



USDZAR Currency Prediction **Machine Learning in Optimizing** **Global Portfolio Construction**



Agenda

- 01** Currency Impact for South African Investors
- 02** Fundamental/Macro-Economic Fair Value Models
- 03** Machine Learning Integration
- 04** Prediction Engine Results
- 05** Use in Portfolio Construction
- 06** Conclusions

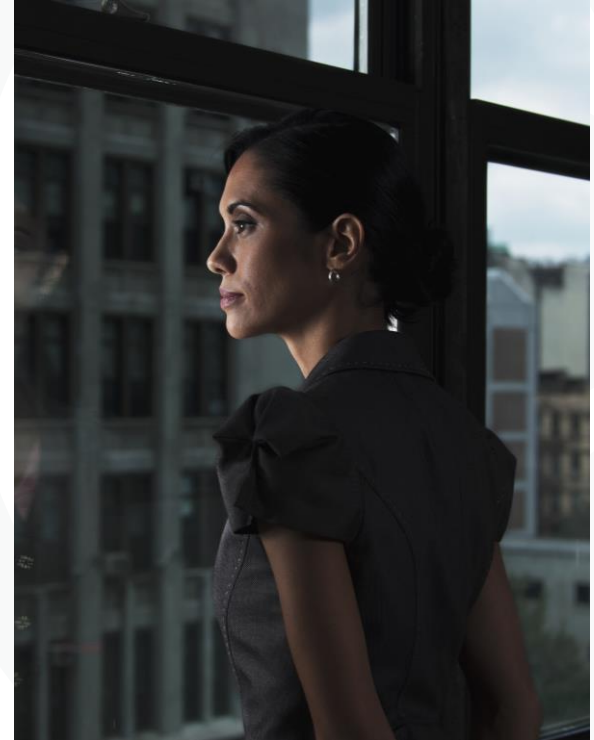
01 Currency Impact for South African Investors

- Currency introduces additional volatility of returns

Understanding Currency Dynamics is Critical for Portfolio Construction

Allocation to offshore assets is a critical aspect for all institutional South African investors:

- All strategic asset allocation philosophies will hold an allocation to global assets
- Depending on the underlying investment philosophy this allocation may vary from 0 to 45%
- The impact of the US Dollar/South African Rand can be significant in terms of:
 - The level of the currency cross can impact relative returns against peers from an investing timing perspective
 - While the long-term expectation is for continued Rand weakness, tactical opportunities over shorter periods of time offer alpha generation opportunities
 - The movement in the underlying currency pair can add significant volatility/risk into offshore holdings
 - Understanding probable near term future currency fluctuations allows for optimal portfolio management both from a top down and bottom up perspective





02 Fair Value Economic Models for Currencies

Fundamental Research Prediction Factors

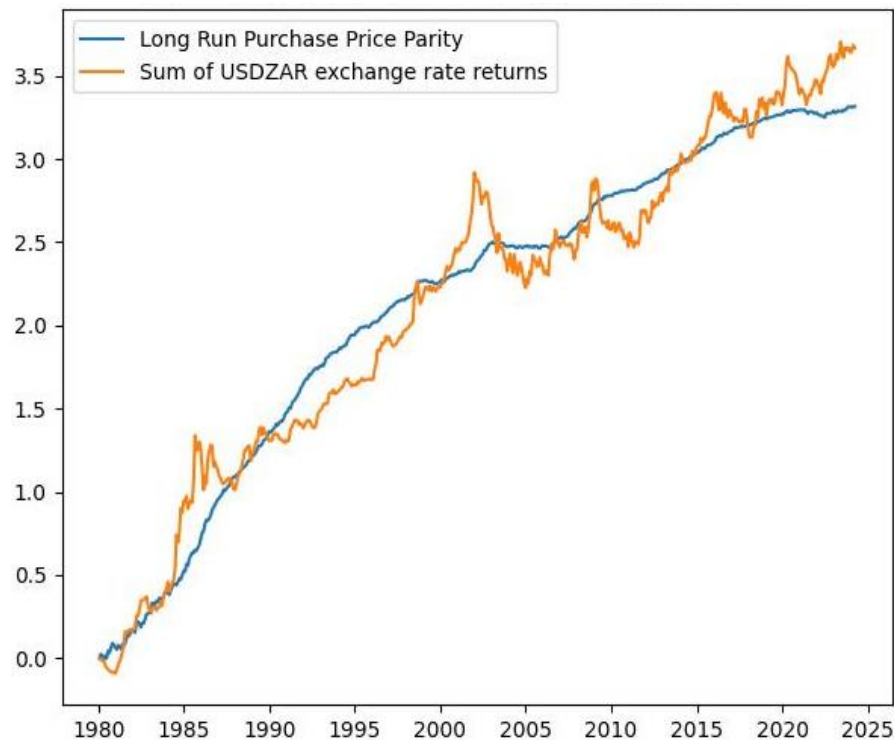
From a macro-economic perspective there are three broad models utilized:

