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<TI>THE DEDI THEORY OF TRAFFIC ACCIDENTS: NOT GDP BUT M1, NOT SPEED BUT DISTRACTION

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<IN>*A*UTOMOBILES+*C*ONCEPTS+*E*NVIRONMENT*S*

<AS>Abstract: This paper has four major parts: a quick review of SAE Paper #970280 which analyzed expressway fatality rates in five European countries in the '70's and in which the Drivers' Economic Distraction Indicator (DEDI) theory was first proposed; data is analyzed for '70 to '95 for 11 countries (D, F, A, CH, I, NL, GB, USA, CDN, Japan and Australia) including the adverse effect of the political business cycle as seen in the Canadian data; supporting research is then reviewed and a new basis for international comparisons is suggested; finally, the implications of the DEDI theory for traffic safety in The Second Century of the Automobile are explored with special emphasis on what North America should learn from Europe.<AE>

<H1>1. Introduction

Those who refuse to study history are fated to repeat it.

Although it is to be hoped that deliberate personal or corporate bias will be absent from a technical paper it is comforting to know 'where the author is coming from'. While a transport officer with the RCAF in the '60's, including four years in France and Germany, the author received thorough training in accident analysis (following a British police model). Routine review of the chain of tertiary, secondary and primary causes of accidents leads one unwaveringly to the conclusion that, if 'the nut that holds the wheel' is often going to 'fall asleep at the switch' (figuratively, or literally) the vehicle speed at the time affects only the severity of the inevitable accident.

The decision to investigate the base data on trends in traffic accidents at the earliest opportunity grew out of the contrast between this training and the political emphasis, over the past few decades, on General Speed Limits (GSL's) as the solution to the menace of traffic accidents. Both curiosity and determination were intensified by the revelation in Reference 1 that Germany, without a GSL on the autobahns, had a better record than most countries with such limits.

As is usual in these matters, the 'earliest opportunity' came only with the author's early retirement (from the public service of Canada). A post-retirement trip to Europe was taken to get back into the automotive environment quickly by attending three major automotive conferences, including FISITA '96. The information and data gathered on that 2-month trip, including the experience of driving over 10,000km in seven European countries, (mostly on expressways) resulted in Ref.8.

<H1>2. Methodology

It being impossible to test theories with experiments (as in the 'hard' sciences) the research had to be done with 'epidemiological studies' - aka 'correlations' (as in the 'soft' ones). However, before concluding that even a strong correlation is evidence of causality, a researcher must remember that a good R^2 could mean only that A and B are both caused by an as yet unobserved, or at least unexplored, third parameter. (Sometimes the serendipidous sighting of such seemingly spurious siblings is the only way to 'see' an underlying cause.)

Correlations were therefore **investigated** in accordance **with the 3P (Plausible Physical Path) principle**. That is, a hypothesis was formed about the effect of a parameter, e.g. 'alcohol consumption per capita', on the annual expressway fatality rate and then the appropriate statistics were collated, graphed and examined for visual and, if found, mathematical correlations which supported or refuted the hypotheses.

The defining moment for GSL's came in the fall of '73 when most of Europe joined North America by imposing limits on their expressways (Italy not but including Germany, who removed the limit in March '74). Thus, this 'get re-acquainted' trip would also permit **in situ investigations** into inter-country infrastructure differences.

All of the data on accidents originates in a report by the on-the-scene police officer. Thus, it was decided that, in addition to **discussions with statisticians, professors and other 'desk-riding' professionals**, some time should be spent down 'where the rubber meets the road'. (OK, that's the last one, I promise.) That is, opportunities would be sought to **discuss traffic safety with expressway police** in order both to understand the data collection process and to benefit from their on-the-job experience to gain some insights into the main causes of traffic accidents.

<H1>3. Genesis of the DEDI Theory

To get a quick overview of SAE970280 [8] we will review four of the graphs presented therein.

Fig.1 (Fig.1b of [8]) shows the trend lines, indexed to 1973, of the Expressway Fatality Rate (EFR - per 10^9 vehicle kilometers travelled) for the five larger central European countries (extracted from the multi-country graph on p.7 of Ref. 2). One can see a general downward trend with a common, sharp, drop in the '73-'75 period. (Note especially the sharp spikes in the trendlines for CH, '71 & '76, and A in 1975. I thought they were data errors and resigned myself to the eventual expense of several long distance phone calls to get the correct numbers.)

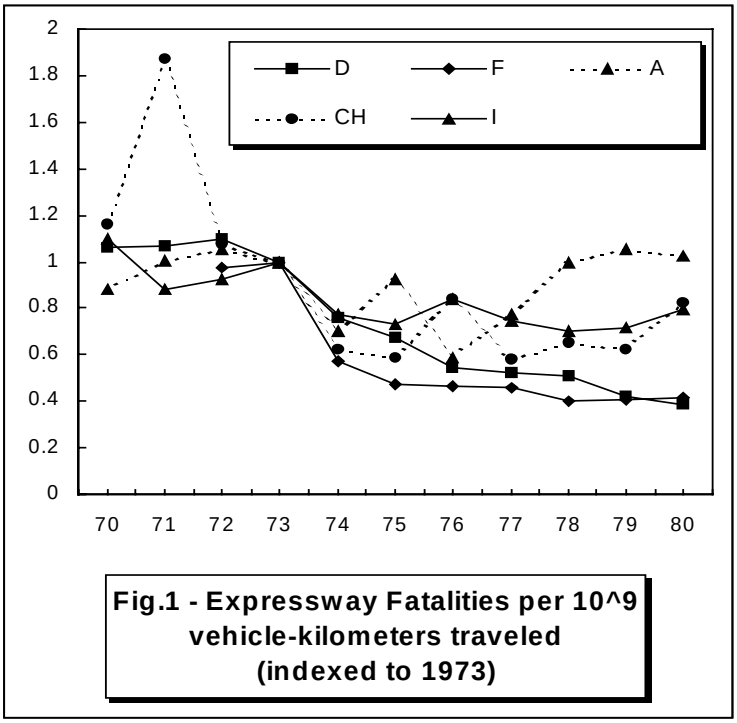


Fig.1 - Expressway Fatalities per 10^9 vehicle-kilometers traveled (indexed to 1973)

Since major changes to the physical infrastructure (the hardware) were not , and could not have been, put in place in a few months **we must find a parameter, and a 3P, which could change the average driving behaviour (the software that holds the steering wheel) of the whole population .... and in all five countries at the same time.**

The first and most obvious parameter change is the imposition of the GSL's. Because of the importance of speed in both accident genesis (available reaction time) and severity (energy considerations) the GSL's might have produced some reduction in '74. In looking at Fig,1 however, two points should be noted.

1. Two countries increased from '72 to '73 and three decreased, with one w/oGSL in each group,
2. All countries (including D&I, the two w/oGSL) show very large reductions from '73 to '74 (the fact that F shows the largest decrease may be attributed - Ref.3 - to the simultaneous imposition of a 'buckle-up' law).

The near-0 correlation with the imposition of a GSL in both points 1 and 2 means that either point taken alone would cast much doubt on the hypothesis that the GSL's produced all, or even most, of the observed decrease in the fatality rate. Taken together they destroy it completely. This leaves most of the observed reduction still to be attributed to an "as yet unobserved parameter, {*RAPPEL:* in all five countries simultaneously, ... and it can't be a decrease in traffic volume}.

<H1>3. Genesis of the DEDI Theory (cont.)

After investigating the two 'usual suspects' , alcohol and the young male driver, and discovering that they were not present at the accident scene, GDP was investigated with Fig.2 (Fig.4b of [8]), which examines the relationship between the EFR and GDP per capita (GDP/C - used here because it removes the effect of increasing population). [Note that the graph does not show the EFR trendlines but rather the percent change from the previous year. This is difficult to grasp visually (at least for me) but it is presented because it was the key to understanding what was 'driving' the EFR.]

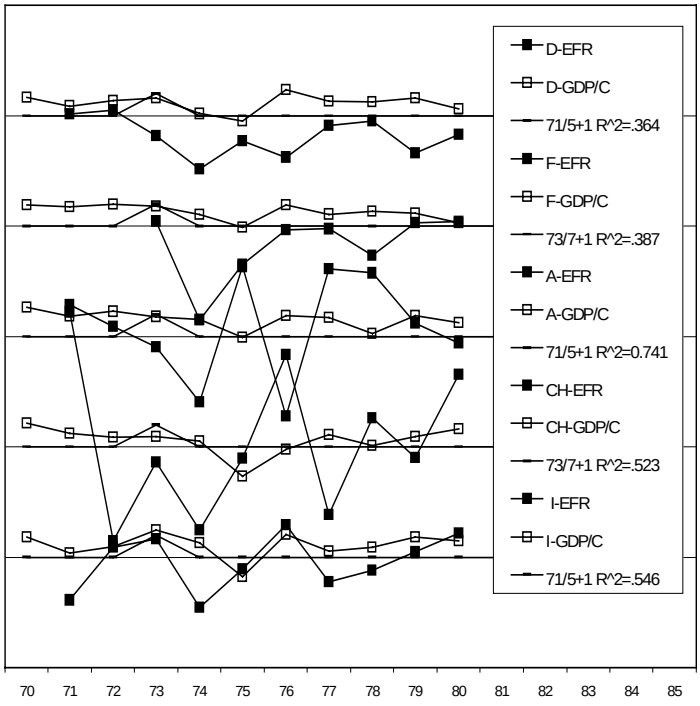


Fig.2 - Expressway Fatality Rate(%chg) and GDP/Capita(%chg)
(country lines are 50 units apart, '73 mark is raised 10 units)

When first done this graph used the EFR trendlines for each country, but the correlations, done on a percent change basis, came out low and/or negative, e.g. R^2 for A was minus 0.271. (and I very nearly cancelled the paper!) After graphing the %change it became possible to see that the %chg in EFR in most of the countries, but particularly in D, seems to be 'predicting' the %chg in GDP/C in the following year. The lagged R^2's range from +0.364 to +0.741 (with the latter Austria's!)

Reference 5 reveals that GDP responds a year or so later to money supply, [p.233, " .. the link ... is agreed to be subject, in Friedman's terms, to 'long and variable lags.'"]. The search thus went on to Fig.3 (Fig.5b of [8]) which shows the trend lines for the nominal money supply (M1 - nominal is used because, pre-stagflation, it would still have been perceived as 'real' by the business community) and the EFR. For the smaller economies the visual correlation is very good; even striking for the sudden jumps in M1 in the first part of the decade. The weaker response in the latter part, and that for D and F, can be simply explained by the entrepreneurs (painfully) gaining experience with 'stagflation'.

