

The Maximum Drawdown Belongs to the Order of the Trades

[F031]

Shuffling the same set of trades alone moves the maximum drawdown by up to 4.23 times its smallest value, with a range of 2,713.40 to 12,267.52 pips — while the total, the mean and the win rate do not move at all — and the actual order lands at a median percentile of 0.5330, above 0.95 in 0 of 16 cases

Yuuki YAMAGISHI / Independent Researcher

ORCID 0009-0006-8587-3450

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Abstract

What this paper asks is whether the maximum drawdown is a property of the trades or of their order — and the answer is: of their order. No new mathematical theorem and no new law is claimed.

First, **shuffling moves neither the total, nor the mean, nor the win rate.** The same numbers are added in a different sequence, so **if these move, the arithmetic is broken** (Section 3).

Second, and this is the core. ★ **But the maximum drawdown moves a long way.** Shuffling alone takes it from **1.77 to 5.39 times** its smallest value (median **4.23 times**), a range of **2,713.40 to 12,267.52 pips** (Section 4).

Third, **the actual order sits inside that distribution.** The percentile of the maximum drawdown has a median of **0.5330** and a range of **0.0060 to 0.8760**, and it **exceeds 0.95 in 0 of 16 cases** (Section 5).

Fourth, **only one case landed at an extreme, and it was the good side.** EURUSD on the sign of the deviation has a percentile of **0.0060 — a smaller drawdown than any of the shuffles** (Section 5).

Fifth, ★ **on a synthetic random walk, shuffling alone still moves the maximum drawdown by a median of 4.28 times**, barely different from the measurement's **4.23 times. This range is not a**

property of the market but the arithmetic of shuffling (Section 6).

Sixth, **the longest stretch under water takes the same shape**. Its percentile has a median of **0.3745** and a range of **0.0170** to **0.9730**, so **the actual order is inside the distribution here too** (Section 5).

Scope of this paper: No new mathematical theorem and no new law is claimed — permutation tests and the definition of drawdown are both known. **No real course or its proponent is discussed** — no real teaching material, author, or vendor is the subject here, and none is named. **Trading is not discussed** — no costs are included, so the figures here are not trading performance (Section 7). **The position size is fixed** — compounding or risk-proportional sizing changes how the maximum drawdown comes out; this paper uses one fixed unit (Section 7). **One way of building trades is fixed** — one entry every 24 bars, exited 24 bars later; other constructions give other counts and ranges (Sections 2 and 7). **The four directions are not independent** — always-buy and always-sell are the same trades with the sign flipped (Section 3). **There are 1,000 shuffles** — the percentile resolves to one part in a thousand and nothing finer can be said (Section 7). **The scope is intraday and few instruments** — four instruments, six years, one-hour bars. Monthly time-series momentum (dozens of markets, one to twelve month holds) is documented in the academic literature and is not contradicted here. **No forecast is claimed**.

1. Notation and the question

An equity curve is shown and the text reads "the maximum drawdown was N pips".

What gets reported	What does not
The maximum drawdown	What it would be if the same trades were shuffled
The shape of the equity curve	Where the actual order lands in that distribution
The longest stretch under water	What the same thing does on a series with no edge

Observation 1.1: ★ A total does not depend on the order of addition. Shuffle as you like and it stays the same. **That is what addition is, not a measurement result.**

Observation 1.2: ★ But the maximum drawdown looks at the path. It deepens when losses arrive together and shallows when they are spread out. The same set of trades gives different values under different orders.

Observation 1.3: The separator is the order in which the trades are placed. The set of trades, the count and the total are all held fixed, and **only the order is varied.**

Observation 1.4: ★ Where the actual order lands in the distribution says whether the market has order structure. In the middle means nothing special. At an extreme means losses arrive together.

Question: is the maximum drawdown a property of the trades or of their order?