- The economic Purchasing Power Parity (PPP):
 - The measurement of the relative price of a basket of goods in different jurisdictions
- Relative Economic Strength:
 - Proposes that higher economic growth will attract foreign capital flows with GDP growth rates being key, however balance of trade as well as other economic factors are key
- Econometric modelling:
 - Driven largely by the view that interest rate differentials impact currency moves
- There are a variety of technical trading techniques used including price momentum and mean reversion signals



Purchase Power Parity

Sum of AAM adjusted PPP versus USDZAR since 1979



Reconstruction of the PPP index from 1979 to 2024 against the USDZAR shows the following:

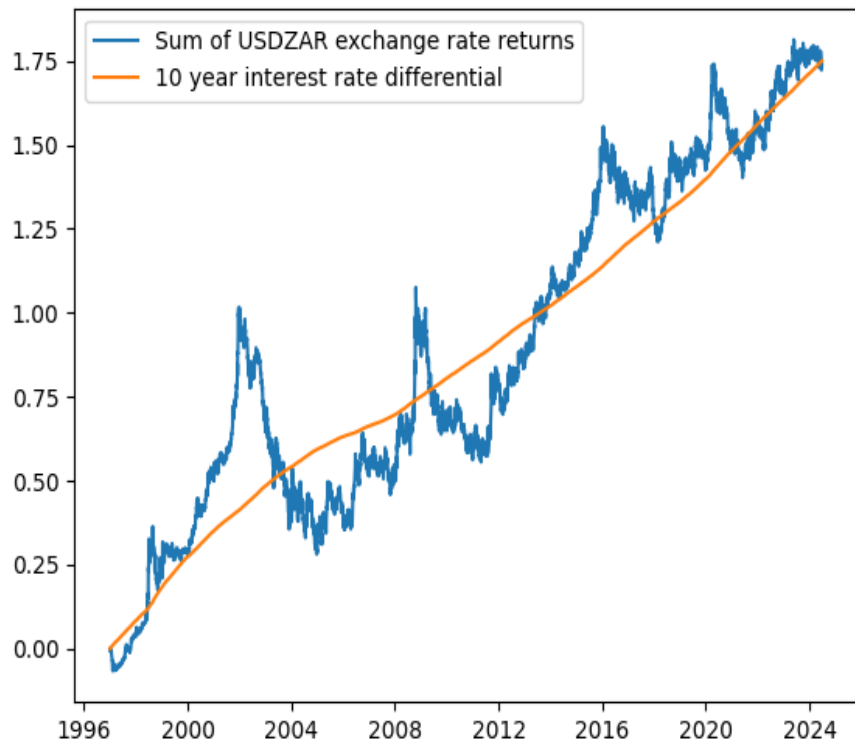
- A mean-reversion relationship between the rand and the PPP, in some instances more so than others (1979 to 2012)
- Instances for a period of approximately 10 years where there was no mean reversion (2015 to present),
- Currently the rand is trading higher than the PPP, based on this model the ZAR would be expected to appreciate
- Given the relation between PPP and the rand, it makes sense to have it an input into the model

Drawback

- PPP may not reflect reality due to differences in local costs, taxes, tariffs, and market competition

Interest rate differentials

Sum of Nominal 10 year rate differential versus USDZAR since 1997



We show the difference in the 10-year constant maturity interest rate and the exchange rate from 1997:

- The USDZAR exchange rate is also strongly mean reverting around the interest rate differential
- Theoretically the currency rate should widen by the interest rate differential and is critically used in the pricing of currency options