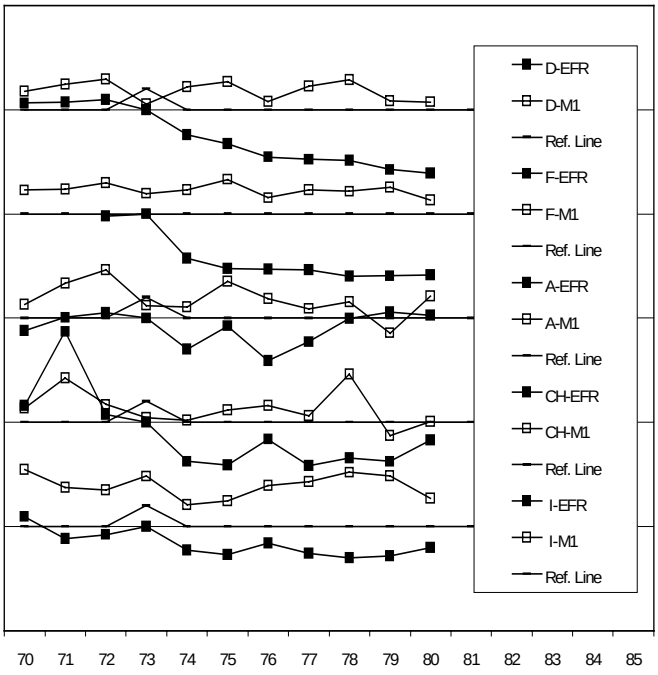


Fig.3 - M1(%chg) and the EFR: The Odd Couple
(scales adjusted for clarity; '73 mark is raised 10 units)

Perhaps the strongest support for a tight connection between the EFR and M1 is that the sharp, seemingly random, spikes in the EFR lines for the three smaller economies, correspond exactly with proportionate jumps in M1. (And I thought they were data errors!.)

Having been drawn, in the search for M1 data, to OECD's publications on 'Leading Economic Parameters' the research for Ref.8 found data for both the Nominal Interest Rate and .... New Car Registrations! These parameters also showed good correlations with the EFR. These pointed to some cause in the high investment part of the business cycle (which precedes the increase in GDP) .... but WHAT! The discussions with five expressway police officers (in D, F, A, CH and B) provided the final clue to the identity of the culprit.

Each impromptu interview (I just pulled off the expressway at the sign for the police station) began with a general discussion of traffic safety issues but **when we got around to the question, "Based on your 20-odd years of experience what, in your <u>personal</u> opinion, is the main cause of accidents on the expressways?" , every officer gave the same response, ... too little concentration on the driving task.** Since the 'Physical Path' between 'too little concentration on the driving task' and job-related stress (including, maybe even especially, euphoria as a stressor - when things are going really well we tend to have a lot of pleasant daydreams) in an over-heated economy is only too 'Plausible' we can now see that variations in job-related distraction are causing the wide swings in the EFR.

In an attempt to get a single number for the distraction level the several parameters were combined in a 'composite sketch' of the investment climate which would also be an indicator of the distraction level of the nation's drivers - **a Drivers' Economic Distraction Indicator (DEDI).**

Fig.4 (Fig.8a in [8]) shows that our 'back-of-the-envelope' creation has done well. The visual fit between DEDI and the EFR trendline is good in the early '70's and, on mathematical correlations, only CH is worse than the individual parameters. F could not be done with only two data points (but R^2 for '73-76 is 0.773).

<H1>4. THE DEDI THEORY: A SUMMARY

It is now time to summarize explicitly the postulates which make up the DEDI theory.

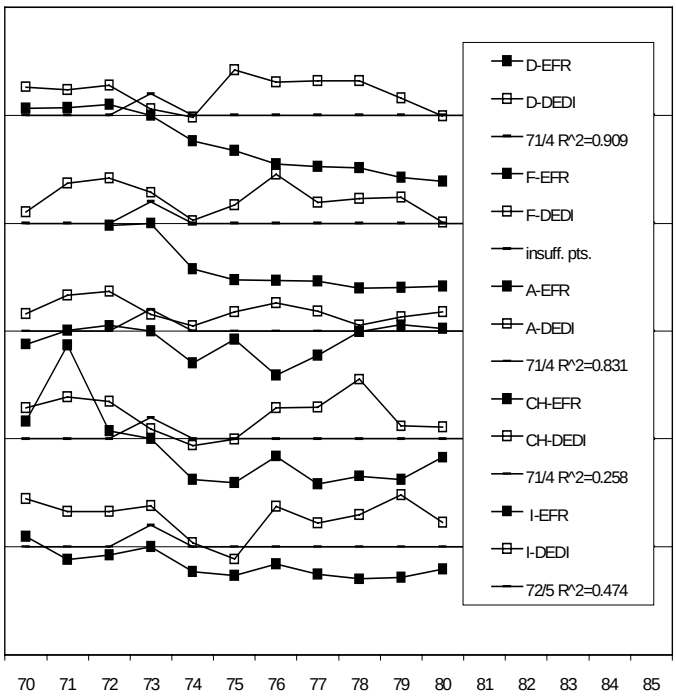


Fig.4 -The DED Indicator and the EFR
(scales adjusted for clarity; '73 mark is raised 10 units)

1. Most accidents occur because the driver's attention was distracted from the driving task.

2. There is an average level of distraction due to the trials, tribulations and triumphs of everyday life, <u>including the job-related ones</u>.

3. The level of distraction due to family and personal matters will 'average-out' over the whole population (except perhaps for the Xmas season).

4. Because of the business cycle the level of distraction in the whole population due to work-related matters will <u>not</u> average-out, but will certainly be higher during 'boom' times (and arguably lower than average during recessions).

<H1>5. A HIGH-AMPLITUDE RESPONSE

Why is the reflex response of the business community to unexpected M1 spikes so large and immediate? For the same reason that fighter jets are designed so unstable that drive-by-wire is not a luxury but a necessity - instability has survival value.

Lucas (Ref.5) does such an eloquent job on this point that I should not try to paraphrase him:
".... How can moderate cyclical movements in prices lead to the high-amplitude movements in durable goods purchases which are observed? Here again, one must insist on the minor contribution of economy-wide risk to the general risk situation faced by (economic) agents. For individual investment projects, rates of return are highly variable, often negative, and often measured in hundreds of percent. A quick, current response to what seems to others a weak "signal" is often the key to a successful investment. The agent who waits until the situation is clear to everyone is too late; someone else has already added the capacity to meet the high demand. What appears, at the aggregate level, to be a high-amplitude response pattern to low-amplitude shocks is, at the level at which decisions are made, a high-amplitude response to still higher amplitude movements in returns to individual investments."

This 'high-amplitude response' will not be limited to the 'money-men' and senior management. This sense of urgency, the excitement of a business expansion and the pressure to drive equipment (and people) to design capacity and beyond will permeate the whole company, right down to the shop floor (and out into the delivery truck) .... **and will be riding home with every employee** (along with the dreams of the promotions to be had in the new plant).

The extra mental effort and unpaid over-time, in the planning and construction stages of increasing production, will be invisible to the GDP statistician. Hence M1 spikes will affect GDP with 'long and variable lags' but will immediately drive the entire workforce to distraction ... and into accidents.

<H1>6. Other Countries

To examine what happened to M1 over the past 25 years Fig.5 was prepared. Note that, in the

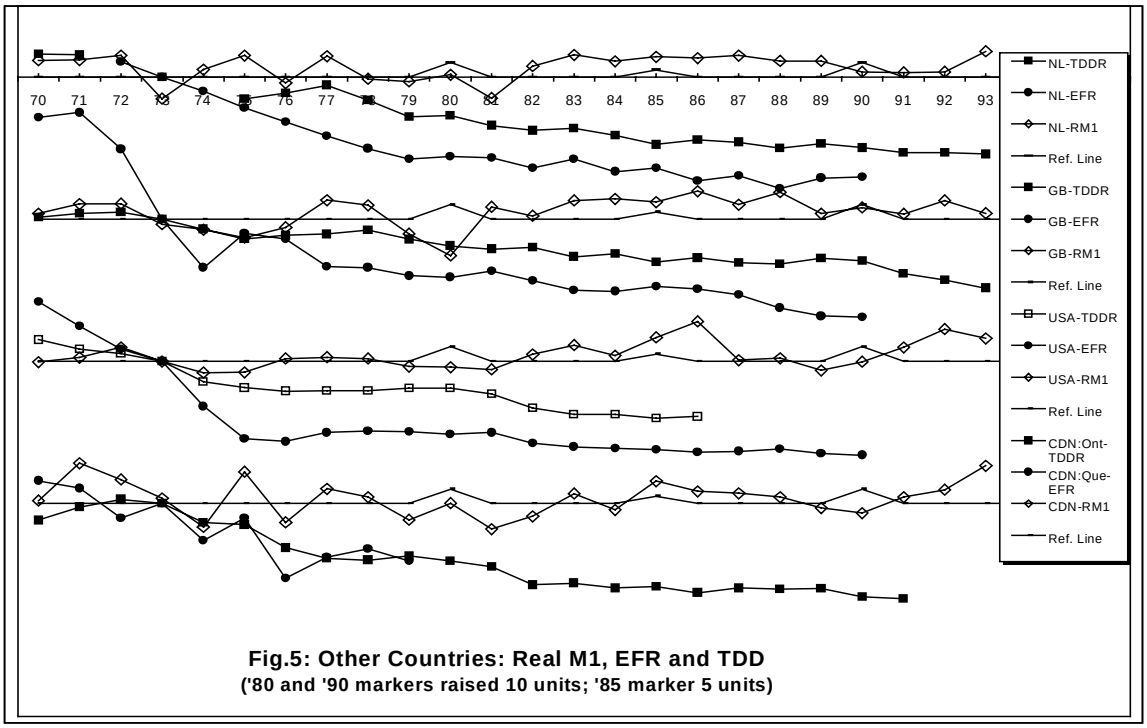


Fig.5: Other Countries: Real M1, EFR and TDD
('80 and '90 markers raised 10 units; '85 marker 5 units)

early '70's all four countries generally show the same tendency (as was shown for the five central European countries above) for M1 and fatalities to rise and fall together. The greater variability in the CDN EFR line is explained by the fact that the data is from only a few hundred kilometers of expressways in Quebec.

In the U.S. M1 shows generally lower variability (larger economy? ... or does the Fed really rival the Bundesbank in economic management?). In '86 the absence of a response in the fatalities line to the spike in M1 may be that the M1 spike coincides with high activity in the stock market (speculative funds getting measured as M1 while in transit from stocks to bonds and back?)

In the smaller economies M1 volatility is distinctly lower in the later years (governments finally getting a grip on stagflation?) with no obvious visual correlation to TDD or EFR. A possible exception being '82 to '90 in NL where a subtle up/down cycle in the M1 line seems to be reflected in the EFR line. (see para 13. below)

<H1>7. From EFR to TTDR

{*RAPPEL:* You are now leaving the autoroute and should adjust your driving accordingly.}
(an exit sign seen on E25 north from Strasbourg)

In every country the fatality rate on expressways, in spite of higher speeds, is vastly lower than that on other roads. It is thus necessary to see if the DEDI theory can help us understand, and thus ameliorate, the large number of accidents on the entire road system. Fig.9a of Ref.8 showed that Total Traffic Deaths correlated very well with the DEDI but this may have been because of traffic volume changes. (A correlates with B only because C correlates with both.)

