

Running One Rule on Four Clocks: What Agrees and What Does Not [F019]

On four clocks matched to a median of 60 minutes per bar, the same moving-average crossover puts the interval between crossings between 12 and 14 bars, a largest-to-smallest ratio of 1.0833 — across the same four, the move per bar differs by 3.0434 times, the session spread by 3.2248 and the absolute daily t by 7.7727 — what the rule sets agrees, and what the cut sets does not

Yuuki YAMAGISHI (山岸 勇輝) / Independent Researcher

ORCID 0009-0006-8587-3450

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Abstract

This paper asks what agrees and what does not when one rule is run on four clocks — the answer is that what the rule sets agrees and what the cut sets does not. It claims neither a new mathematical theorem nor a new law.

First, four ways of cutting bars (clock, event count, displacement, path length) were built with their scales chosen so that **the median time per bar comes closest to 60 minutes. The departure from 60 minutes is 5.0000 minutes at the median and 5.0000 at the maximum** (Section 3).

Second, and this is the core of the paper, running the same moving-average crossover (**5** and **20**) on all four puts **the interval between crossings between 12.0000 and 14.0000 bars**. The median largest-to-smallest ratio by instrument is **1.0833** (Section 5).

Third, **⚠ across the same four, other quantities do not agree**. The largest-to-smallest ratio is **3.0434 times** for the median move per bar, **3.3746 times** for its scatter and **3.2248 times** for the session spread (Sections 4 and 7).

Fourth, **the session spread (largest ÷ smallest) is 3.5561 for the clock, 1.6429 for the event count, 1.0837 for displacement and 2.0177 for path length. ⚠ Cutting by displacement all but removes**

the difference between sessions (Section 4).

Fifth, ⚠ as for directional information, **the daily t reaches 2 in absolute value in 0 of 16 cells on all four clocks**, against about **0.7** by chance. The median D is **-0.0150 pips** against a median spread of **0.8000 pips** (Section 6).

Sixth, putting five quantities on one page, **only the interval between crossings agrees**. ⚠ **Taking "agrees" to mean a ratio below 1.5 is a convention this paper adopted** (Section 7).

Scope of this paper (scope note): No new mathematical theorem and no new law is claimed — the four ways of cutting and the moving-average crossover are known. **No particular product or proponent is discussed** — no real course, author, or vendor is the subject here, and none is named. What is treated is the public bar types themselves. **Trading is not discussed** — what is measured is intervals, moves and directional information, not trading performance including commissions, fills and money management. **The scope is intraday and a small number of instruments** — four series over three years. Monthly time-series momentum (dozens of markets, holding one to twelve months) is documented in the literature, and this paper does not contradict it. ★ **The source bars are fixed at five minutes** — all four clocks are assembled from five-minute bars, so **every boundary falls on a five-minute mark** (Section 8). **One rule only** — the crossover of moving averages 5 and 20. **"Agrees" was set at a ratio below 1.5** — ⚠ this is the paper's convention, not something the measurement produced (Section 7). **No forecast is claimed. Relation to earlier papers:** F001 showed that the interval of a moving-average crossover comes from the two periods, F017 measured what changes on a renko chart and F018 on tick bars — this paper closes the sixth part by **putting all four on one footing**. What is added here is **matching the median time per bar, putting what agrees and what does not into one table**, and **writing the convention behind that judgement into the text**.

1. Notation and the question — writing the predictions first

There are four ways of cutting bars.

Clock	What cuts it	What one bar means
Clock	time	the convention of an hour
Event count	the number of quote updates	N updates
Displacement	distance from the previous bar	that price moved the chosen distance
Path length	the accumulated amount moved	that this much was travelled, round trips included

Observation 1.1: ⚠️ **these are four different clocks.** From one market they produce four different sequences of bars.

