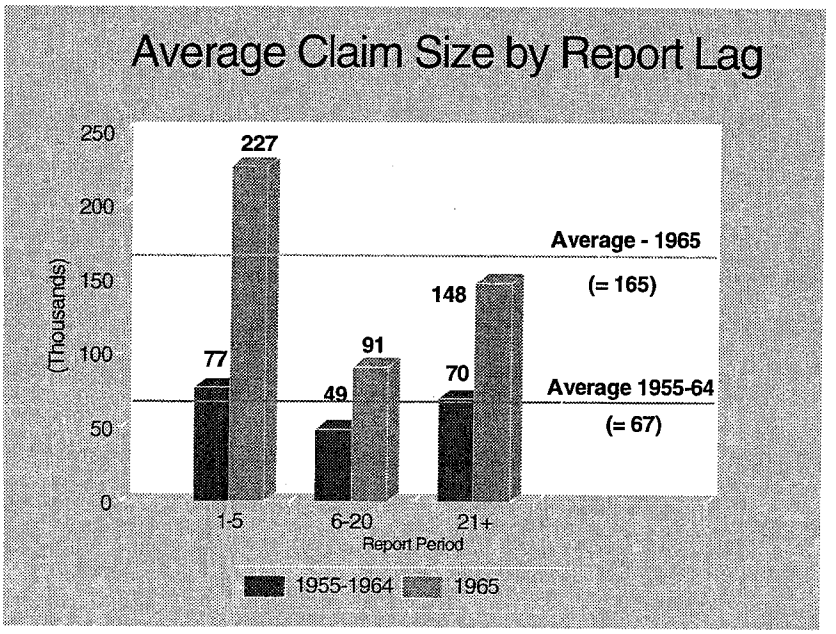
Reporting of excess compensation claims is notoriously slow. Although about half of the claims are reported by the end of the fifth year, 5% to 10% are still unreported after 20 years. A few continue to trickle in much later than that. Claims with accident dates in the 1940's have been reported to the Bureau in the 1990's, one of which was 52 years old at first report! Claims this late are usually small (e.g., $35,000 with a $25,000 retention) and have either not been identified as being subject to reinsurance, or have been first reported to the primary insurer at a very late date, usually in support of a products claim for asbestosis. Accident year 1965, with the higher retention, shows a longer reporting pattern than the other years.

The biggest claims do appear to be reported earlier. For instance, the claims reported in the first five years are

usually larger than average, while the claims reported in

years 6-20 tend to be smaller. Claims reported after the 20th year, however, again tend to be large.





The average size tends to be larger in 1965 because of growth in claims in general but also because of the higher retention. The larger sizes for the later reports probably relate to the high inflation rates of the late 1970's and early 1980's, especially in medical costs.

Payment Pattern

Loss payments in this study go through year end 1991, which represents 37 years of payment for accident year 1955, and 27 years for 1965. Payments are projected into the future using current annual medical and indemnity rates and standard mortality assumptions. In states where benefits escalate with inflation, indemnity payments are escalated at 6%, as this is a standard assumption. Medical payments are escalated at 4% in all states. This is probably too low, but the tail effects are nonetheless fairly dramatic even with this assumption.