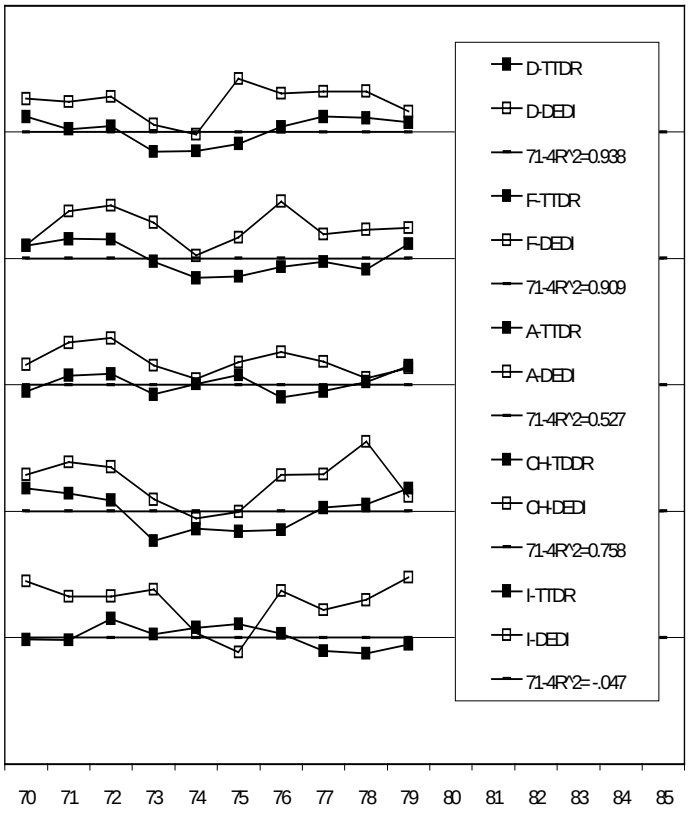


Fig.6-The DEDI and the Total Traffic Death Rate*
***per MTOE in road vehicles; %+or- 20yr trendline**

Although almost all countries keep track of the total number of deaths in traffic, VMT data is often not available for current years and hardly at all for the '60's and '70's. However, the International Energy Agency (IEA) publishes energy balances for OECD countries since the '60's and includes fuel consumption by road vehicles in their statistics. It is thus possible to remove traffic volume changes, at least to a first approximation*, by dividing annual deaths by annual fuel consumption to arrive at a Total Traffic Death Rate per million tonnes of oil equivalent. Fig.6 is the result for the original five countries studied. **[*It is true that the fuel consumption of vehicles of all types has been cut by around 1% per year for the last 30 years. However, we are not interested here in the absolute value of the TTDR, nor in the relative values between countries, but only in the year-to-year variations in the trendline for the TTDR in each country.]**

The result is very good for the DEDI theory. The visual correlation is good for all countries, spectacularly so for D, and the R^2 for the early '70's (shown in the legend) is strongly positive for all countries except Italy. [Italy was often the 'problem child' in the research for Ref.8. This was usually because the business community seemed to react faster, without Friedman's 'long and variable lag'. In Fig.6, using the TDDR line as a surrogate for business planning activity and shifting it one year forward, it seems that the business community knew a full year in advance what the government was going to do with M1 and the interest rate. I wonder...?]

<H1>8. Different Continents, Same Humans

All of the fatality rate trend lines seen to this point have a significant downward slope which is indicative of the massive effort at passive safety made by vehicle and roadway construction

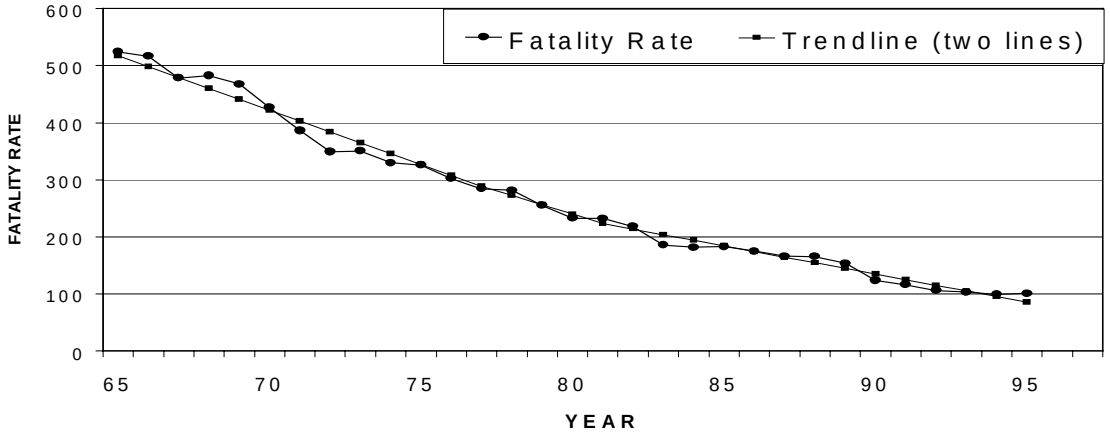


Fig.7a - AUSTRALIA: Traffic Fatality Rate* 1965-1995
*per MTOE consumed in road vehicles
(2 regression lines are used to account for a higher rate of technical change in '65-'75 period)

engineers. It does however make it difficult to see correlations with economic parameters which are normally expressed as '% change per year'. In Fig.6 we have already used the technique of calculating a regression line for the fatality rate and then 'plotting the residuals' along a horizontal axis. (The reader should contrast the lines for D in Figures 4 and 6.)

<H2>8.1. Australia

This is illustrated for Australia in Figures 7a&b.

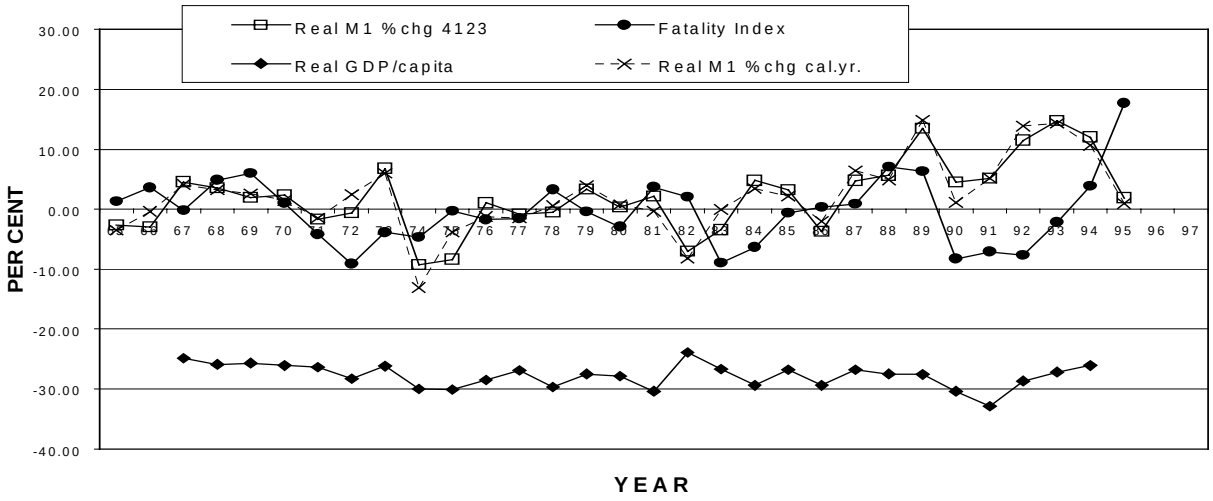


Fig.7b- AUSTRALIA: Real M1* and Traffic Fatality Index**
*AnnAv4123, yr/yr %chg; **% +or- 30yr trendline(fatalities/MTOE)
For clarity the 0-line for GDP has been moved to the -30 line

The technique is really quite intuitive. From Fig.7a the value of the regression line for each year is subtracted from the actual fatality rate for that year (above is positive and below negative) and the result plotted, as a per cent of the regression line value, in Fig.7b. The visual correspondence of the M1 line (% change per year) with the fatality index line (% above or below the technology driven trendline) becomes quite striking. [Some interpretation is still required. At first glance one 'sees' the '72 point for M1 as being an increase over '71. In fact since it is below the 0-line it actually represents a second straight year of decline for M1 and thus corresponds very well with the fatality rate dropping even further below the trend line; the same can be seen in '81-'83. On the economist's 'other hand' the converse situation occurs in '84-'85 when two years of solid M1 growth bounces the business community out of the recession only to have their balloon burst in '86 by a 4% decline in Real M1 (on a 1-quarter advance basis – see **4123 Works Better** below)]

<H2>8.2. U.S.A.

From Australia we come back across the water to the U.S.A. To give the reader more confidence in the use of 'energy consumed in road vehicles' as a surrogate for 'vehicle kilometers traveled' in calculating a fatality rate we will present both for the U.S.

<H3>8.2.1. Fatality Index from MTOE

Fig.8a presents the U.S. fatality rate per million tonnes of oil-equivalent over the past 30 years or so. The recessionary period in the mid-'70's is clearly visible. [In all these graphs two regression lines were used to take account of the higher rate of technical change in the '65-'75 period; with a 3-year, straight-line transition chosen to give the 'best-fit' to the fatality rate data points.]

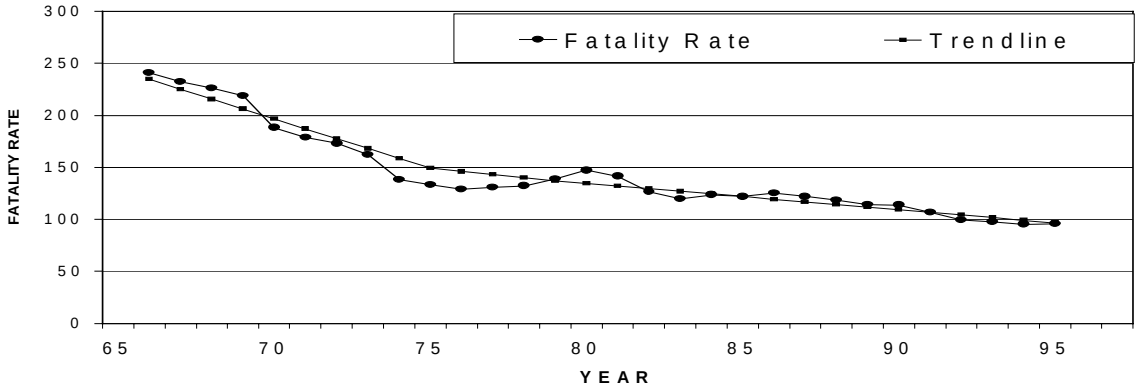


Fig.8a - USA: Traffic Fatality Rate* 1965-1995
*per MTOE consumed in road vehicles
(2 regression lines are used to account for a higher rate of technical change in '65-'75 period)

In Fig.8b we have once again 'plotted the residuals' along with the annual percentage change in Real M1 .... and have added a line showing the residuals for the fatalities/10^8VMT (which turns out to be in very good agreement with the energy consumption line).