Observation 1.2: Prediction. The interval between moving-average crossings (in bars) is **set by the two periods** (F001 of this series). If that is so, **the number of bars should agree even when the clock changes.**

Observation 1.3: A second prediction. The size of the move per bar is **the definition of the cut itself**, so it **should not agree.**

Observation 1.4: ⚠️ ★ **any comparison requires matching the median time per bar.** Without that, it is only a comparison of "the finer bars differ".

Question: when one rule is run on four clocks, what agrees and what does not?

2. Writing the quantity and the design in advance

Design (declared before running and unchanged at run time)

Item	Decision
Source bars	five-minute bars (mid price, completed bars only)
① Clock	five-minute bars grouped a fixed number at a time
② Event count	one bar once the tick count sums to N or more
③ Displacement	one bar once price moves k or more from the previous bar's close (renko)
④ Path length	one bar once the absolute differences of five-minute closes sum to L or more
Matching	the scales for ②③④ are chosen so that the median time per bar comes closest to 60 minutes
Rule	the crossover of moving averages 5 and 20 (buy when the fast is above)
Directional information	288 bars ahead (24 hours)
Sessions	five non-overlapping bins in Coordinated Universal Time
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Period	2019–2024. Evaluation 2022–2024

Observation 2.1: ⚠️ ★ the scales are chosen by "closest to 60 minutes", not by results. Choosing by results would be the act of picking the best of four.

Observation 2.2: ⚠️ all four are assembled from five-minute bars. So every clock has boundaries on five-minute marks, and the finer the scale the more that coarseness matters.

Observation 2.3: ⚠️ the threshold for "agrees" is not decided afterwards; it is set at a ratio below 1.5 and written in Section 7. ★ It is the paper's convention, not something the measurement produced.

The median five-minute move is **2.1000** pips for USDJPY, **1.3000** for EURUSD, **1.7500** for GBPUSD and **4.7000** for XAUUSD.

3. Matching the four clocks on the median time per bar

Calculation 3.1 The chosen scales and the time per bar (evaluation period)

Instrument	Clock	Scale	Bars	Minutes per bar (median)
USDJPY	clock	12	17,857	60.0000
USDJPY	event count	7,201	15,482	55.0000
USDJPY	displacement	0.198329	8,558	65.0000
USDJPY	path length	0.379989	16,823	55.0000
EURUSD	clock	12	17,883	60.0000
EURUSD	event count	4,919	15,480	55.0000
EURUSD	displacement	0.001228	8,585	60.0000
EURUSD	path length	0.002352	16,911	55.0000
GBPUSD	clock	12	17,864	60.0000
GBPUSD	displacement	0.001653	8,228	65.0000
XAUUSD	clock	12	17,483	60.0000
XAUUSD	event count	10,540	13,047	65.0000
XAUUSD	displacement	3.781029	9,741	55.0000
XAUUSD	path length	8.504516	15,960	60.0000

Observation 3.2: the departure from 60 minutes is 5.0000 minutes at the median and 5.0000 at the maximum. With five-minute bars as the building block, **matching is only possible in five-minute steps.**

Observation 3.3: ⚠ the counts do not agree. Displacement gives 8,228 to 9,741 bars, the clock 17,483 to 17,883. The medians agree while the shapes of the distributions differ.

Observation 3.4: ⚠ displacement has half as many bars. Even with the median time per bar at 60 minutes, a distribution with few long bars and many short ones yields fewer bars. ★ **Matching medians does not match distributions.**

4. What does not agree — the move per bar and the session spread

Calculation 4.1 Move and session spread (evaluation period)

Instrument	Clock	Median move (pips)	Move CV	Session largest ÷ smallest
USDJPY	clock	7.6500	1.2842	2.2673
USDJPY	event count	10.8500	1.0361	1.4400
USDJPY	displacement	22.9000	0.4539	1.0510
USDJPY	path length	11.3500	0.9506	1.5132
EURUSD	clock	4.5500	1.1991	4.0000
EURUSD	event count	6.9500	0.9226	1.8280
EURUSD	displacement	14.0750	0.3498	1.1128
EURUSD	path length	6.7500	0.8957	2.1446
GBPUSD	clock	6.1000	1.2056	4.1509
GBPUSD	event count	9.3500	0.9601	1.8719
GBPUSD	displacement	18.9000	0.3630	1.0773
GBPUSD	path length	9.0500	0.9086	2.0548
XAUUSD	clock	16.3000	1.2125	3.1121
XAUUSD	event count	24.9000	0.9277	1.4579
XAUUSD	displacement	43.7500	0.3268	1.0901
XAUUSD	path length	23.0200	0.8831	1.9806