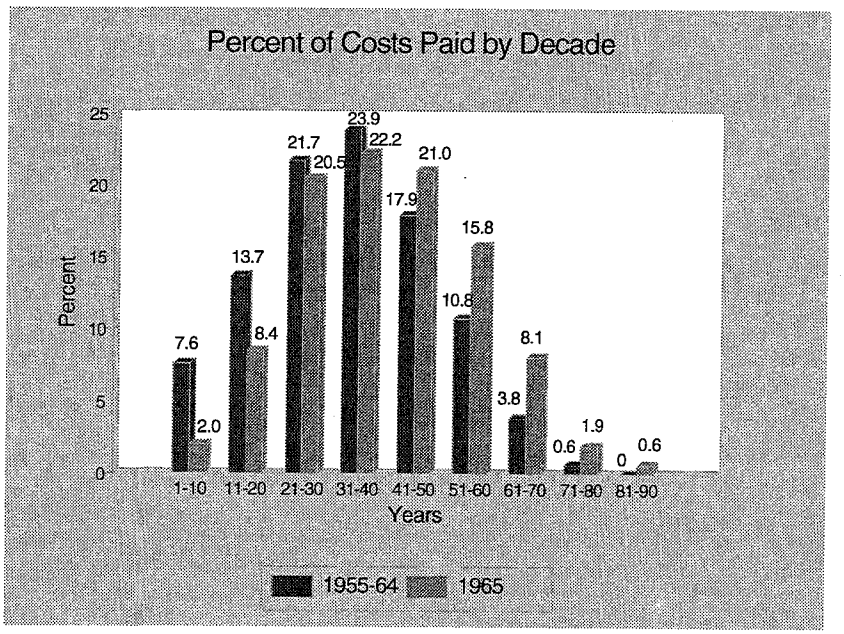
As claims are paid over the lifetime of a claimant, and often at increasing rates over time, it takes quite a while for losses to be paid. For accident years 1955-64, half of all payments are made after about 33 years. For 1965 this is estimated to be 39 years. To reach 90% paid for claims from these two periods will take 54 and 60 years, respectively.

Years Needed to Pay Given Percent of Costs

Percentile	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%
1955-64	12	19	25	29	33	37	42	47	54	59	68
1965	20	25	30	34	39	43	48	53	60	65	73

How long does it take to pay 100%? Accident year 1916 closed in 1990, after paying for 75 years. Accident year 1922 is still paying after 70+ years. Given improved mortality, it is reasonable to expect over 80 years of payments on recent accident years. I.e., 1992 will probably still be paying in 2072!

Another way of looking at the payout pattern is percent of losses paid in each decade after the start of the accident year. For instance, the 4th decade after the accident (years 31 to 40) is the heaviest paying, with 23.9% of total payments for 1955-64 and 22.2% for 1965.



The payment tail is quite long in either case, but more so for 1965. For example, 33% of payments for 1955-64 are after the 40th year, but for 1965 this is 47%, again reflecting the higher retention. The claims reported in the 6 to 20 year lag period, which were noted above to be somewhat smaller than average, also pay somewhat faster than the other claims, reaching 50% paid by about the 29th year.

Present Value

For reserving annuity based losses it is customary to discount for the time value of money. This is particularly true for excess workers com-

pensation, with a payout pattern more like a life insurance line than most property-casualty lines. The discounted reserve is the amount needed to invest at the assumed interest rate in order to cover all the loss payments as due. This can be expressed as a percentage of the ultimate payout. For example, using the payout pattern for 1955-64 and a 5% annual interest rate, 25.4% of ultimate losses are needed as the discounted reserve.

Present Value Percentages with Different Interest Assumptions

Payout Pattern	Interest:	3.5%	5%	8%
Like 1955-64		36.1%	25.4%	14.3%
Like 1965		29.3%	18.9%	8.9%

Thus somewhere between 8.9% and 36.1% of ultimate losses would fund the reserves at year 1, which would make the ultimate losses from 2.77 to 11.2 times the discounted reserve. This is an effect that probably should be taken into account in cost estimates of excess reinsurance as well. However, before discounting with such dramatic factors, the ultimate costs should be fairly well understood.

