The More Precise the Pricing Model, the Harder It Becomes to Test Whether the Market Is Efficient

— Testing "the market is efficient" always requires a pricing model, so when a test fails there are $k+1$ suspects: the k components of the model and efficiency itself — the separator is whether the pricing model has been fixed — [Paper 708]

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— *From thinking to syncing.* —

Abstract

Whether the market is efficient is treated as an empirical question. But testing it requires a pricing model, and when the test fails the blame cannot be divided.Counting where the blame can fall shows that a better model dilutes the principal suspect.No new theorem or law is claimed. First, there are always at least two suspects——a model of k components makes $k+1$ suspects, counting efficiency itself (Section 2). **Second, and this is the core. A better model makes efficiency less likely to be the culprit——from 0.500000 with one factor to 0.090909 with ten, a factor of 0.181818** (Section 2). **Third, with three factors it is already exactly a quarter——0.250000 at $k=3$, the common case, where the principal suspect is one in four** (Section 2). **Fourth, there is more than one way to count——counting whole subsets gives 0.533333 at $k=3$, which is 2.133333 times the other count** (Section 3). **Fifth, dropping the model makes the probability one, and makes the test impossible——1.000000 at $k=0$: there is one suspect only because no case has been brought** (Section 3). **Sixth, the separator is whether the pricing model has been fixed——only once it is fixed does a result say anything about efficiency** (Section 4). **Keywords**: efficient market hypothesis, joint hypothesis, Duhem--Quine, assignment of blame, pricing model, convention in counting.

Scope of this paper (scope note): **No new theorem or law is claimed——that market efficiency can be tested only jointly with a pricing model is standard (Fama 1970, Campbell et al. 1997).No empirical claim is judged——nothing is said for or against any real market or any particular study.No model is chosen——which factor model ought to be used is not treated; only the number of components k is varied.No prior is claimed——the figures follow from taking every suspect as equally suspect, and no claim is made that real priors are like that. Other assignments give other numbers.Degrees of efficiency are not distinguished——the weak, semi-strong and strong forms are not treated.Relation to earlier papers**: **Paper 481 showed that "a law has been broken" can be blamed on any of the assumptions——there the point stopped at the qualitative fact that blame can be shifted. Here the places it can fall are counted, and a direction emerges: refining the model dilutes the principal suspect.**What is added is **putting the number of suspects at $k+1$ and computing the probability**, **putting the dilution at $\mathbf{0.181818}$**, **showing it to be exactly $\mathbf{0.250000}$ at $k=3$**, **showing two ways of counting to differ by $\mathbf{2.133333}$**, and **placing the separator on whether the model has been fixed**.

1. Notation and the Question

Setting: **the proposition "the market is efficient" cannot be set against observation on its own. Doing so requires a model saying how prices are formed. Let the model have k components.**

$$P_{\text{single}} = \frac{1}{k+1}, \qquad P_{\text{subset}} = \frac{2^k}{2^{k+1}-1}$$

The left counts exactly one culprit; the right allows any non-empty subset to be at fault.

Question: **when a test fails, in how many ways can the blame fall?**

2. A Better Model Dilutes the Principal Suspect

Computation 2.1: **counting exactly one culprit, the probability was derived for each number of factors.**

factors	probability that efficiency is to blame
0	1.000000
1	0.500000
3	0.250000
5	0.166667
10	0.090909

Observation 2.2

this is the core: the direction runs against the usual intuition.Refining a model ought to sharpen a test. Here adding components dilutes the suspicion on efficiency from 0.500000 to 0.090909, a factor of 0.181818——refinement makes the intended question harder to ask.

Observation 2.3

at three factors, the common case, it is already a quarter.The 0.250000 at $k = 3$ means that when a test fails, efficiency can be named as the cause only one time in four——the other three times, something in the model is wrong.

Observation 2.4

this is not a question of power.More data and finer observation leave the assignment problem untouched ——what is lacking is not data but a means of dividing responsibility.

3. Two Ways of Counting, and Dropping the Model

Computation 3.1: **allowing any non-empty subset to be at fault gives the following.**

factors	exactly one culprit	subsets
1	0.500000	0.666667
3	0.250000	0.533333
5	0.166667	0.507937
10	0.090909	0.500244

Observation 3.2

the same situation gives probabilities 2.133333 apart.At $k = 3$, 0.250000 and 0.533333. Neither is wrong; the convention for what counts as one case differs——quoting a probability requires saying what was counted as one.

Observation 3.3

counted by subsets, it sticks at a half.0.500244 even at $k = 10$——on this count a better model does not dilute anything. Even the direction changes with the convention.

Computation 3.4: with no model at all, at $k = 0$, the probability is 1.000000.

Observation 3.5

but that is another way of saying no test exists.Without an account of how prices are formed, there is nothing against which to call an observation out of line——there is one suspect only because no case has been brought.

4. The Separator

Observation 4.1

the separator is whether the pricing model has been fixed.Fixed, a result is a claim about efficiency under that model. Unfixed, it is a claim about nothing——fixing is not a restriction but the condition under which a claim becomes a claim.

Observation 4.2

beside Paper 481.Paper 481 showed that "a law has been broken" can be blamed on any assumption——there the matter rested on the qualitative fact that blame can be shifted. Here the places are counted, and the direction appears. Putting numbers into a qualitative point reveals a direction.

Observation 4.3

what is not said.No market and no study is judged, and no prior is claimed——what is shown is the number of places blame can fall, and that there are two ways of counting them.

5. Roll Call and Closing

1. $\mathbf{0.500000}$ **at** $k = 1$ (Computation 2.1): **two suspects.**
2. $\mathbf{0.250000}$ **at** $k = 3$ (Computation 2.1): **the common case.**
3. $\mathbf{0.090909}$ **at** $k = 10$ (Computation 2.1): **the core.**
4. **a factor of** $\mathbf{0.181818}$ (Observation 2.2): **refinement dilutes.**
5. **not a question of power** (Observation 2.4): **more data does not help.**
6. $\mathbf{0.533333}$ **by subsets** (Computation 3.1): **at** $k = 3$**.**
7. **the two counts differ by** $\mathbf{2.133333}$ (Observation 3.2): **a convention is needed.**
8. $\mathbf{0.500244}$ **even at** $k = 10$ (Computation 3.1): **even the direction changes.**
9. 1.000000 **at** $k = 0$ (Computation 3.4): **no test exists.**
10. **is the model fixed** (Observation 4.1): **the separator; Paper 481.**

Closing: **The more precise the pricing model, the harder it becomes to test whether the market is efficient.A failed test leaves $k+1$ suspects, and counting exactly one culprit the probability that efficiency is to blame falls from 0.500000 at one factor to 0.090909 at ten, a factor of 0.181818——refinement makes the intended question harder to ask.At three factors, the common case, it is already 0.250000.And there is more than one way to count——counting subsets gives 0.533333 at $k=3$, a factor of 2.133333, and stays at 0.500244 even at $k=10$: even the direction changes with the convention.Dropping the model gives 1.000000, which is another way of saying no test exists.The separator is whether the pricing model has been fixed.Placed among the earlier papers——Paper 481 showed blame can fall on any assumption; here the places are counted and a direction appears.To be honest——no market and no study is judged, and no prior is claimed.**

References

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