Drawback

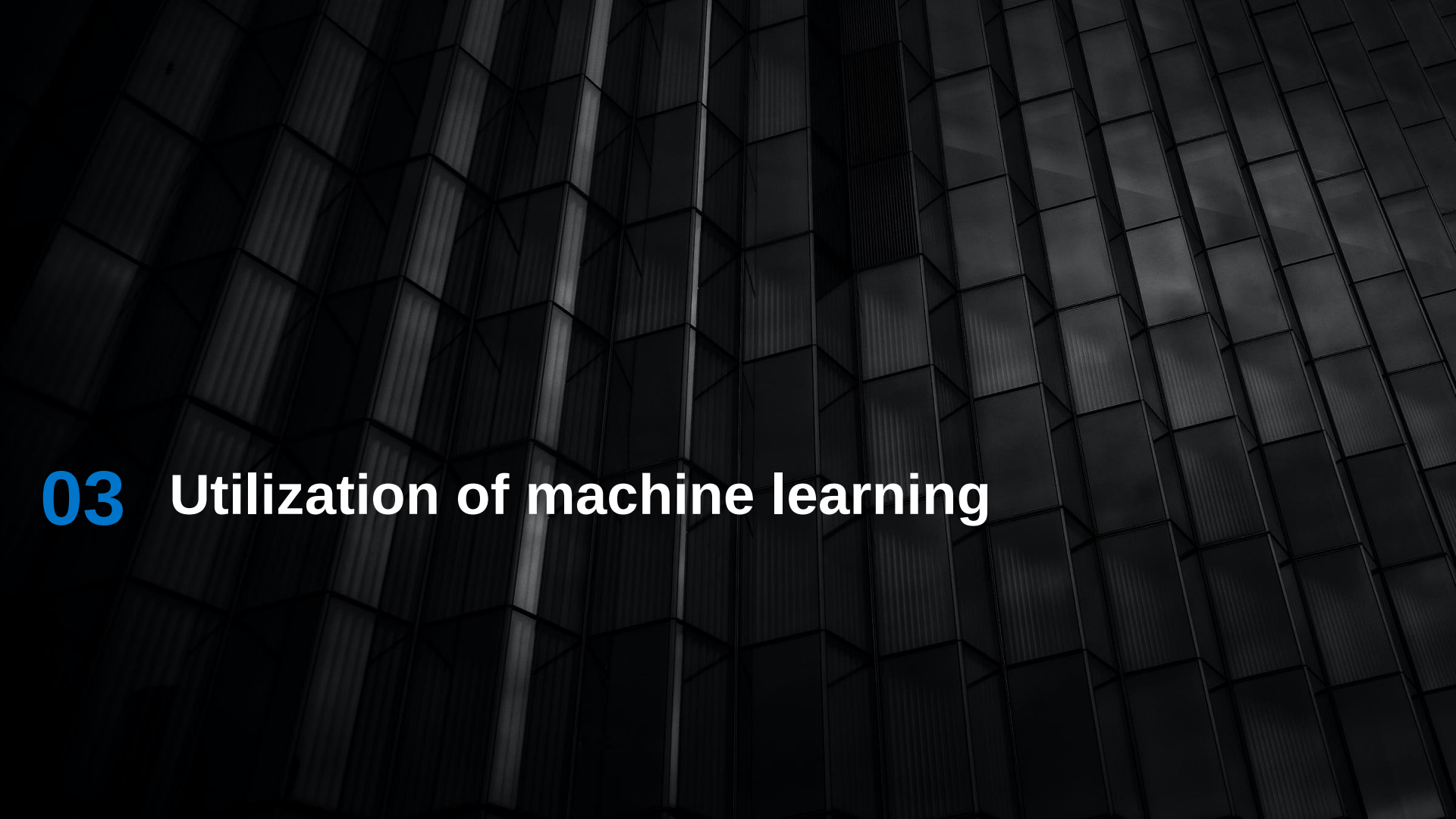
- The no arbitrage assumption is agnostic to a number of additional factors that might drive currency changes

Impact of the Commodity Complex on the USDZAR Exchange Rate

South Africa is largely a commodity driven economy; discussions with the Sanlam economics team led to several reasons why commodity prices might be linked to the USDZAR:

- Commodities such as copper, platinum, palladium, gold and silver are key exports for South Africa
- Oil/energy complex drives the cost base significantly and changes are likely to impact SA
- Copper is used as a Bell-weather globally to elucidate global growth conditions
- Copper demonstrate a strong relationship with the rand; changes in the copper price were quite strongly related to the changes in the rand price
- China's performance is significant for SA's growth trajectory impacting sharply on GDP and export revenue



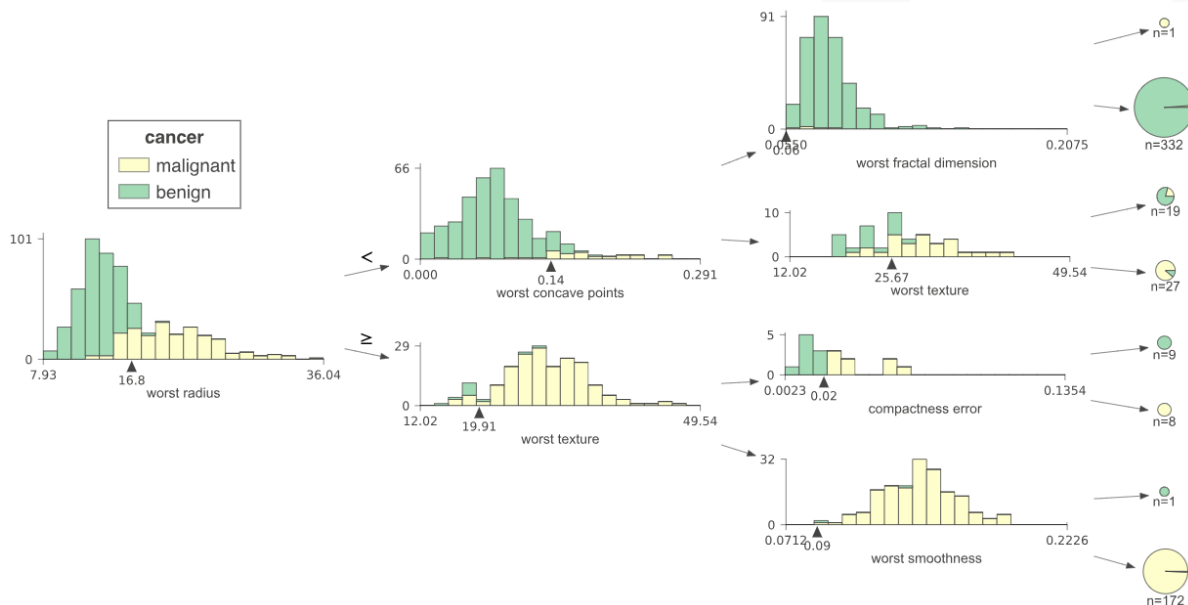


03 Utilization of machine learning

Machine Learning: Feature Designs

A brief explanation of decision tree mechanics

- Decision Trees partition data into statistically differentiated sets along variable inputs creating an empirical solution to non-linear problem sets



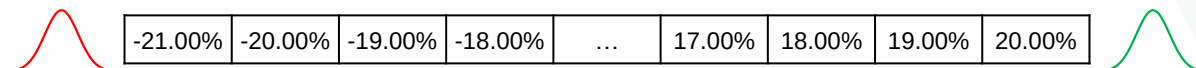
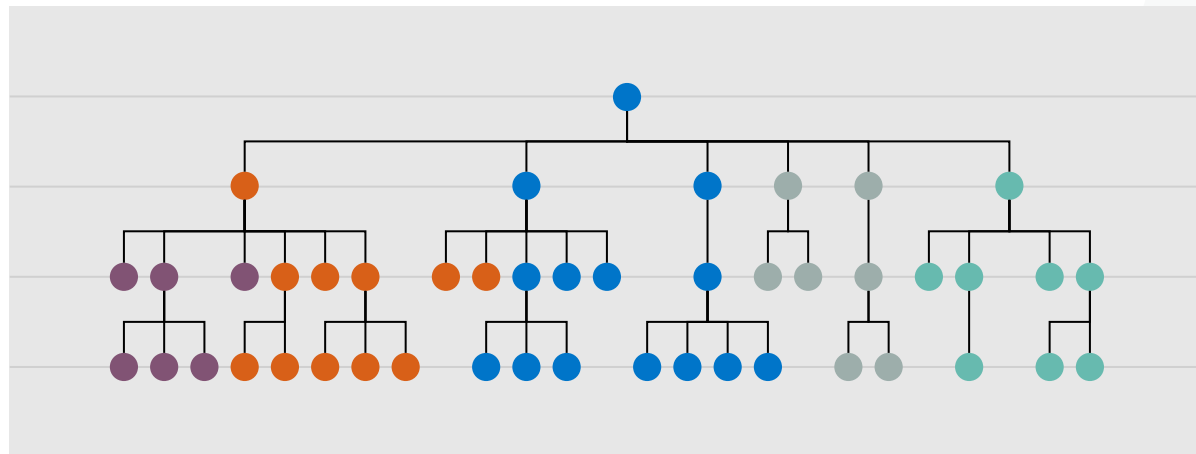
Defining a Machine Learning Model for USDZAR Prediction