2. State the quantity and the design first

Predictions (written before running)

- ① The total does **not move at all** under shuffling (addition does not depend on order).
- ② The maximum drawdown **moves a long way**.
- ③ ★ The actual order's maximum drawdown **sits inside the shuffled distribution**. If it does not (if it lands at an extreme), the market has order structure.
- ④ On a synthetic random walk the actual order should land **right around the middle** (independent increments have no order structure).

Design (declared before running and not changed during it)

Item	Decision
Trades	Enter at the close of a one-hour bar, exit 24 bars later
	One entry every 24 bars (no overlap)
Directions	Always buy / always sell / sign of the SMA(20) slope / sign of the deviation
Sets	Instrument × direction = 16. 1,452 to 1,522 trades per instrument
Shuffles	1,000 (fixed seed)
Measured	Total / maximum drawdown / longest stretch under water
Position size	One fixed unit (no compounding)
Costs	Not included
Baseline	Synthetic random walk down to within-bar movement (3 series)
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Period	2019–2024

Observation 2.1: ★ With the overlap removed, the equity curve can simply be stacked up. A 24-bar hold with one entry every 24 bars means positions never overlap.

Observation 2.2: ★ Always-buy and always-sell are the same trades with the sign flipped. Whether their totals match with opposite signs is itself a check.

Observation 2.3: The position size is one fixed unit. With compounding or risk-proportional sizing, later trades weigh more on the account and the effect of order grows further. This paper measures on the side that does not inflate it.

3. What shuffling does not move (a check)

Calculation 3.1 Total, mean and win rate

Instrument	Direction	Count	Total	Mean	Win rate
USDJPY	always buy	1,521	4781.85	3.1439	0.5345
USDJPY	always sell	1,521	− 4781.85	− 3.1439	0.4655
USDJPY	sign of slope	1,521	2838.85	1.8664	0.5082
EURUSD	always buy	1,522	− 995.05	− 0.6538	0.4895
EURUSD	always sell	1,522	995.05	0.6538	0.5092
GBPUSD	always buy	1,521	− 80.85	− 0.0532	0.5108
GBPUSD	sign of slope	1,521	1660.65	1.0918	0.5266
XAUUSD	always buy	1,452	13172.91	9.0723	0.5324
XAUUSD	always sell	1,452	− 13172.91	− 9.0723	0.4676
XAUUSD	sign of deviation	1,452	1464.17	1.0084	0.4876

Observation 3.2: ★ The totals of always-buy and always-sell match exactly with opposite signs: 4781.85 against −4781.85 for USDJPY, 13172.91 against −13172.91 for XAUUSD. They are the same trades with the sign flipped, so a mismatch would mean broken arithmetic.

Observation 3.3: ★ The total, the mean and the win rate do not move at all under shuffling, by definition. The same numbers are simply added in a different sequence.

Observation 3.4: XAUUSD always-buy totals 13172.91 pips. That means gold rose over six years, not that a method worked. The drift is not separated here.

Observation 3.5: The win rate stays between 0.4655 and 0.5345 for every direction. ★ With the win rate near 0.5 throughout, the total ranges from +13172.91 pips to −4781.85.

4. What shuffling does move

Calculation 4.1 The actual maximum drawdown against the shuffled distribution (pips)

Instrument	Direction	Actual	Shuffled median	Minimum	Maximum
USDJPY	always buy	2247.70	2089.42	1120.20	4604.10
USDJPY	sign of slope	2725.30	2430.25	1335.65	4982.45
EURUSD	always buy	2788.90	2459.87	1307.15	4541.75
EURUSD	sign of deviation	874.70	1527.05	846.95	3560.35
GBPUSD	always buy	3584.20	3085.05	1536.60	6268.80
GBPUSD	sign of slope	3120.60	2500.72	1229.60	5230.35
XAUUSD	always buy	4483.68	4669.50	2435.18	11487.06
XAUUSD	always sell	15120.63	15915.08	12950.51	22957.23
XAUUSD	sign of deviation	9422.06	7023.74	3355.60	15623.12

Observation 4.2: ★ This is the core. Shuffling alone takes the maximum drawdown from **1.77** to **5.39** times its smallest value (median **4.23** times).