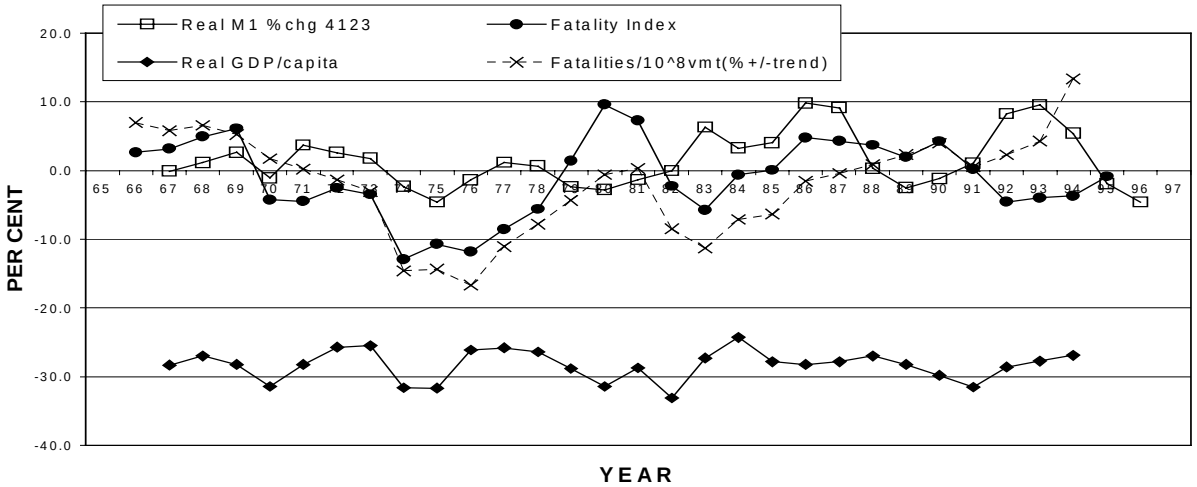


Fig.8b - USA: Real M1* and Traffic Fatality Index**
*AnnAv4123, yr/yr %chg; **% +or- 30yr trendline(fatalities/MTOE)
For clarity the 0-line for GDP has been moved to the -30 line

Here again the M1 line must be carefully interpreted. The '76 point is a further *decrease* in the money supply and the '77 and '78 points are very small increases from a very low level of M1. The decreases in M1 in the following few years, as well as the increase in the fatalities is probably because the business community financed a mini-boom with equity money(see para 9.4 below).

<H3>8.2.2. U.S.A., NYS & Colorado

To save space the trendlines for the fatalities per VMT for the states of New York and Colorado are shown together with the trendline for the entire United States in Fig.9a (by raising two of the lines so they wouldn't fall all on top of one another).

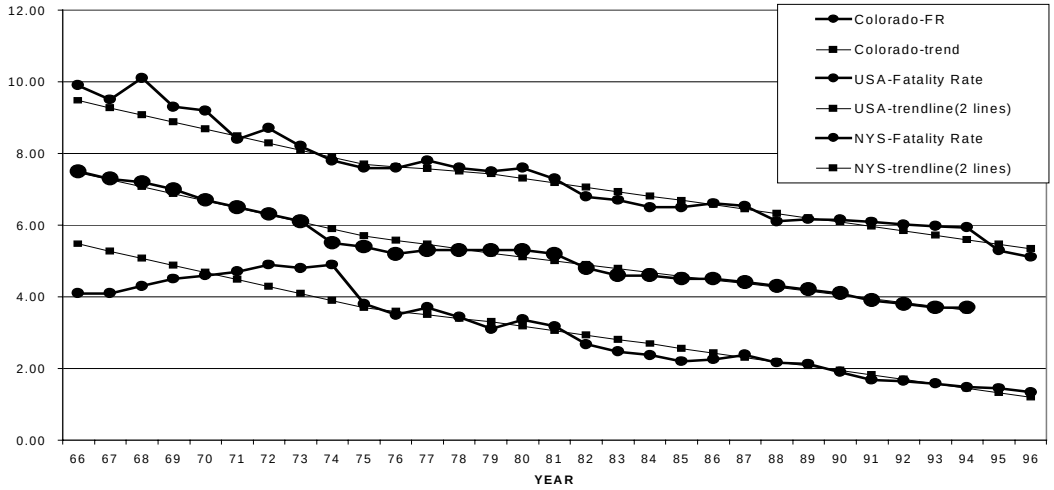


Fig.9a - FATALITY RATES* & TRENDLINES: NYS, USA and Colorado(top)

***fatalities per 10^8VMT**

(USA & Colorado lines have been raised 2 and 4 units resp.)

This arrangement, however, also lets us see that, in spite of a good concordance in the trend lines for each region, the variation about each trendline varies greatly in timing and amplitude. This is magnified in Fig.9b where the residuals are plotted with Real M1 for the U.S.

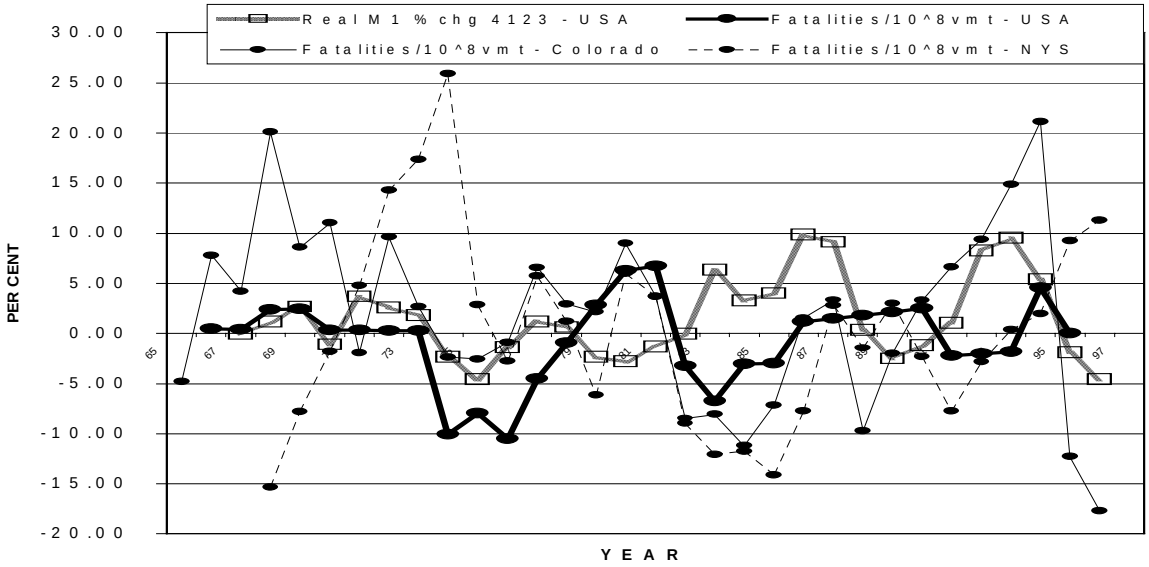


Fig.9b - USA (with New York & Colorado): Real M1* and Traffic Fatality Rate**

***AnnAv4123, yr/yr % chg; **% +or- 30yr trendline**

This graph is the first strong indication that, if the DEDI is going to be useful in explaining local trends in accident rates, it will have to be created from local economic conditions. This should not be difficult since the regional motor vehicle sales will undoubtedly track the investment climate very closely.

<H2>8.3 JAPAN

Across the waters again to see a truly extraordinary trendline for the fatality rate - Fig.10a.

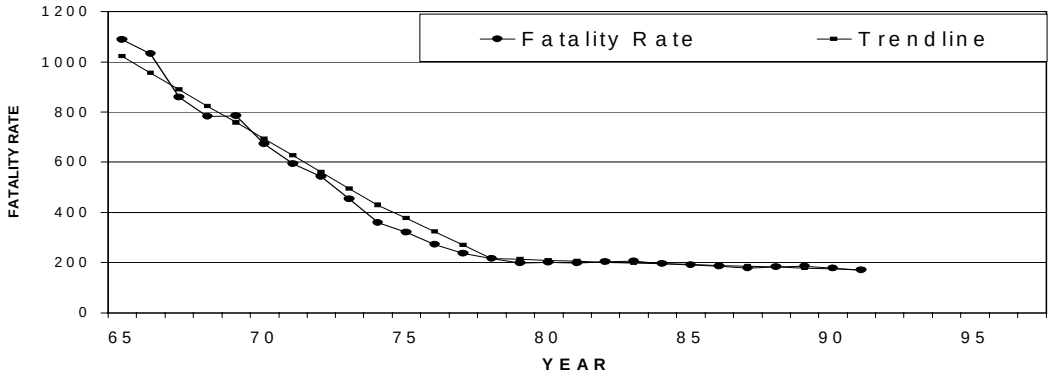


Fig.10a - JAPAN: Traffic Fatality Rate* 1965-1995
*per MTOE consumed in road vehicles
(2 regression lines are used to account for a higher rate of technical change in '65-'75 period)

Whatever could have caused that tremendous drop from ’65 to ’75? There are a number of candidates. There was a large increase in the ‘passive safety’ of the cars. There was probably a massive increase in limited-access roadways. Moreover*, the rate of change of average fuel consumption for the whole fleet was both strong and in the right direction, i.e. upward, that the use of a fatality rate based on fuel consumption might well have contributed to the steepness of the trendline in that period. [*he hastens to add, before someone else does]

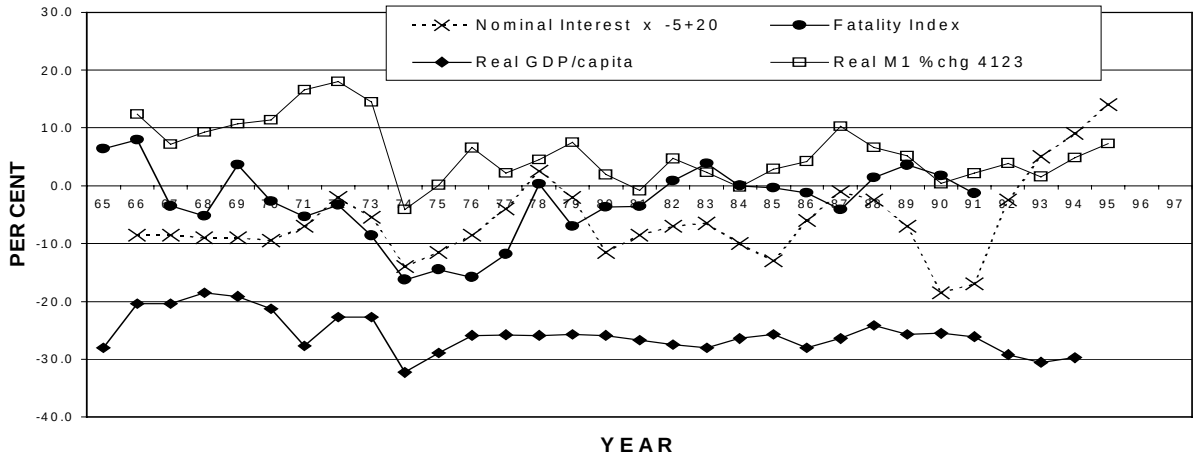


Fig.10b- JAPAN: Real M1*, Nominal Interest (inverted)
and Traffic Fatality Index***
*AnnAv4123, yr/yr %chg; **Short term, times -5 plus 20;
***% +or- 30yr trendline(fatalities/MTOE)
For clarity the 0-line for GDP has been moved to the -30 line

As we can see in Fig.10b, however, the DEDI can’t be ruled out. The sudden switch of the M1 line from ‘high and wild’ to ‘narrow-band’ growth is rivaled only by the Canadian data (which we will see next) but they got there ten years before we did. Moreover, the business community may have seen it coming. A regression on the GDP/capita line during that period would have the right (negative) slope to indicate a serious cooling of the investment climate.