Calculation 4.2 Medians by clock

Clock	Median move CV	Median session ratio
Clock	1.2090	3.5561
Event count	0.9439	1.6429
Displacement	0.3564	1.0837
Path length	0.9021	2.0177

Observation 4.3: the move CV scatters from 0.3268 to 1.2842 (a ratio of 3.9302). The session ratio runs from 1.0510 to 4.1509 (a ratio of 3.9495).

Observation 4.4: ★ cutting by displacement all but removes the difference between sessions (median ratio 1.0837). ⚠ That is to be expected. Cutting by displacement means "one bar per fixed distance travelled", so the move per bar is nearly constant by definition.

Observation 4.5: ⚠ so "cutting by displacement makes the move uniform" must not be written up as a benefit. ★ It is not a measurement but a restatement of the definition.

Observation 4.6: ⚠ the session difference survives in the order clock 3.5561, path length 2.0177, event count 1.6429. Cutting by event count narrows it considerably (consistent with F018).

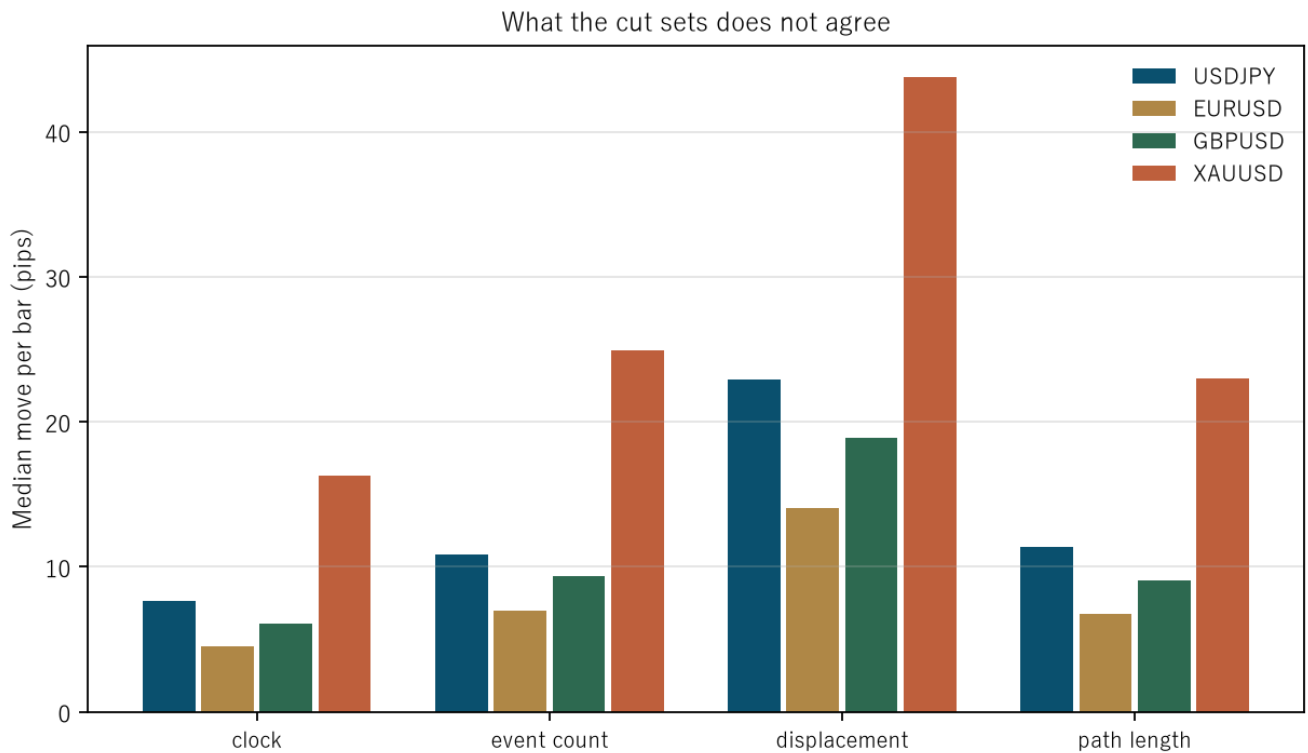


Figure 2: median move per bar on the four clocks. Across different instruments the clocks fall in the same order.

5. What agrees — the interval between crossings

Calculation 5.1 Median bars between moving-average crossings (evaluation period)