Observation 4.3: The range (shuffled maximum minus minimum) runs from 2,713.40 to 12,267.52 pips. ★ The same trades and the same total can produce equity curves this different.

Observation 4.4: ★ USDJPY always-buy comes out anywhere from 1,120.20 to 4,604.10 pips under shuffling alone. The sentence "the maximum drawdown was 2,247.70 pips" reports one value out of that spread.

Observation 4.5: The total does not budge while the maximum drawdown moves this far. ★ Both come from the same equity curve, yet one does not depend on the order at all and the other depends on nothing else.

Shuffling the same set of trades alone scatters the maximum drawdown this far

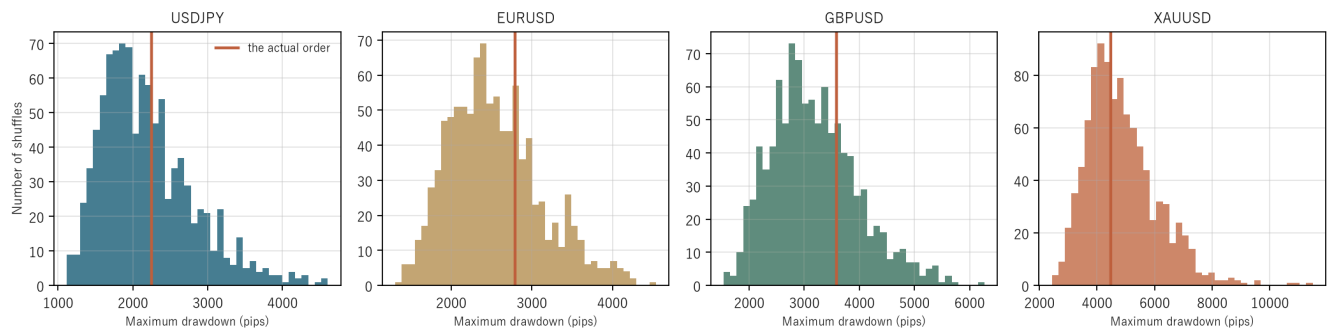


Figure 1: horizontal is the maximum drawdown, vertical is the number of shuffles. **The vertical line is the actual order's value (always buy).**

5. Where the actual order lands in the distribution

Calculation 5.1 Percentiles (0.5 is the middle; near 1.0 means the actual order was bad)

Instrument	Direction	Drawdown percentile	Longest under water	Shuffled median	H
USDJPY	always buy	0.6070	636	451.5	
USDJPY	sign of slope	0.6630	300	614.0	
EURUSD	always buy	0.7050	1,002	1185.0	
EURUSD	sign of slope	0.1140	258	575.0	
EURUSD	sign of deviation	0.0060	316	618.5	
GBPUSD	always buy	0.7240	898	993.5	
GBPUSD	sign of slope	0.7720	1,068	718.0	
XAUUSD	always buy	0.4450	812	387.0	
XAUUSD	always sell	0.3260	1,386	1387.0	
XAUUSD	sign of deviation	0.8760	936	807.5	

Observation 5.2: ★ Prediction ③ held. The drawdown percentile has a median of **0.5330** and a range of **0.0060** to **0.8760**, and it **exceeds 0.95 in 0 of 16 cases**.

Observation 5.3: ★ The actual order is not special. If losses arrived together the percentile would push toward 1.0, and it does not.

Observation 5.4: Only one case landed at an extreme, and it was the good side. EURUSD on the sign of the deviation has a percentile of **0.0060** — **a smaller drawdown than any of the 1,000 shuffles**.

Observation 5.5: The longest stretch under water takes the same shape, with a median percentile of **0.3745** and a range of **0.0170** to **0.9730**. **Only XAUUSD always-buy pushes to 0.9730, one case out of 16.**

Observation 5.6: With 1,000 shuffles the percentile resolves to one part in a thousand. Nothing finer can be said.