Before leaving for Canada you should note that the Nominal Interest Rate, after inversion and suitable scaling/translation, does a better job of hitting the local peaks (’72, ’78 and ’83) in the fatality rate line than does the ‘Real’ M1. For non-economists, the ‘nominal’ number is the one those dead drivers would have been looking at in their newspapers back then. The ‘real’ number is calculated afterward when the economists know what the inflation ‘really’ was.

<H2>8.4. CANADA

This can be quick. After such a world tour the only surprising thing would be if Canadians somehow showed a different on-highway response to off-highway economics. A few more economic parameters will be explored so don't skip it.

<H3>8.4.1 The Same (Distractable) Humans

Figures 11a&b show the same rise in fatalities in the early '70's boom, and the same drop in the mid-'70's recession, as we have seen in all the other countries. In addition you should note the large variability in M1, fatalities and the GDP line until '83 and the much lower variability thereafter, ... in all three lines. This will be discussed in detail later.

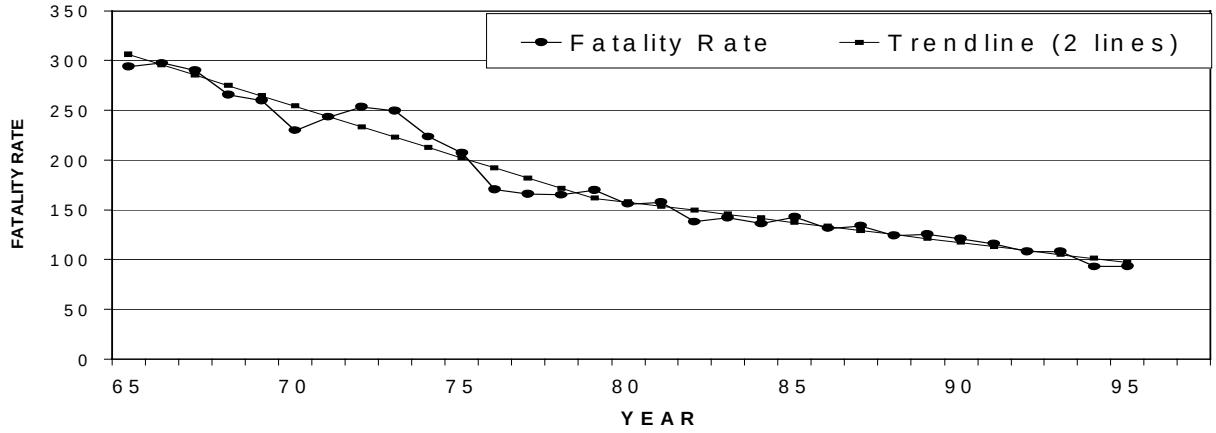


Fig.11a - CANADA: Traffic Fatality Rate* 1965-1995
***per MTOE consumed in road vehicles**
(2 regression lines are used to account for a higher rate of technical change in '65-'75 period)

To show the commonality of the economic and highway experience the U.S. fatalities line (residuals plot) is repeated in Fig.11b.

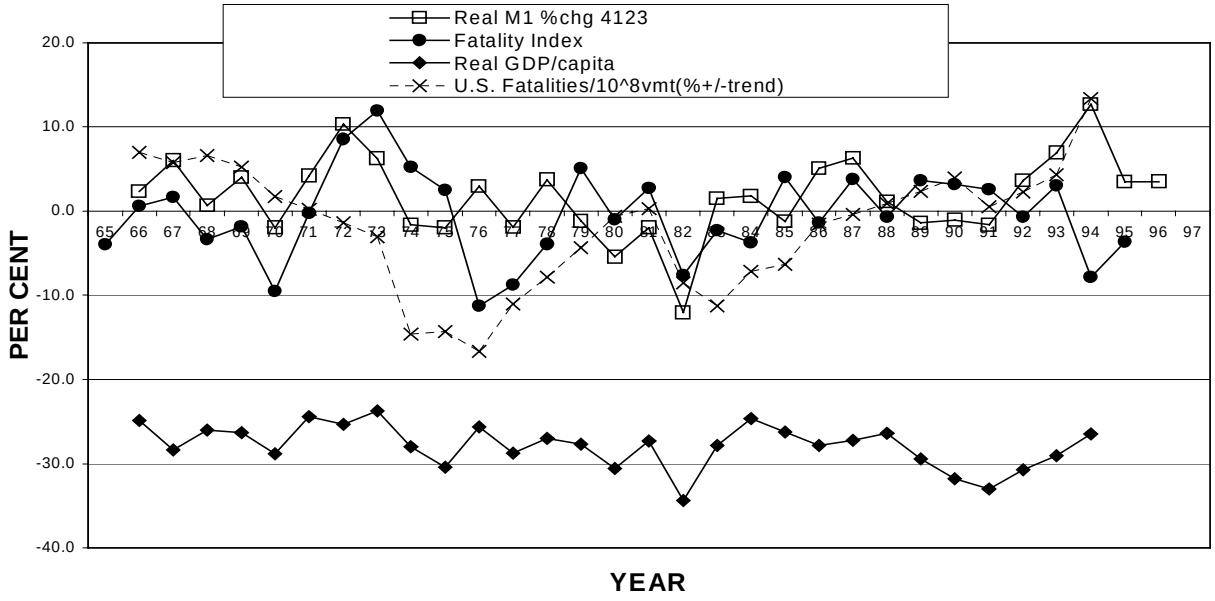


Fig.11b - CANADA: Real M1* and Traffic Fatality Index**
***AnnAv4123, yr/yr %chg; **% +or- 30yr trendline(fatalities/MTOE)**
For clarity the 0-line for GDP has been moved to the -30 line

<H3>8.4.2. Economics and Accidents

In Fig.12a the Nominal Interest Rate (NIR) and New Vehicle Sales (NVS-% change from previous year) have been added. This gives us three 'leading economic indicators' plotted with the variation of the fatality rate about its trendline. Were it not for the big black dots put there so you could pick it out, the fatalities line would merge with the other three lines. **They all move together.**

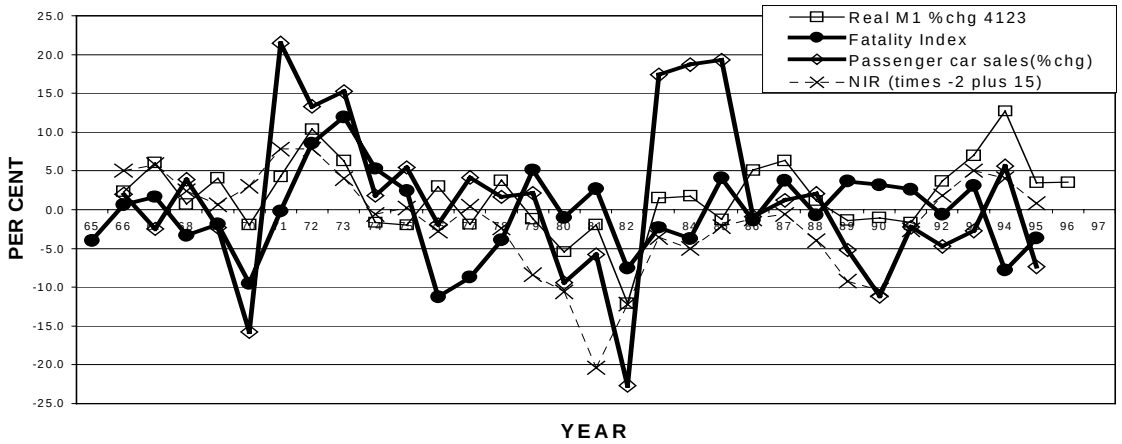


Fig.12a - CANADA: ECONOMICS AND ACCIDENTS
Real M1*, Nom. Int. (inverted), New Vehicle Sales*** and Traffic Fatality Index******
***AnnAv4123, yr/yr %chg; **Short term, (times -2 plus 15); ***%CHG(yr/yr)**
******% +or- 30yr trendline(fatalities/MTOE)**

In Fig.12b an attempt was made to combine these three, with the GDP and the U.S. M1, in a Canadian DEDI similar to the European one used in Figs. 4&6. Although it works well into the late '70's, the changing micro-economics (see 9.4 below) make it rather pessimistic thereafter.

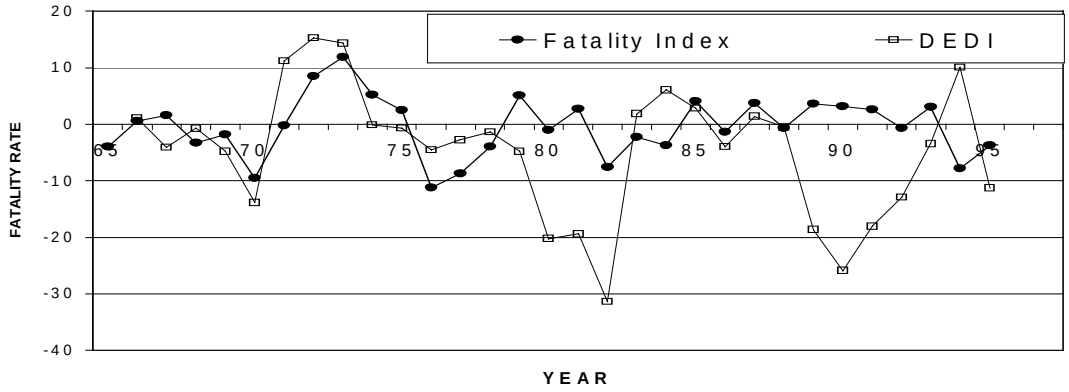


Fig.12b - CANADA: The DEDI* and theTraffic Fatality Index 1965-1995**
***0.5[NM1]-NIR+GDP+3[ln(NVS)]+0.5[USNM1](lagged 1yr)-6;**
****% plus or minus 30-year trendline**

Before moving on to the discussion it seems timely to repeat here one of the comments made in Ref.8 under the title, "OUTRAGEOUS OBSERVATIONS".

"**Dentists cap theirs, surgeons bury theirs but government economists (and/or their political bosses) see their mistakes recorded in blood on the nation's highways.**
[It's no wonder they call it ...'the dismal science']"

<H1>9. Economics & Accidents (On and Off the Highway)

Now that we have had a quick tour of the globe, and found the same good correspondence between 'leading economic parameters', especially M1, and the accident rate* in every country on our route, it's time for a review of the economics which create such swings in the 'investment climate'. {**RAPPEL*: We are dealing with the number of fatalities per distance traveled and thus the correspondence cannot be attributed to changes in traffic volume with the ups and downs of the business cycle.}

<H2>9.1. The 'Friedman Flatspot' is ... *Confirmed*

Ref.8 predicted that, with the fatality rate up sharply in boom times and severely depressed during recessions, a plot of the DEDI against changes in the fatality rate would produce a 3rd degree polynomial curve. The inflection point in such a graph was named the 'Friedman Flatspot' because it would be created when M1 and the economy were both making steady progress following his recommendation for 'narrow-band M1 management' and (thus) strict inflation control. Ref.8,"...this neutral point should be .... neither boom nor recession, and the level of distraction would 'average out' .... and DEDI would fade into the 'background' level of distraction."