Set an objective function of predicting the one-year return of the USDZAR currency change

Macro-Economic

Commodity Factors

Factors on Multiple Currencies



Output - One year prediction on USDZAR as percent

We use a gradient boosted decision tree model

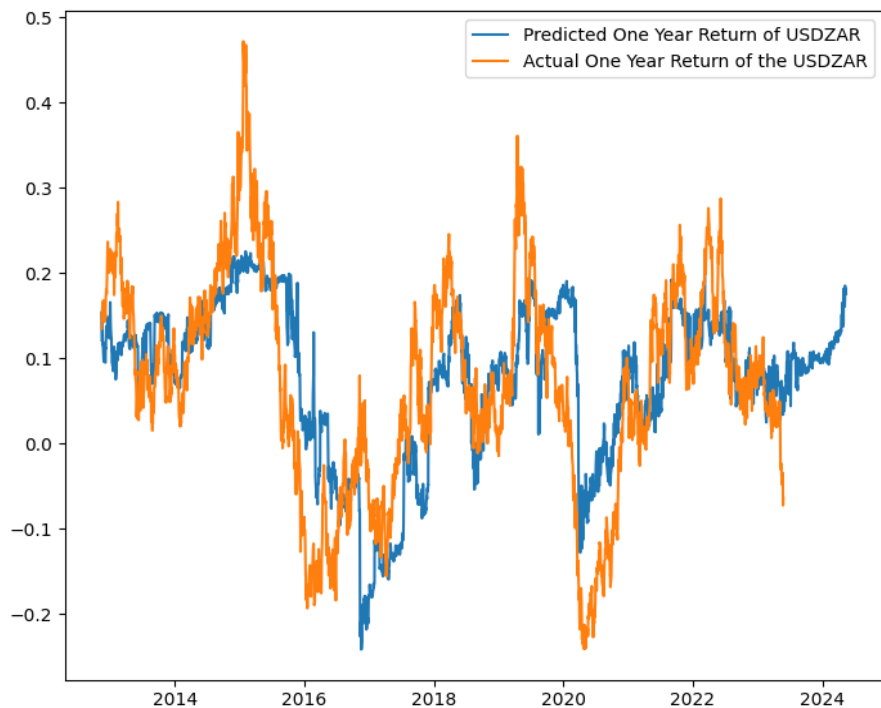
- Include data from 1997 to date
- Initial window of 15 years with prediction made completely out of sample
- Expanding window used to predict USDZAR daily
- Out of sample prediction can then be compared to the true value
- We maximize the Pearson coefficient between the predicted and true value
- Pearson values are in the region of 0.7