6. Baseline — do the same thing on a series with zero directional information

Calculation 6.1 Measurement against synthetic random walk (medians across four instruments)

Direction		Drawdown percentile	Drawdown ÷ shuffled median
always buy	measured	0.6560	1.1494
always buy	random	0.3745	1.0812
always sell	measured	0.4090	0.9613
always sell	random	0.4955	0.9573
sign of slope	measured	0.4980	1.1855
sign of slope	random	0.4600	1.0316
sign of deviation	measured	0.6130	1.0831
sign of deviation	random	0.2975	0.9729

Observation 6.2: ★ Prediction ④ held. The random walk's percentile has a median of **0.3915** and a range of **0.0440** to **0.9820** — **the same band as the measurement.**

Observation 6.3: ★ And the shuffling range is the same too. On the synthetic random walk, shuffling alone still moves the maximum drawdown by a median of **4.28 times**, **barely different from the measurement's 4.23.**

Observation 6.4: ★ So this range is not a property of the market. It is the arithmetic of shuffling. A series known to have no order structure moves just as much. **What this baseline is zero about was measured in [F033].**

Observation 6.5: Percentiles above 0.95 occur in 4 of 48 random-walk cases. Chance alone would give 2 or 3, so that is not special. The measurement gives **0 of 16.**

Observation 6.6: Only the measurement's always-buy has a higher percentile than the random walk's (0.6560 against 0.3745). ★ Losses may cluster somewhat, but with 0 of 16 above 0.95 this paper does not claim it as an effect.

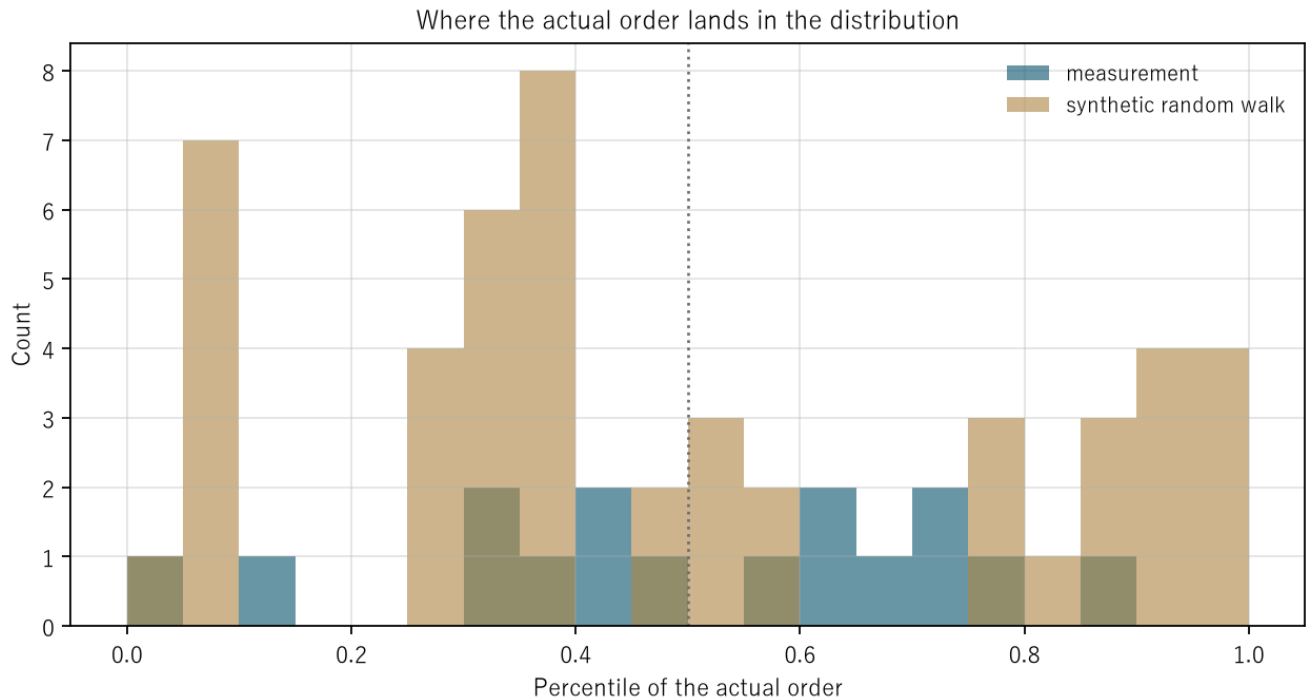


Figure 2: horizontal is the percentile of the actual order, vertical is the count. **The darker histogram is the measurement, the lighter one the synthetic random walk, and the dotted line is the middle (0.5).**