This can in fact be seen in the graphs for Australia, the USA*, Japan and Canada from the '60's through to the '80's. When M1 is up or down by large amounts the fatality rate follows quite well but when M1 is in Friedman's 'narrow band' the relationship deteriorates, with the fatality rate moving randomly within + or – 5% or so of the trendline. This interpretation is reinforced in Canada ('85-'93) and the US (the '80's) when governments in both countries were known to be at least attempting to follow Friedman. [*The lesser correspondence in the USA is explained in 9.3 below.]

Further support can be found in the expressway data for the five European countries. Fig.8b of Ref.8 showed a linear regression with an R^2 of 0.792 for DEDI with the % change in the EFR (data from all five countries in the years '71-'74). When the author used that same data set to plot the DEDI against the cube root of the % change in the EFR the R^2 moves to 0.935.

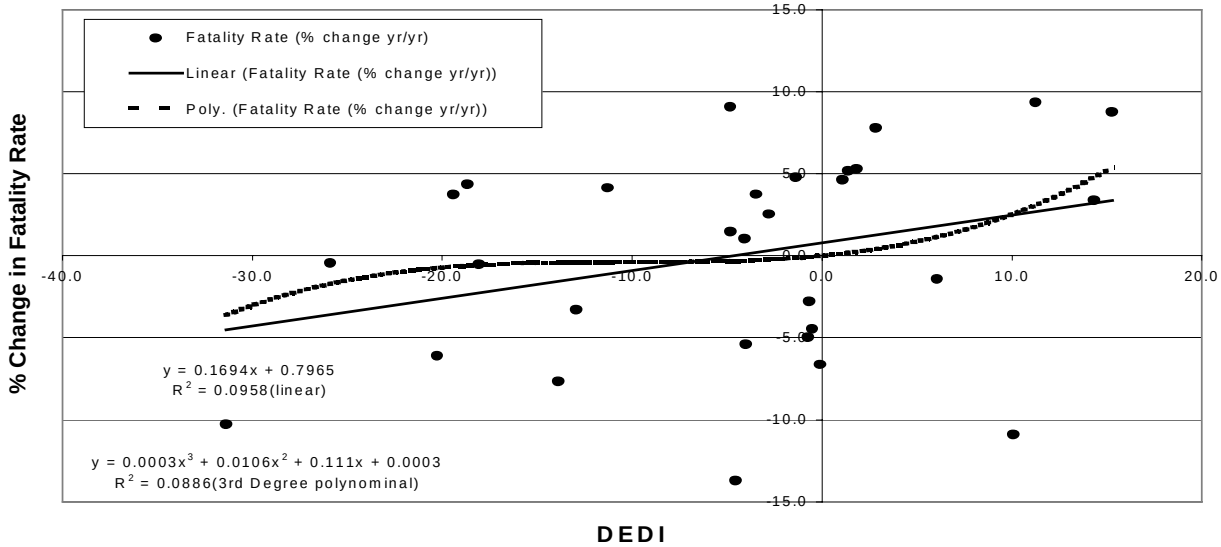


Fig.12c - CANADA: DEDI vs Fatality Rate* - '66 to '96
(*% change yr/yr)

Fig.12c above provides the 'icing on the cake'*. When the full 31 years of data were tossed in (without 'massaging' of any kind) and a regression, polynomial, 3rd degree requested, the computer produced the predicted curve! [*rather thin icing actually, given the R^2 of 0.1.]

<H2>9.2. GDP: The Objective of It All*

[*A one minute course in macroeconomics. Pay attention! There will be questions.]

The underlying interest in things economic, by politicians as well as economists, is that the 'Gross Domestic Product' should increase steadily (all workers, including the new ones, are happily employed), without ever decreasing (many workers, especially the new ones, are unhappily unemployed).

After the economic debacle of the '30's, Keynes suggested that governments could plan their budgets to save in good times and spend heavily in bad times, thus keeping more of the people happy more of the time. About the time that politicians began to understand the full implications (see para 13 below) of Keynes' concept, along came Friedman to point out that the 'long and variable lags' between such actions and their results meant that no human could possibly get the timing correct. He also predicted that governments with the hubris to try it anyway would very probably make the business cycle more, not less, variable.

A brief study of the interplay of M1 and GDP for all four countries (Figs.7, 8, 10 and 11) shows that Friedman has the correct view. The Canadian graph (Fig.11a) is particularly telling .... and ironic. In the period up to '83 when governments were trying to 'manage' the economy (by fiddling with the fiscal and monetary 'levers') the GDP line looks like no one is in control of this vehicle. After '83, when governments were eschewing 'GDP management' in favour of getting and maintaining control of inflation, the GDP line looks as though someone was trying to smooth it out – even as the 'vehicle' runs smoothly (following the U.S) into the recessionary ditch and back out without a lot of damage. **Viewing the fatality rate line as a reflection of what was in the minds of economic agents (all levels) it is easy to see that the first period reflects 'turmoil' and the second 'tranquil progress'.**

The questions* are, "What's wrong with boom times? Aren't we just making progress faster?"

[*You can't say I didn't warn you!]

With the answer being, "**In the tumultuous 'boom times' all the accidents don't happen on the highways .... many of them happen in the boardrooms of the nation.**"

In the hurry-up atmosphere of 'getting the product to market before the competition' mistakes are made which lead to plant closures and bankruptcies and unemployment and .... recessions. These things mean a vast waste of resources, human and otherwise .... and, if it is a falsely-high boom (caused perhaps by mismanagement of the money supply?), both the intensity of the turmoil, and the losses, are larger. Many of these losses can be avoided with steady, business-as-usual progress. [After reviewing a pre-print of Ref.8 Professor Robin Neill, of the University of Prince Edward Island, emailed back that economists,"... have a number of reasons for wanting to smooth out the advance of the economy. You have supplied another."]

<H2>9.3. Inflation Matters

Although we have, up to this point and because of large questions of comparability, carefully avoided inter-country comparisons (of absolute levels of fatality rates) there is some evidence in the data that the turmoil caused by high levels of inflation raises the fatality rate. Table 1* has been prepared to show this correspondence between M1 and the rates of inflation and fatalities in nine of the countries studied so far. (*in two parts, one deals with EFR and the other TTDR)

Table 1: Ranking of M1, Inflation and Traffic Fatality Rates (avgs.1973-79)

Part A: EFR (fatalities/10^9vkmt) Part B: TTDR (fatalities/MTOE)

Country	Nom M1	Inflation.	Fatalities		Country	Nom M1	Inflation	Fatalities	Adjusted*
I	18.8	16.3	23		Australia	10.5	12.1	280	196
A	11.9	6.3	18		Japan	9.7	10.0	360	180
F	9.0	10.7	15		Canada	8.9	9.2	160	176
G	8.7	4.7	13		U.S.A.	6.5	8.5	135	135
CH	5.5	4.0	7		*relative to US to account for differing average weights of vehicles; Canada higher because of cold weather fuel consumption & heavier mix				

The correspondence is quite stunning with the only anomaly being a suspiciously low rate of inflation for Austria. It is difficult to avoid the inference that, after we have accounted for the year to year variability with the DEDI, the random distraction causing the remaining accidents still has economics as a major component .... and the higher the inflation the higher the accident rate

<H2>9.4. M1: No Longer a "Leading" Role?

In the '60's and '70's M1 was measuring investment activity at an early stage in the business cycle, i.e. as the money was borrowed and before (most of) it was spent - perhaps slightly less effectively in the U.S. where a larger part of investment capital was already coming from the public stock market than was the case with the 'closely held' corporations in Europe. Also, in those pre-inflationary times, households and the small-retail sector probably did all of their transactions in accounts that would be measured as M1. Thus, changes in M1 measured the ups and downs of the interplay between consumer spending and business investment very well and it was useful as a 'leading economic indicator'.

However, necessity is the mother of invention and sky-rocketing inflation in the late '70's and early '80's made innovative financing, using equity instruments which don't get measured as M1, very necessary. In North America industry managed, over 15 years, to reverse the loan/equity ratio of their financing from 75% plus in loans to 45% and declining. It also became worthwhile for industry, the retail sector and even households to make the effort to minimize M1 holdings, in favour of term deposits and other M2 accounts.

As an example of this trend the DEDI used with the EFR in Europe in the '70's(Figs.4 and 6) has M1 entered at full value (both domestic and foreign - the latter lagged 1 year) and thus weighted at about 60%. In the Canadian data on the other hand the same good visual correspondence was only obtained with an M1 weighting of about 40% (by entering the M1's at half value – see formula in Fig.12b). Even at that the correspondence is good only until the mid-'80's.

<H2>9.5. Future Work: Do We Need a New DEDI?

At this point the DEDI in the '70's combined with The Police Report in the present (see below) point clearly to the need to redirect traffic safety resources away from such ineffective measures as speed limit enforcement and toward programs to reduce distraction/inattention. In that sense the DEDI has done its duty and, in view of its inability to cope with recent developments in microeconomics (para 9.4.), might be honourably retired, without further attempts at refitting it.

There are, however, two good reasons to refit the 'good ship' DEDI to better conform with economic realities in the 'Second Century of the Automobile', with particular attention to short-range (both time and distance) operations.

Firstly, research into the effect of traffic safety measures can no longer be credibly done without some attempt to account for variations in economic distraction over the study period**. To ignore such, now obvious, human psychology aspects is to run a very grave risk of completely misinterpreting the results of the research and then implementing further programs which will, once again, fail because they run counter to .... human psychology.**

Secondly, if a region-specific DEDI could be created from metropolitan-area data (since the various regions of a country progress at varying rates and schedules) a large quarter-over-quarter increase* might give a timely signal to intensify accident prevention programs. [*in per capita leading indicators, i.e. as the title of this paper indicates "not GDP (or employment) but M1(or something like retail sales of computers and cars)"]

<H1>10. Further Support for the DEDI Theory

As the research progressed on the data for the graphs presented above a number of supporting studies, anecdotes and observations came to the author's attention.

<H2>10.1. Encouraging Observations

Some of these items were self-generated.

<H3>10.1.1. The Police Report (again)

As mentioned above Ref.8 reported on impromptu interviews with traffic police in five central European countries. All the interviewees pointed to inattention as the major cause (alcohol excluded) of traffic accidents. This unanimity (of personal opinion) has now been extended to officers in 8 different forces (no names, I promised.) after interviews with provincial/state traffic police in North America. [Since 8 is not a large number perhaps I should mention that I am only counting the first officer I talked with. The total number is now rising past 20 without meeting a single one, active or retired, who would seriously argue against the statement that, alcohol excluded, accidents are caused by inattention.]

<H3>10.1.2. 4123 is Better

After beginning work on this paper (and initially finding weaker correlations) it was discovered that the M1 data that was used in Ref.8 was calculated as "% change from Dec31 to Dec31". Such 'end of period' accounting characterized the previous 360 days with whatever M1 happened to be in the final week of the year. Fortunately Bank of Canada staff responded promptly to a cry for help with quarterly data (still 'end of period') from which a more representative annual average could be calculated and the correlations improved greatly.