04 Results

Results: Output

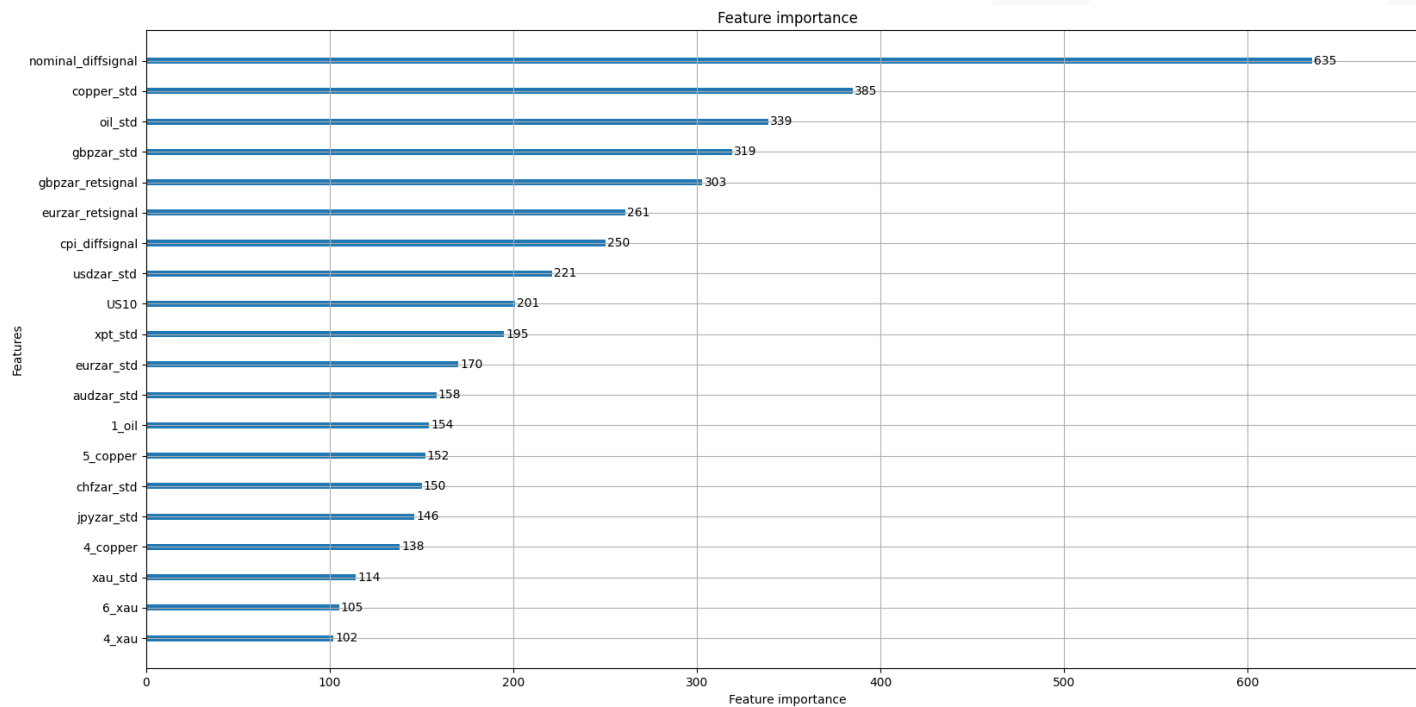
Out of Sample One Year Regression prediction on the USDZAR



Source: SSS Prediction engine

- Orange line is the actual one year USDZAR while the blue line is the prediction
- Has a Pearson co-efficient of 0.72
- It is impossible for the engine to predict idiosyncratic events i.e., Nene gate, Covid 19 and recently SA-arms to Russia
- it does kind of deviate through times, it picks up a lot of the movements and it's a very powerful tool in being able to decide when the best time to hedge is because ultimately from a hedging perspective, we're trying to capture as much as we can that the Rand strength
- Presently, the prediction engine itself is not constructive at all on the Rand.

Feature importance



Source: SSS

05 Use in Portfolio Construction

- Currency hedging: Lock-in alpha or Limit your downside

Currency Derivatives

The case for currency hedging

Institutional clients:

- We use currency derivatives to manage the risks or take advantage of the opportunities brought about foreign exchange currencies in portfolios and sometimes for efficient portfolio management
- Specifically, currency hedges used to protect offshore investments against the strengthening of the Rand to the Dollar
- Simultaneously, currency hedges allows clients to enhance returns due to the currency depreciation
- Currency hedging allows the institutional clients to manage their offshore exposure limits