Instrument	Clock	Event count	Displacement	Path length	Largest ÷ smallest
USDJPY	13.0000	13.0000	13.0000	13.0000	1.0000
EURUSD	14.0000	13.0000	12.0000	14.0000	1.1667
GBPUSD	12.0000	12.0000	13.0000	12.0000	1.0833
XAUUSD	13.0000	13.0000	13.0000	12.0000	1.0833

Observation 5.2: ★ the interval falls between 12.0000 and 14.0000 bars in all 16 cells. The largest-to-smallest ratio is 1.1667, with a median by instrument of 1.0833.

Observation 5.3: ★ the medians by clock are 13.0000 for the clock, 13.0000 for the event count, 13.0000 for displacement and 12.5000 for path length. ⚠ Different cuts and different instruments, and the same number of bars.

Observation 5.4: ★ as predicted. What sets the interval is the two periods of the moving averages — neither the market nor the cut.

Observation 5.5: ⚠ ★ therefore "on this bar type the crossover captures waves of about 13 bars" is a restatement of the periods one chose. That the number does not change when the bar type changes is the evidence.

Observation 5.6: ⚠ the count agrees while the time does not. The median time per bar is 60.0000 minutes on the clock and 65.0000 on displacement (USDJPY), so the same 13 bars do not take the same time.