7. Limitations

1. ⚠️ **The position size is one fixed unit.** With compounding or risk-proportional sizing, later trades weigh more on the account and **the effect of order grows further.** This paper measures on the side that does not inflate it.
2. **One way of building trades is fixed:** one entry every 24 bars, exited 24 bars later. Other constructions give other counts and ranges.
3. **The four directions are not independent.** Always-buy and always-sell are the same trades with the sign flipped.

4. **There are 1,000 shuffles.** The percentile resolves to one part in a thousand and nothing finer can be said.
 5. **The drift is not separated.** XAUUSD always-buy totalling 13,172.91 pips means gold rose over six years.
 6. **No costs are included.** The figures here are therefore not trading performance.
 7. **The longest stretch under water is counted in trades, not time,** so it changes meaning if the spacing of trades changes.
 8. **Four instruments over six years.** Nothing is said about other markets or other periods.
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Conclusion

The same set of trades was shuffled **1,000 times**. The total, the mean and the win rate **do not move at all**, because the same numbers are simply added in a different sequence. The totals of always-buy and always-sell come out as **4781.85** and **-4781.85**, exactly opposite, **confirming the arithmetic is not broken**.

But shuffling alone takes the maximum drawdown from **1.77** to **5.39 times** its smallest value (median **4.23 times**), a range of **2,713.40** to **12,267.52 pips**. ★ **USDJPY always-buy comes out anywhere from 1,120.20 to 4,604.10 pips on the same trades with the same total.**

The maximum drawdown is a property not of the trades but of their order.

★ **And the actual order is not special.** The drawdown percentile has a median of **0.5330** and **exceeds 0.95 in 0 of 16 cases**. Only one case landed at an extreme, at **0.0060** — **the good side**. The longest stretch under water has a median percentile of **0.3745**, **inside the distribution as well**.

★ **On a synthetic random walk, shuffling alone still moves the maximum drawdown by a median of 4.28 times**, barely different from the measurement's **4.23**. **This range is not a property of the market but the arithmetic of shuffling.**

So a report of a maximum drawdown needs the distribution from shuffling the same trades. ★ **That single figure is one realization out of a spread four or five times as wide.** And this paper

measures with a fixed position size: **with compounding, the effect of order grows further.**

Data and reproduction

Data	FX is Dukascopy-derived tick data (from 2019 onward, confirmed identical down to the millisecond, bid and ask). Gold is Dukascopy
Period	2019–2024 (six years)
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Bars	One-hour bars, mid prices, closes of completed bars only. No bar is made where there are no ticks
Trades	One entry every 24 bars, exited 24 bars later (no overlap). 1,452 to 1,522 per instrument
Directions	Always buy / always sell / sign of the SMA(20) slope / sign of the deviation
Shuffles	1,000, fixed seed
Position size	One fixed unit. No costs
Verification	<code>検算/F031.py</code> (<code>--zu</code> also writes the figures). Every figure in the text comes from <code>検算/F031_output.txt</code>
Figures	<code>図/F031_zu1</code> , <code>図/F031_zu2</code> (png, svg, English versions)
Random seeds	Fixed. Re-running gives the same values
Foundation check	<code>_ツール/audit_bars.py</code> (bar look-ahead, daylight saving, day boundaries). The record is <code>_土台の検査.txt</code>

References

- Yamagishi, Y. (2026). A Synthetic Random Walk Has No Volatility Clustering [F033]. This series, unpublished