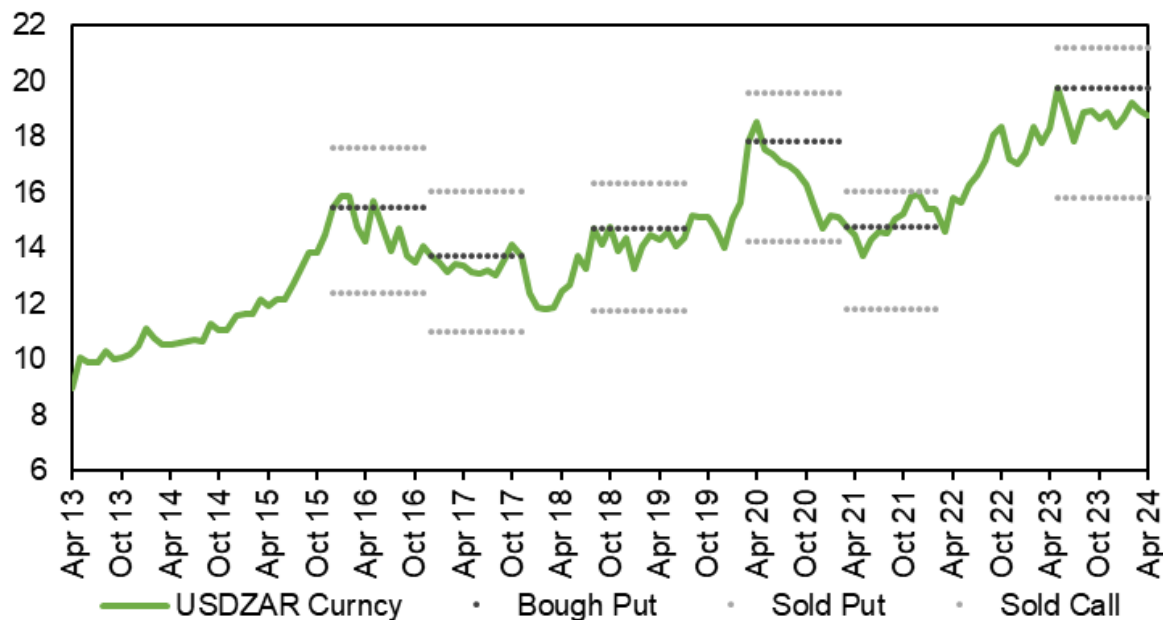
Corporates

- Manage currency risk in either input costs or sales
- Optimize currency exposure on their balance sheet



Use in Portfolio Construction

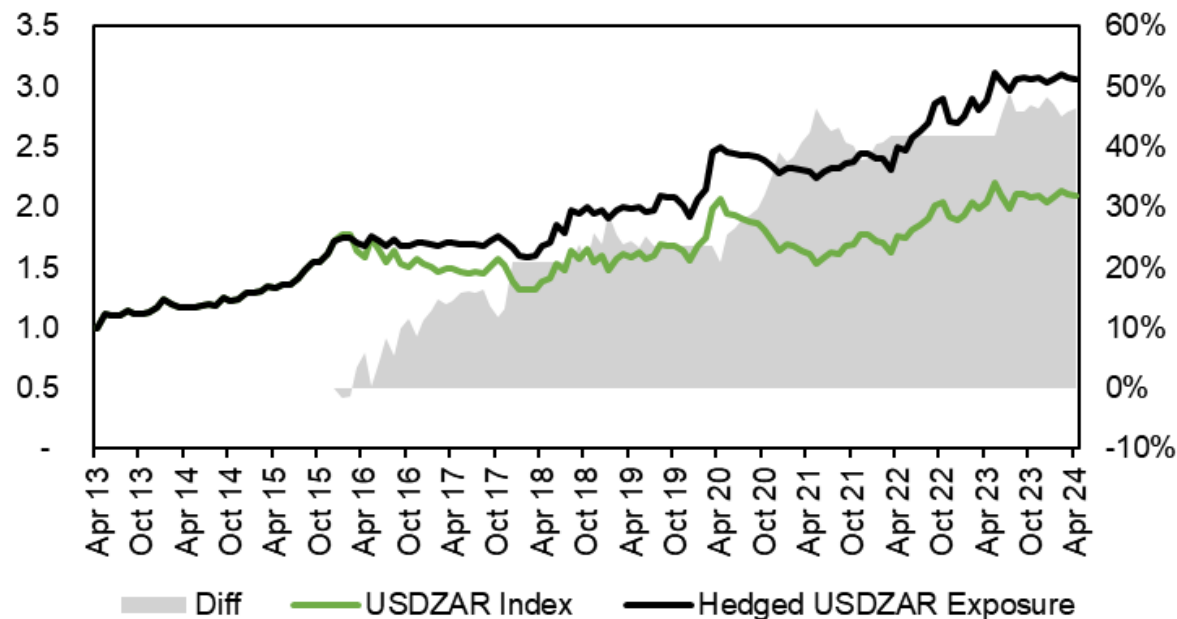
The prediction engine gives a framework for the inclusion of derivative structures