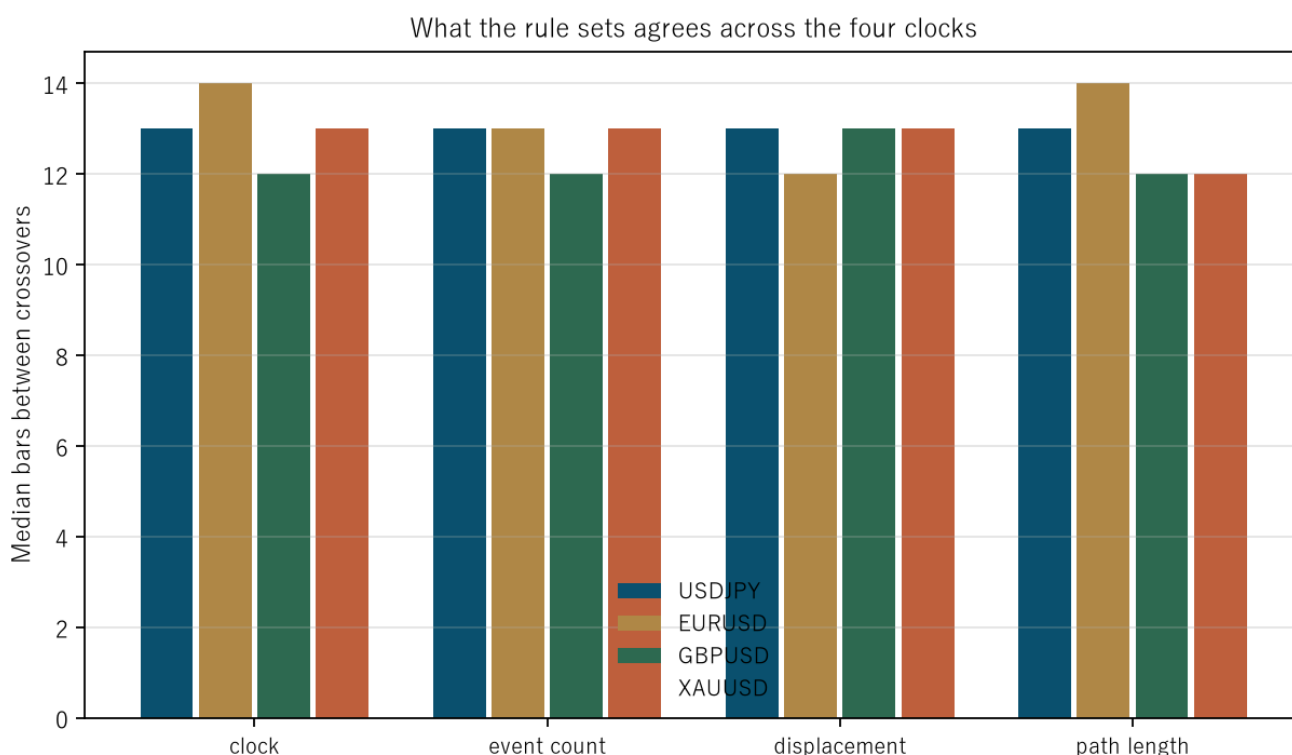


Figure 1: median bars between crossings on the four clocks. In every instrument the four bars stand at nearly the same height.

6. Does the directional information change with the clock?

Calculation 6.1 Same rule, same horizon, only the cut changed (evaluation period)

Instrument	Clock	Count	D (pips)	Daily t	Spread
USDJPY	clock	17,813	1.9350	1.37	0.60
USDJPY	event count	15,443	0.2463	1.15	0.70
USDJPY	displacement	8,529	− 3.3003	0.59	0.70
USDJPY	path length	16,783	0.0621	1.63	0.70
EURUSD	clock	17,840	0.5482	1.36	0.30
EURUSD	event count	15,446	0.5852	1.14	0.30
EURUSD	displacement	8,559	− 1.5699	− 0.14	0.30
EURUSD	path length	16,872	0.2036	1.09	0.30
GBPUSD	clock	17,819	− 0.0922	0.34	0.90
GBPUSD	displacement	8,201	− 0.3602	0.13	0.90
XAUUSD	clock	17,440	1.9130	− 0.11	3.54
XAUUSD	event count	13,012	− 1.3384	− 0.61	3.61
XAUUSD	displacement	9,710	− 1.3173	− 0.11	3.70
XAUUSD	path length	15,920	− 0.1511	− 0.21	3.61

Observation 6.2: the daily t reaches 2 in absolute value in 0 of 16 cells. Chance gives about 0.7, so the measurement is **below chance**.

Observation 6.3: the overall median D is **−0.0150 pips** against a median spread of **0.8000 pips**. **No clock reaches it.**

Observation 6.4: ⚠️ **the median D by clock scatters:** **+1.2306** for the clock, **+0.2178** for the event count, **−1.4436** for displacement and **−0.0445 pips** for path length, a largest-to-smallest ratio of **7.7727** (Section 7). ⚠️ **But no daily t reaches 2, so that scatter is noise.**

Observation 6.5: ⚠️ **D is negative for displacement in all four series.** ⚠️ **This paper does not claim it.** The counts are half those of the others and the daily t runs from **−0.14** to **0.59**.