With the quarterly data available the temptation to investigate how much lag there was between M1 going up and the increase in traffic accidents* was too great to resist. [*the time, as it were, for the news of the economic boom to travel from the boardroom to the emergency room] Calculating an annual average from the last quarter of the previous year with the first three of the target year (4123) produced a significant improvement. For example, in the Canadian data – Fig.11b – the correlation (Rsquared) over the 10 years '66-'75 moved from 0.83 to 0.92! Although 3412 was better than 1234 it was not as good as 4123 which was used thereafter.

In moving from country to country this comparison was made and 4123 was also better in the U.S. and Australia (whether using Real or Nominal M1) but not in Japan or in Europe. This suggests that physical proximity propagates 'boom fever" rather than the announcement in the media of a change in the Treasury Bill rate.

<H2>10.2. Corroborative Studies

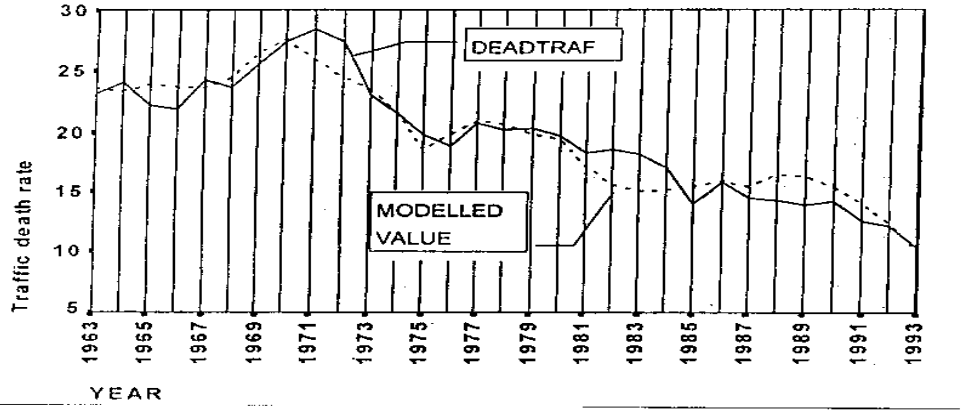
With only a preliminary search a number of studies and reports were found which, in some aspect of the research, provided anecdotal support for the theory that most accidents are caused by inattention/distraction. The following two papers, however, provide completely convincing corroboration of the DEDI theory. (Although the research for all three papers was being done almost simultaneously it was being carried out in three different 'environments' so the researchers were unaware of each others work until after publication.)

<H3>10.2.1. Switzerland: Economics and Accidents

In Ref.10 Wilde and Simonet have modeled the traffic fatality rate per 100,000 residents using an index of industrial production and two measures of employment levels. The correlation is very good (see below) with the modeled values being within 5% of the actual values for 20 of the 31 years reported in this longitudinal study ('63-'93).

REPRODUCTION (with permission) OF FIGURE 1 FROM REFERENCE 10

Figure 1:
Modelled and actual values of the traffic death rate (DEADTRAF) per 100,000 residents, 1963-1993



The corroboration of the DEDI Theory comes from the following observation. **In every one of the 11 years where the 'gap' between modeled and actual values is greater than 10% the incorporation in the model of the M1 value for that year would act, in the correct direction and approximately proportionally, to eliminate that gap.** (while being neutral in other years)

Indirect support for distraction as the cause of traffic accidents comes from Fig.4 in this study in which the line for the "NON-TRAFFIC DEATH RATE" is shown with the "TRAFFIC DEATH RATE". After mentally adjusting for the improving trend in traffic deaths due to technology in the '70's and '80's the two lines correspond very well. There are however 6 'local peaks' in the non-traffic line: '66, '71, '74, '83, '87 and '91-'92. Those peaks occurring in the recession years '66, '74, '83 and '91-'92 (Real M1's -2.6, -5.4, -1.7 and –7.4 & -0.4 respectively – compare with Friedman's target range of +3.5 to +5.0) are attributed by the authors to higher rates of suicide and homicide in recessions. The Real M1 values for '70-'72 are +2.1/+11.0/–1.1 and those for the three years '86-'88 are –0.4/+7.9/+0.9. This indication that an over-heated economy causes accidents both on the road and off (as we all try to do too much in too little time) thus lends some interesting statistical evidence in support of the adages:

"Haste makes waste!"
"Plus on s'hate moins on avance!"
and
"Eile mit Weile!".

Before going on to the next study it should be noted that, in speculating on, "... how the effect of the economy on the rate of traffic death and damage is mediated.", the authors quoted a study of U.S. data by Wilde (1994), "Increases in employment seem to be associated with more road mobility per head of population *and* with more road deaths per mile driven. So, during bad economic times people reduce the distance they drive, and when they drive, they drive in a more cautious manner." (italics in original – see also **10.3. Explaining the Heretofore Unexplainable**)

<H3>10.2.2. Toronto: Cellphones and Accidents

Ref.8 called for,"A long term study .... focussing only on tertiary causes and only on 'material damage' accidents (to avoid the short term memory loss associated with the trauma of personal injury)." Ref.11, published 10 days *before* Ref.8, is just such a study!

Redelmeier & Tibshirani studied the use of cellular telephones in the 5, 10 and 15 minute periods before a 'material damage only' accident. They concluded that, "The use of cellular telephones in motor vehicles is associated with a quadrupling of the risk of a collision during the brief period of a call. Decisions about ....".

However, the Abstract also noted that,

- "... (cellphones) that allowed the hands to be free .... offered no safety advantage over hand-held units ....;",

and, in the body of the report (p.455), the authors note that,

- "The average duration of the calls was 2.3 minutes, and 76% lasted 2 minutes or less (similar to cellular-telephone calling patterns elsewhere...".

Combining the latter two quotations makes it abundantly clear that **the problem is not absent hands but absent minds.**

Given the current public controversy over the use of telephones in vehicles this report would be remiss if it did not finish quoting their ***Conclusions*** here, "... of a call. Decisions about regulation of such telephones, however, need to take into account the benefits of the technology **and the role of individual responsibility**." (emphasis added)

[Curiously, the authors never mention how many of the drivers were actually engaged in a telephone call at the time of the collision, perhaps there is a legal liability inherent in such an admission.]

<H3>10.3. Explaining the Heretofore Unexplainable

The basic test of a new scientific theory in an existing field of study is whether or not it is able to explain everything that the old theory (or theories) were explaining **in a simpler manner and/or with fewer postulates*.** That is often a very subjective judgement. For example 'cutting someone off' is often currently called "aggressive driving" which implies a deliberate decision to impose one's will on others, a "Me first and to hell with you!" attitude. The observed action may however have been done after the other driver awoke from a pleasant daydream, discovered himself in the wrong lane for his intended route and simply pulled right without looking and thus should be called "distracted driving". Which of these 'theories' to explain the observed behavior would best survive Occam's Razor? It's a matter of opinion.

It ceases to be a matter of opinion, however, when the new theory, in addition to explaining everything that the current theory explains, is able to explain observations which none of the previous theories can explain.

Between the ages of 16 to 26 the male of the human species has the best eyesight, the best eye-hand coordination and the fastest reaction time that he will ever have. Yet, even after the effects of alcohol are removed, he also has (on average) the worst accident record he will ever have.

Examine for a moment the period within the business cycle in which the traffic fatality rate is the highest. It is not when the new plants have been built and are busy filling the trucks which then fill the highways on the way to filling the new retail stores which are busy filling the new houses which are being busily built. It is when the planning, dreaming and scheming is being done to create the new plants and the new retail stores. It is not when the new foreman is spending his new salary on one of the new houses but when the two prime candidates, and four other not-so-prime candidates, are <u>all</u> day-dreaming about getting the promotion. It is "not GDP but M1".

The analogy with planning a life during the ages of 16 to 26 is striking. Those are the years in which the male is seeking a life-partner, getting the training for that 'dream job', applying for that all-important first job, getting the 'dream car' .... "Honey, we're pregnant!!!" In short they are the high-distraction years. After 26 he switches to a more defensive mode, protecting what he's got. And that's exactly the mindset which promotes 'defensive driving'.... and a good accident record.

Ref.10 provides some solid support for this explanation. After noting (p.20) the large under-prediction of traffic deaths in the years '71 and '72 and being unable, ".... to suggest a plausible explanation ..." the authors mention, without discussion, "Additional inspection of the data revealed that the underestimation of the actual death rate in the years 1971 and 1972 was .... *particularly pronounced in the age groups 15 through 19 and 20 through 29."* [*italics* gleefully added]

The explanation, while beyond the powers of expert traffic researchers working with 'the conventional wisdom', is both simple and obvious with the DEDI Theory. Business in Switzerland was booming. Over 5% Real GDP growth in '69 and '70 and the relative scarcity of young people entering the workforce had forced the government to permit more 'Gastarbeiters' into the country in '69. M1 went through the roof in '71. France and Germany were also booming. Opportunities for jobs and promotions were everywhere. A situation of which daydreams are made....and many of the young people woke up from those dreams in the hospital ....or not at all. [QUESTION: How many of these young people would be alive and well today – and contributing to the GDP – if they had been told, often and forcefully, that ,"DISTRACTION Kills" rather than, as they probably were, "*SPEED* Kills"?

<H1>11. Comparing Countries: Some Immodest Suggestions

Just prior to driving that 10,000km on the expressways of Europe in the spring of '96 the author drove 3000km on U.S. & Canadian expressways (Ottawa, Washington, Detroit, Ottawa – within 6 days) and has since covered an estimated 5,000km of expressways (much of it three times) on trips to Detroit and Nova Scotia.

<H2>11.1. A New Measurement for Comparisons

Traveling those kilometers, mostly with vehicle safety on his mind, has led the author to the conclusion that the traffic conditions on the expressways on the two sides of 'the pond' are so disparate that comparing fatality rates on the basis of vehicle-kilometers traveled does a gross injustice to the traffic safety programs in Europe, and is inadequate even within Europe.

In the comparison that is often made the German Autobahns and the American Interstates have very near the same rate per VKmT, which is in fact fatalities per traffic volume. Basing the comparison on traffic density, i.e. fatalities per VKmT per total *lane-kilometers* of roadway, would probably show that the Autobahns were much safer than the Interstates. Although, because Germany has added a 3rd and even a 4th lane in many places on the Autobahns that would not be classified as intra-urban expressways, this is not a foregone conclusion.

We should however go one step further, at least for expressways. The vast majority of accidents on expressways occur in association with the interchanges. Presumably there is readily available data on the number of interchanges on any given expressway. Dividing the density rate by the number of interchanges would give us something much closer to the theoretical ideal - a fatality rate per *interaction opportunity.*

Because speeds and thus fatalities go down as traffic density goes up, such a statistic would probably be unjust to the North American safety programs*. The solution might be to do a dozen or more countries on the 'traffic density ' basis, establish a regression line for fatality rate against traffic density and then compare countries on the basis of their percentage distance from the regression line. The German organization BASt (Bundesanstalt fuer Strassenwesen) has the data and the qualified research staff. Maybe they could be persuaded to carry out such a comparative study. [*A quick calculation from 1992 data switches the German and the U.S. fatality rates from 22 and 15 on volume to 14 and 96 on density.]

Of course given the strong influence of the business cycle on the fatality rate revealed above, both the development of the regression line and any subsequent comparison would have to be based on data from 'neutral' periods in the cycle.