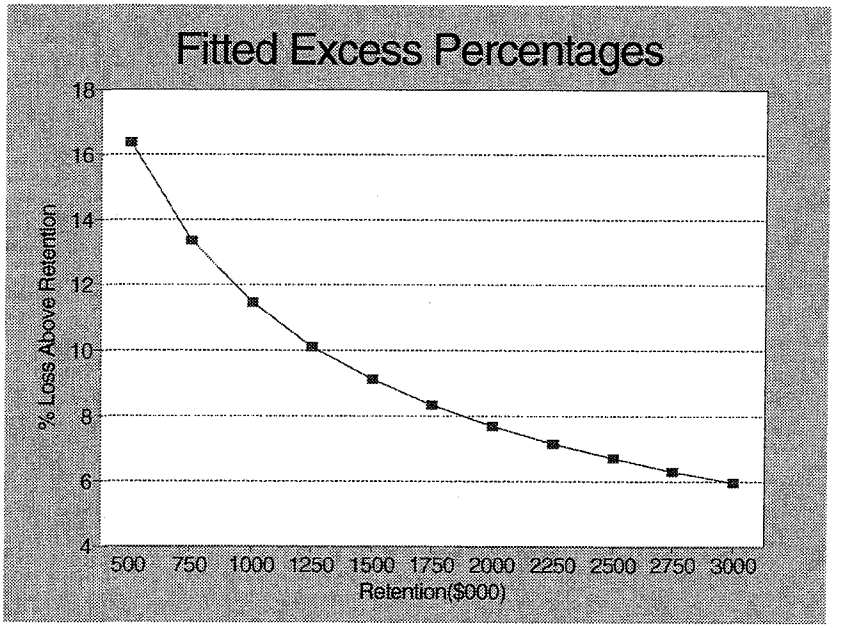
Claim Size

The long payout tail of workers compensation reinsurance is also associated with a heavy tail in the claim severity distribution. It is often useful to have an estimate of the percentage of total losses that are above various retentions. WCRB does not collect loss size information below the bureau retention, so does not have the full severity distribution. However, by relating total excess losses to estimated ground up losses of bureau members, excess percentages can be estimated. These can be compared to the implied excess percentages from a standard mathematical severity curve (the lognormal distribution) to get an implied severity distribution. The details of this are in the technical appendix.

The curve below shows the resulting excess percentages on an ultimate undiscounted basis. For instance, 6% of total losses would be expected above a retention of $3,000,000.

This is quite a bit higher than some other estimates may be, e.g., those based on National Council on Compensation Insurance (NCCI) excess loss factors. (It should be pointed out that NCCI factors are not intended for reinsurance pricing, although they are often used for that.) The main reason for the difference is probably the longer development period available for WCRB losses, and the recognition of the tail emergence.

On a present value basis, the excess percentages are substantially lower. Using the discounts above, they could be as low as 8.9% of the ultimate values. (It should be noted that the distribution shown was fit to retentions around $500K to $1.5M, and may not be applicable to very small or very large retentions. WCRB data suggests it may be reasonable for somewhat higher retentions, however.)



Rating bureau rates for workers compensation probably do not incorporate provisions for tails as heavy as indicated here, partly because their tail loss development is limited. The difference is small after discounting, however, which in effect implies that bureau rates are implicitly discounted to some degree.

Looking at individual large losses, there is now a single person case from 1957 projected to cost over $6M at ultimate (a carpenter from New York state paralyzed at age 22). This amount would have been quite unanticipated in 1957 when total industry workers compensation premium was $1.2B, and a loss like this would have added 50 points to the loss ratio of a writer with 1% market share, if fully

reserved. Application of inflation factors would suggest that such a claim occurring in 1993 could produce an ultimate cost close to $100M, although this may be overstated due to possibly different inflation rates applying to large losses. Nonetheless, losses of this magnitude point out the importance of adequate reinsurance coverage, especially for small carriers.

Claims tend to get larger over time not so much through inflation, but more through jumps to higher costs levels. This can happen either due to medical condition changes or loss of a low cost care provider, typically a relative. By tracking claims over time and seeing how often such jumps occur, estimates can be made of the number of claims likely to become large in the future.

To study this, claims were divided into four size categories:

1 Below $2M
2 $2-5M
3 $5-8M
4 Above $8M,

and further subdivided into open, closed, or unreported and fatal, permanent total with medical, or permanent total without medical. Costs are in 1992 dollars. A claim classified in a given cell one year can stay there the next year, or can move to some other cell. The probabilities for this movement (or non-movement) are called transition probabilites, and they can be estimated by past movements and used to project future distributions. The tables show how 1000 WCRB claims (excess say of $1M) would be expected to move over a 30 year period.