- We implement short fence zero cost derivative structures based on signals from the prediction engine
- Utilizing short fence structures allows for immunization against a stronger rand while allowing for a potential upside to a capped level
- The graph alongside shows the implemented structures including the protection level (bought put) as well as the downside protection level and capped level

Use in Portfolio Construction

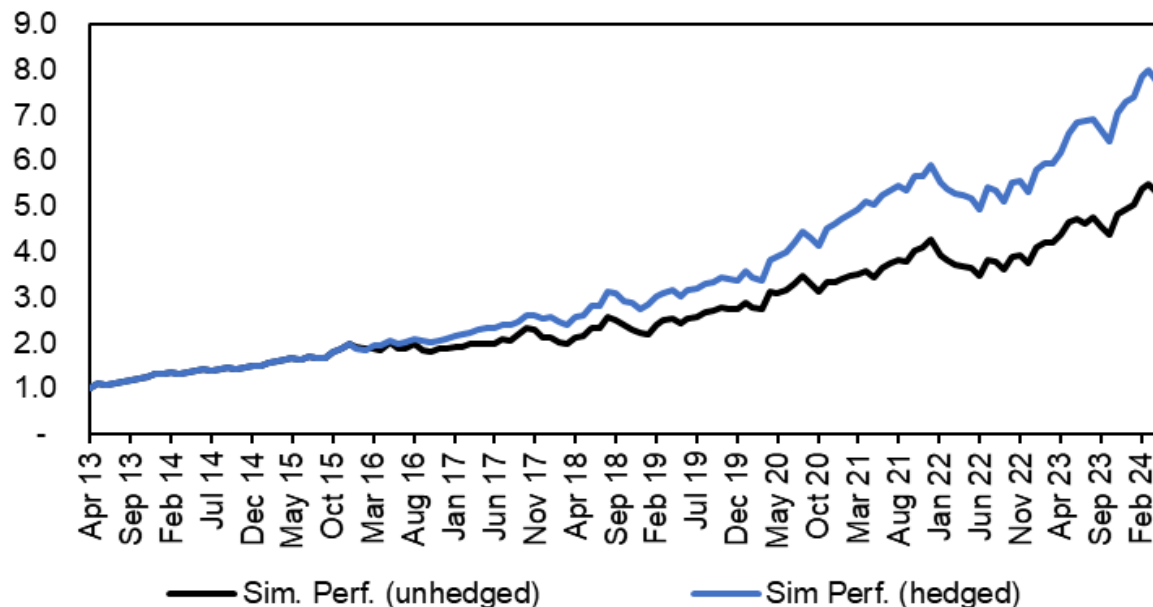
Impact on the USDZAR exchange rate with the implementation of the short fence strategy



	USDZAR Index	Hedged USDZAR
Return p.a.	6.95%	10.73%
Stdev p.a.	14.64%	11.51%
Max Down Month	-9.60%	-6.27%
Max Up Month	13.90%	13.90%

Use in Portfolio Construction

Impact on the performance of the MSCI world with the inclusion of a currency hedging program



	MSCI (unhedged)	MSCI (hedged)
Return p.a.	16.30%	20.41%
Stdev p.a.	14.94%	13.26%
Max Down Month	-8.20%	-6.58%
Max Up Month	14.99%	12.69%



05 Conclusion

Conclusions

- Utilization of Machine Learning combining Macro-economic analysis as well as factor research allows for the development of a robust prediction regime
- Capture of USDZAR future returns is notoriously difficult however we can use the prediction output to optimize a regime expectation which allows for optimal derivative structuring
- Dampening the volatility of the currency pair has significant benefit in the risk/return relationship increasing typical portfolio measures such as Sharpe and Information ratios
- This modelling can also assist in the timing of externalizing assets in line with recent increases in prudential limits





thank you[®]