<H2>11.2. What North America Should Learn from Europe

Europeans have been living for years with traffic densities, particularly on their expressways, that we in North America have yet to experience, except on a very local and short-term basis. It only makes sense to try to learn from them, their mistakes as well as their successes, rather than be 'fated to repeat' their experience. Space and time limits the following comments to Germany and France.

<H3>11.2.1. Germany

There *are* speed limits on large sections of the German Autobahns. And, in contrast to here and in other European countries (where 15-20 km/hr over is the norm), they are obeyed. This is not for fear of radar traps but because they are set at speeds which 'feel right' to an alert driver. For that reason they have a very effective "Rappel effect". One learns to trust them. The mental reaction is that maybe the person who put that limit sign there knows something about the road ahead that you don't. The road is talking to the driver - in stark contrast to the 'dumb' sign for a general speed limit which only tells you something you've heard a thousand times.

In a rather perverse confirmation of this, the Germans do *not* strictly obey the noise-protection speed limits. Since they are labeled as such and thus clearly not safety-related (but merely a bureaucratically imposed nuisance) the Germans go 15-20 km/hr over as do the drivers in countries imposing GSL's.

The German police, not being constrained by a GSL and its requirement for radar traps, are using video monitoring, both stationary and mobile, to catch bad driving in the truly dangerous places, places which are (thankfully) recognized by all police forces, GSL or not, as too dangerous for a conventional radar trap. Germany is also making very effective use of electronically variable speed limit signs. The computer collects data on such things as traffic volume, visibility, precipitation, temperature and then puts up a legally enforceable speed limit (and some of the signs contain photo-radar). Early results indicate a 3-5 year payback based on reduced accident costs.

<H3>11.2.2. France

Germany is widely recognized as having the best roadway signage in Europe, for consistency, clarity and for being there when you need it. France is not far behind in that regard but seems to be following a 'softer', more personal and thus more effective, approach when alerting drivers to highway hazards.

Since at least the '60's they have been using the word "RAPPEL" – a reminder or, in the military, a call to order – in their road signs. This seems to implicitly recognize that the true safety hazard on the highway is driver distraction. The impression one gets is that the traffic authorities, and thus the police, are not 'ordering you about' but working with you for safer highways. The road is talking to the driver.

<H1>12. Distraction and Traffic Accidents: A Solution *Can* be Found

Adage: A problem well stated is a problem half solved.
Al's Corollary: A problem *badly* stated will consume tonnes of resources without *ever* being resolved.

<H2>12.1. The First Half of the Solution: Define the Problem Well

The DEDI Theory has now proven itself in 11 countries around this planet of ours. Moreover, in showing that economic distraction accounts for the major swings of the fatality rate about the technology trendline, it is now clear that mental distraction is second only to traffic volume in the generation of accidents. Thus it is now time to admit that the traffic police are correct and come to the following **conclusion**:

The major traffic safety problem is the mentally distracted driver.

<H2>12.2. The Second Half of the Solution

The second half of the solution will take a little longer but need not take more than the first few years of the 'Second Century of the Automobile'. A good start can be made with the following actions.

<H3>12.2.1 Economics and Traffic Safety

At the political level governments must finally recognize that 'fiddling with the economic levers' only distorts the true market signals and thus, at best, can only create an unsustainable boom. The increase in traffic deaths, which we have now seen always accompanies a false boom and while tragic in the extreme, is only part of the wealth thus wasted. In short governments should cancel Keynes and follow Friedman and thus return the money to neutrality in the marketplace ... and thus in traffic safety.

<H3>12.2.2. Courteous Driving

At the individual level the best means the author has found to avoid long periods of daydreaming at the wheel (I call it 'going on autopilot'; the Belgian police officer called it 'la conduite instinctive') is to move to the 'top level' of driving. As in a computer game, at the beginner's level you are learning to drive the car but that quickly becomes 'automatic'. The second level is 'defensive driving' and, while entertaining, can eventually be done with 'half your brain'. The top level, 'courteous driving', involves being aware of every car on the road with you and trying to place your car, in time and space, in such a manner that you facilitate whatever the other drivers are trying to do. Courteous driving can never be done with half a brain and thus the tendency to 'go on autopilot' while you sort out a business problem, or dream about your daughter's wedding, is greatly reduced.

<H3>12.2.3. The Road Should Talk to the Driver

Traffic safety professionals have always known that the biggest safety problem was 'the nut that holds the steering wheel'. Now they have the information to take to the budget meetings and get the money for the anti-distraction programs that they have always wanted to implement.

Traffic police should be an excellent source of advice on local safety policy. However, the democratic division of powers between the regulators, the judiciary and the police make the necessary 'frank' discussion unlikely. A panel of retired officers would not have the same reticence about challenging the 'conventional wisdom' and thus should make an effective advisory panel for the elected official responsible for road transportation.

<H1>13. The 'Political' Business Cycle

[For reasons which will become obvious this section is placed 'below' the conclusion.]

While doing economics research to better understand the mechanics of the business cycle the author came across this interesting section in Ref.9. - Lipsey et al (6th Ed. p.660):

"**A political business cycle.** As early as 1944 Polish-born Keynesian economist Michael Kalecki warned of a political business cycle. He argued that once governments had learned to manipulate the economy, they would engineer an election-geared business cycle. In pre-election periods they would raise spending and cut taxes. The resulting expansionary demand shock would create high employment and good business conditions, which would bring voters' support for the government. But the resulting inflationary gap would lead to a rising price level. So after the election was won, the government would depress demand to remove the inflationary gap and provide some slack for expansion before the next election.
" This theory invokes the image of a cynical government manipulating employment and national income solely because it wants to stay in office. Few people believe that governments deliberately do this all the time, but the temptation to do it some of the time, particularly before elections, may prove irresistible."

In Fig.13 we see the same graph which was shown earlier as Fig.11b but here the years in which there was a federal election have been marked with an X on the –10 gridline.

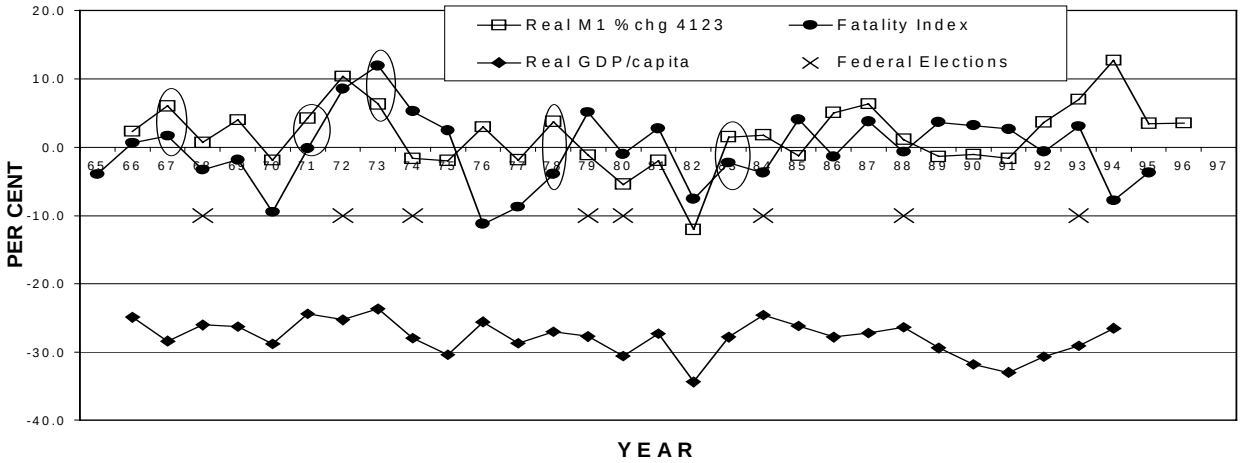


Fig.13 - CANADA: Real M1*, Traffic Fatality Index and Elections**

*AnnAv4123, yr/yr %chg; **% +or- 30yr trendline(fatalities/MTOE)

For clarity the 0-line for GDP has been moved to the -30 line

As was discussed in paras 9.1 and 9.2 above, the large fluctuations seen in both M1 and GDP up until 84/85 and in M1 after 93/94 show a Keynesian government trying to 'fine-tune' the economy. During the 'Friedmanites' period in office, however, both lines have a much calmer, more ordered appearance. The graph is thus strong evidence that Friedman is right in insisting that governments should try to maintain M1 in a 3 to 5% range and, with the automatic stabilisers (such as employment insurance) in most developed countries, the economy will look after itself.

From looking at the pre-election years it would seem that Keynesian governments have a very low resistance to the temptation postulated by Ref.9. Five times out of five* they reached for the fiscal and/or monetary levers in the year preceding an election to artificially raise M1 and thus, hopefully, lower unemployment during the election campaign**. Five times out of five also the fatality rate is higher than the previous year**. The GDP line indicates that they don't even have the excuse that they were trying to cure a recession ... in all five cases real GDP growth was positive. [*They were not the incumbent government for the 1980 election.]

In the two elections in which the 'Friedman following' government were incumbent there is a relatively high M1 but data in the Bank of Canada Review indicate that the fiscal and monetary levers seem to have remained locked in the 'narrow M1 bandwidth' positions*.

[*Society has found use for forensic engineers, biologists and auditors ... and, quite recently, for forensic geologists. Now it seems we have need of forensic economists?]

<H1>14. Future Work: FISITA and Traffic Safety

Traffic safety, particularly technology and programs to combat distraction, could benefit from the work of FISITA members on two fronts.

<H2>14.1. The Technical Front

To illustrate the possibilities of electronics helping us with distraction I have to pose a question to the male readers. How many times has your wife stopped in mid-sentence, looked at you accusingly and said, "You're not listening to me!" I suspect that the answer is "Often!" Now, how did she know? You were looking right at her but she knew you were really 'dans la lune' as the French say.

Obviously we will never have a video camera and computer with the sensitivity of a human female (honed by thousands of years of dealing effectively with difficult males). However, maybe we don't need that level of sensitivity. Maybe there are some clues that the video could pick up.

Several papers at FISITA'96 in Prague reported work on detecting the drowsy driver. Some of that technology could be relevant. Several firms are now working on electric-assist steering which can only function if it is able to detect small inputs from the driver. The possibility is clearly there.

Given the possibility of eliminating about 90% of vehicle accidents I would hope that this paper would act as a spur to the development of a DDD – Distracted Driver Detector.

<H2>14.2. The Systems Front

In the first century of the automobile the traffic safety field was occupied by civil engineers (with few being members of FISITA societies) while mechanical, latterly electronic, engineers designed the vehicles. However it is our customers who are driving the vehicles and our customers who are becoming the fatality statistic. Fatality statistics do not buy cars. In the 'Second Century of the Automobile' FISITA members should, in their respective countries, open a dialogue with government traffic safety professionals (perhaps using SAE's G/I Meetings as a model) with a view to taking a systems approach to future traffic safety programs/policies.

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Mr. Gullon retired from Environment Canada in February, 1996 to establish ACEs. Immediately prior to retirement he had spent five years managing a program which assisted small business in the development of innovative recycling technology. His work experience includes about a decade each as a motor transport officer in the Canadian military, as the chief of motor vehicle emissions for Environment Canada and, latterly, in various technical management positions with that department. He has separate (by ten years) science and engineering degrees and, in his off-hours over the past decade, has been nosing around in economics. He may be contacted at

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