1000 Claims after 10 Years - 139.5 as yet Unreported						
	Fatal		PT No Medical		PT with Medical	
Size	Open	Closed	Open	Closed	Open	Closed
1	66.5	85.9	8.2	80.4	283.3	299.0
2	2.7	0	0.3	0.5	22.6	0.8
3	1.2	0	0.1	0	4.8	0
4	0.2	0	0.1	0	3.7	0.1

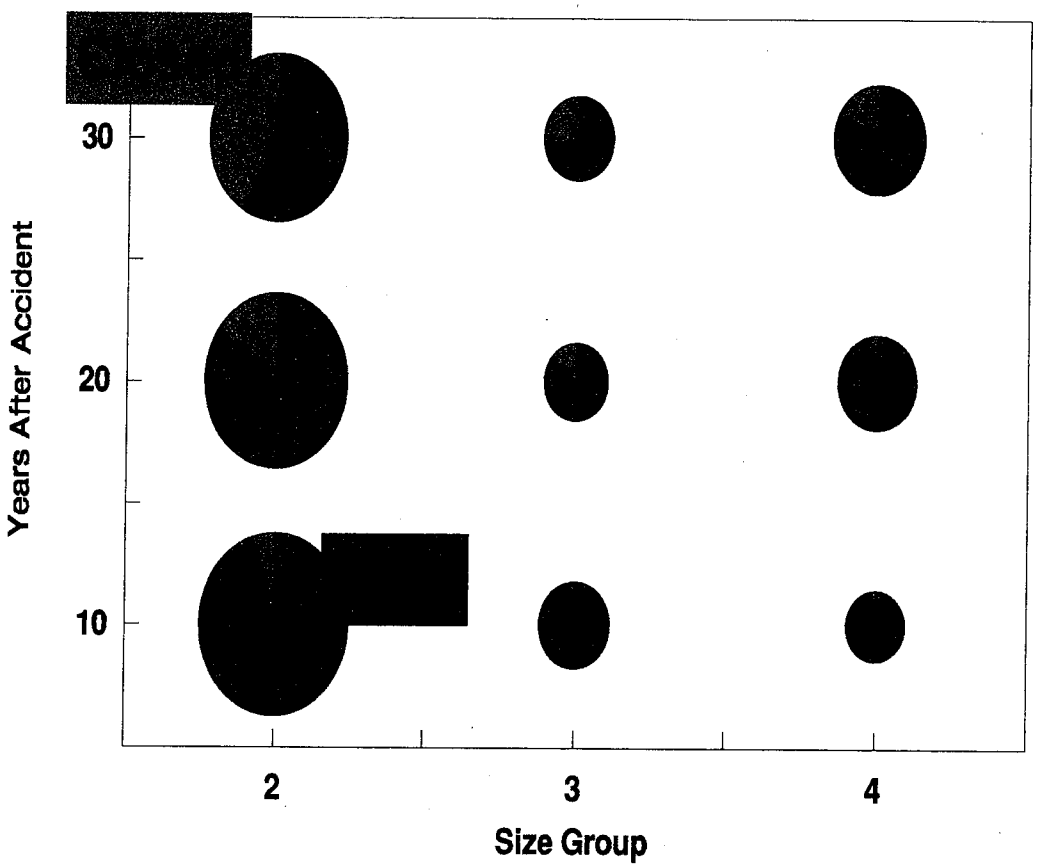
1000 Claims after 20 Years - 25.1 as yet Unreported						
	Fatal		PT No Medical		PT with Medical	
Size	Open	Closed	Open	Closed	Open	Closed
1	43.8	125.5	6.8	96.8	205.1	460.0
2	1.7	0	0	0.5	19.4	3.2
3	0.3	0.1	0	0	3.9	0.6
4	0.3	0	0.1	0	6.8	0.2

1000 Claims after 30 Years - 10.8 as yet Unreported						
	Fatal		PT No Medical		PT with Medical	
Size	Open	Closed	Open	Closed	Open	Closed
1	28.6	143.4	3.5	101.5	110.1	561.2
2	3.3	0.4	0.1	0.5	12.3	8.6
3	0.1	0.1	0.1	0	4.1	1.5
4	0.1	0	0.1	0	8.3	1.5

This shows a gradual drift to the larger claim sizes. After 10 years only 4 claims are over $8M, but this increases to 10 claims after 30 years. Again, these projections are greatly influenced by the inflation assumptions, as neither the actual impact of inflation on large claims over the last 30 years nor the inflation for the next 30 years is well known.

Size groups 2, 3, and 4 are shown in the graph. All claim types are combined, with just the open-closed breakout shown by the wedge and the relative number of claims in each group shown by the size of the circle.