7. Putting what agrees and what does not on one page

Calculation 7.1 Largest ÷ smallest across the four clocks (median of four series)

Quantity	Largest ÷ smallest	Agrees?
Bars between crossings	1.0833	yes
Move per bar	3.0434	no
Move CV	3.3746	no
Session largest ÷ smallest	3.2248	no
Absolute daily t	7.7727	no

Observation 7.2: ⚠️ ★ "agrees" was set at a ratio below 1.5. That is a convention this paper adopted, not something the measurement produced. Another threshold would change the verdict. ⚠️ **But the gap between 1.0833 and 3.0434 is wide enough that any threshold from 1.5 to 2.5 gives the same answer.**

Observation 7.3: ★ **what agreed is only what the rule sets.** The interval between crossings is set by the two periods of the moving averages and **does not move when the clock changes.**

Observation 7.4: ★ what did not agree is what the cut sets. The move per bar, its scatter and the session difference all **follow from the definition of the cut.**

Observation 7.5: ⚠ the absolute daily t has the largest ratio at 7.7727, but that is not "disagreement" so much as "all of them near zero". Ratios between small numbers come out large.
★ A ratio must not be read alone.

Observation 7.6: ★ so any discussion of bar types should be read in two parts: is the quantity set by the rule or by the cut? ⚠ **The former cannot be presented as a benefit of the bar type, and the latter cannot be presented as a property of the market.**

8. Limitations

1. **★ The source bars are fixed at five minutes.** All four clocks are assembled from five-minute bars, so **every boundary falls on a five-minute mark.** The median time per bar can therefore only be matched in five-minute steps, and **a departure of 5.0000 minutes from 60 remained.**
 2. **One rule only**, the crossover of moving averages 5 and 20. Another rule might make other quantities agree.
 3. **★ "Agrees" was set at a ratio below 1.5.** ⚠ It is the paper's convention, not something the measurement produced.
 4. **Medians were matched; distributions were not.** Displacement gives half as many bars. **The same median time per bar does not mean the same shape.**
 5. **Scales were not chosen by results** but by "closest to 60 minutes". ⚠ Choosing by results would be the act of picking the best of four.
 6. **The drift is not separated.** The signs of D in Section 6 include which way each instrument moved over the period.
 7. **Four instruments over three years.** Nothing is said about other markets or other periods.
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Conclusion

Four ways of cutting — clock, event count, displacement, path length — were built **matched to a median of 60 minutes per bar**, and the same moving-average crossover was run on all four.

The interval between crossings fell between 12.0000 and 14.0000 bars in all 16 cells, a largest-to-smallest ratio of **1.0833**. **Different cuts and different instruments, and the same number of bars.**

But across the same four, the move per bar differed by **3.0434 times**, its scatter by **3.3746** and the session spread by **3.2248**.

What the rule sets agrees, and what the cut sets does not.

As for directional information, the daily t reached 2 in absolute value in **0 of 16** cells on all four clocks (chance gives 0.7). The median D is **-0.0150 pips** against a median spread of **0.8000 pips**.

★ **Choosing a bar type is choosing a ruler.** "On this bar type the crossover captures waves of about 13 bars" is a restatement of the moving-average periods one chose, and **that the number does not change when the bar type changes is the evidence.**

And what this paper could measure is four clocks assembled from five-minute bars. **About four clocks cut directly from ticks, nothing is answered here.**

Data and reproduction

Data	Currency ticks from Dukascopy (agreement to the millisecond, bid and ask, verified from 2019 onward). Gold from Dukascopy
Period	2019–2024 (six years). Evaluation 2022–2024
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Source bars	Five-minute, mid price, closing value of completed bars only. Bars with no ticks are not created
Four clocks	Clock (a fixed number of bars) / event count (summed tick counts) / displacement (distance from the previous bar) / path length (summed absolute differences)
Matching	Scales chosen so that the median time per bar comes closest to 60 minutes (never chosen by results)
Rule	Crossover of moving averages 5 and 20; horizon 288 bars (24 hours)
Verification	<code>検算/F019.py</code> (with <code>--zu</code> it also writes the figures). Every number in the text is taken from <code>検算/F019_output.txt</code>
Figures	<code>図/F019_zu1</code> , <code>図/F019_zu2</code> (png, svg, English versions)
Audit of the foundation	<code>_ツール/audit_bars.py</code> (look-ahead in the bars, daylight saving, the day boundary). The record is <code>_土台の検査.txt</code>

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