Claims by Size and Development



Technical Appendix - Excess Ratio Estimation

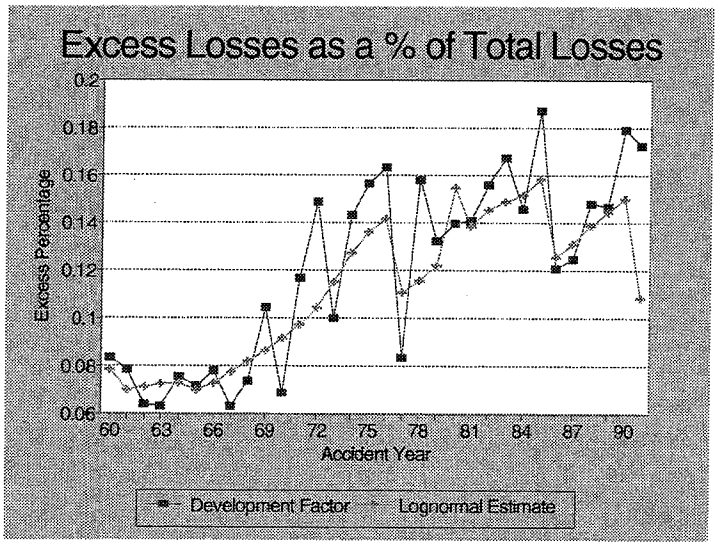
WCRB studies of workers compensation loss severity over fairly high retentions have suggested the lognormal distribution with $\sigma=3$ as a distribution function, i.e., $F(x)=\Phi[\ln(x/b)^{1/3}]$, where Φ is the standard normal distribution[1]. With this the mean is 90b and the portion of claims excess of a retention r is:

$$X(r)=1-\Phi[\ln(r/b)^{1/3}-3]+r[1-F(r)]/90b$$

Given estimated excess ratios from the development factors in the WCRB annual reserve review and ground up losses from WCRB members, and knowing the retentions r (in 1993 dollars), the parameter b can be estimated so that the theoretical and empirical excess ratios are as close as possible. Due to the changing nature of the workers compensation line, different b parameters were found appropriate for different time periods, as shown below.

Lognormal b Parameters for Selected Time Periods

60-64	65-71	72-80	81-85	86-91
2.3	4.3	6.7	13.3	7.6



The development factor and lognormal estimates are graphed at left. The excess ratio tends to increase as the retention, in fixed dollars, goes down, and drops when the retention increases. This does not explain the drop in 1986, however, which may be due to a transfer of the most hazardous business to the involuntary market pool, which is not reinsured by WCRB. The poor fit for the last two years is not vexatious, in that development estimates this new are erratic.

---

[1]This can be approximated to 7 places numerically by $[1-\Phi(x)]\exp(.5x^2)(2\pi)^{.5}=.319381530t-.356563782t^2+1.781477937t^3-1.821255978t^4+1.330274429t^5$ for $x>0$, where $1/t=1+.2316419x$.

Excess Ratios from Development Factors and Lognormal Distribution

Year	Retention	Factors	Lognormal
1961	700,000	0.078	0.070
1962	675,000	0.064	0.071
1963	665,000	0.063	0.072
1964	655,000	0.075	0.073
1965	1,300,000	0.071	0.070
1966	1,240,000	0.078	0.066
1967	1,120,000	0.063	0.073
1968	1,020,000	0.074	0.082
1969	935,000	0.104	0.086
1970	845,000	0.069	0.092
1971	760,000	0.117	0.097
1972	1,040,000	0.148	0.104
1973	875,000	0.100	0.115
1974	725,000	0.143	0.127
1975	640,000	0.156	0.136
1976	590,000	0.163	0.141
1977	935,000	0.083	0.111
1978	865,000	0.158	0.116
1979	785,000	0.132	0.124
1980	980,000	0.140	0.158
1981	1,225,000	0.140	0.138
1982	1,115,000	0.156	0.145
1983	1,065,000	0.167	0.148
1984	1,020,000	0.145	0.151
1985	935,000	0.187	0.158
1986	840,000	0.121	0.126
1987	775,000	0.125	0.131
1988	695,000	0.148	0.139
1989	645,000	0.147	0.144
1990	595,000	0.179	0.150
1991	1,100,000	0.172	0.108