<https://fastercapital.com/questions/how-to-choose-between-full-replication,-stratified-sampling,-and-optimization-methods.html>

what collateral optimization is because it’s a rather broad topic and mean a lot of different things.

I just want to start with like the scope.

Large Banks participate in a lot of trading activities and Loan activities and those can generate collateral requirements.

So, covering the scope: what's in scope for CIB and even taking a broader step to cover Enterprise wide.

what are things that CIB does to generate collateral requirements: So, there is

**OTC Derivatives**

* **OTC Derivatives trading**: Collateral requirements are driven by bilateral OTC derivatives such as IR Swaps, Caps/Floors, CDS, Swaptions.
  + - Variation Margin is driven by mark to market following the nettings rules withing legal agreements (ISDA master agreement and CSA). This could be Net-Net, Net-Gross, or Gross basis. Net-Net is the most common application.

Under UMR, there are typically two CSA (Credit Support Annex) :

* one governing **Initial margin** rules: The driver for the initial margin is the net risk withing a legal netting set calculated using SIMM (Standard Initial Margin Model).
* and another governing Variation Margin.

**CSAs define timing requirements** around requests for **collateral substitution and collateral delivery**. Typically, **time to meet a margin call is considered same day**. (collateral must be delivered by EOD upon receipt of a margin call). Substitution timing will range from Next Day to 10-day timing. This poses some timing risk.

**For CSA Eligibility:**

* **IA CSA: Eligibility** schedules are broad. There agreements accept security collateral ranging from US Treasuries, to Sovereign Bonds, to Equities.
* **VM CSA: Eligibility** schedules are narrow. Typically, cash is the only acceptable collateral under UMR. Occasionally, US treasuries are acceptable. However for legacy clients, there may be more optionality

**Cleared Derivatives: CCP (CME, LCH,LME)**

* Like OTC Derivatives, requirements are driven by net risk for initial margin and mark to market for variation margin for Futures, Cleared IR Swaps, Cleared CDS, Cleared Repo.
* **Initial margin is calculated by propriety models housed at each** Clearing House. Some of them expose an API to interact with their models but don’t expose the full details of calculations.

**For CCP Eligibility:**

* IM Eligibility: Eligibility schedules are often broad accepting collateral from Cash to Equities. Schedules are bespoken by the clearing house
* VM: Typically, there is no optionality. So for the purpose of optimization, we exclude this date set. As of 8/8/2024, all CCPs use settle to market convention, where variation margin does accrue but is treated as settlement payment on each day. There is an exception with LMEs, where VM has a collateralized to market treatment

**Triparty Secured lending/Funding**

Counterparties will enter into a triparty agreement between themselves and custodian bank

* WF uses two majors’ triparty venues for trading Triparty secured funding.
  + **BONY** (Bank of New York-Mellon) : is primarily used to transact fixed funding with limited equity funding (Triparty Repo)
  + **JPM**: is primarily used to transact equity funding and Convertible bonds with limited fixed income funding.

**GMRA** (General Master Repo Agreement) is the governing agreements for fixed income

**GMSLA** (General Master Securities Lending Agreement) is the governing agreements for equity funding.

**Triparty eligibility:** Similar to CSA ,there is a broad eligibility for securities to be delivered. There is some optionality with less operational managements (managed by JPM/BONY). Sometimes, for an MBA trade, the agreements allows usage of US Treasuries, Agency Debt, IG Corporate Bonds.

**Trading:**

To support delivery of improved collateral and PnL, certain trades may need to be executed. The collateral optimization model designs support trading in bilateral Repo/Reverse Repo, Cleared Repo, Bilateral FX Forwards, and cash purchases.

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These are the activities that generate collateral. The bank has to post collateral to counter parties to mitigate the credit and market trades. So embedded in all of these, there is a lot optionality. So, each of these is governed by different legal agreements

* OTC derivatives have a master trading agreement under ISDA. And under those, they have something called CSA Credit Support Annex which outlines the optionality that you have and what type of collateral you can deliver (could be cash or securities, from treasuries, MBS corporate bonds, non- us sovereigns)
* CCP (Center Clearing Counterparties), each has its own bespoke legal agreement.
* Tri party repo and security are governed by GMRA, GMSLA. They have optionality like CSA. If you do trade for MBS security funding, you have optionality in what types of agency MBS you are allowed to deliver.

**In order to take advantage of that optionality, you need to be able to trade** (FX swaps, FX Forwards, bilateral or cleared repo.)  
**The goal of the model is how to look at this picture holistically and figure out what's the best way to allocate our collateral**

**how do we measure what best means**

* best could mean maximize my PnL
* best could mean maximize balance sheet (there is a constraint on balance sheet, we can run this model to tell us what are the optimal moves so that we don't have to pay as much to manage our balance)
* best could mean maximize my RWA.
* best in some cases could mean that we're coming up on a key metric snapshot (quarter end, yearend) and we have to get that number where we would like it to be

**Question: if I have bond that would expire in 6 months, can I use it?**

That falls in the realm of “**constraints**”. Tri party custodians ( JPM, BONAY) don’t like to hold securities through coupon date. If the collateral itself is expiring, you can put a constraint or remove them from the options.

In the constraints: if you can say do not put anything that has a coupon date within the next month

the modeling is tedious but nothing is very fancy. The hard part is how to get the data right.

**Example 1: Simple Carry Optimization**

We start with a **single OTC collateral requirement,** governed by CSA.

The agreement allows for the delivery of USD Cash and US treasuries at 2% haircut. In current state, we are currently pledging/posting cash as collateral, for which the counterparty pays us a legal interest.

CSA

Examining cash rates and short term funding markets ( repo/reverse repo), we can come to the conclusion that executing some trading will leave us with more return compared to the initial state.

CSAs have this notion of legal interest , so when you deliver cash , they will pay a certain rate usually indexed to some index so fed funds(or SOFR) .for legal interest on cash , CSA pays us fed funds minus 15 but we see that they accept us notes also,

I wanted to show some of these examples to kind of give an intuition of why we want to take a model-based approach as opposed to doing this just through pure like Manpower and Analysis.

**T0 state**

* Collateral agreement type: CSA 1
  + Eligibility:
    - Cash -🡪 current state $100M
    - UST-notes 🡪 current state 0
* Legal Interest = FEDFUN – 15bps

**Current rates for consideration in optimization**

* **CSA1 = FEDFUN – 15**
* UST Repo = FEDFUNDs + 7 (we can earn FEDFUNDS + 7)
* Unsecured Borro = FEDFUNDS + 25 pbs

Considering UST Repo = FEDFUNDs + 7 , we can earn fed funds plus 7 but the counterpart is not going to pay it to us we have to execute some trading so on T1

So, what will happen:

* CSA accepts treasuries, but at 2% haircut. So, we have to deliver a little bit more of treasuries ($2M more to cover). we take the cash from the CSA it goes to some collateral management desk right now this is XVA
* CSA1
  + USD-cash = 0
  + UST-Notes = 102M
    - --🡪 Gives Collateral Desk (XVA) $100
    - XVA Desk will need $2M cash.
    - we don't have 102 million of cash: typically, US Treasury repos will be traded at 0% haircut so for 102 million of cash you'll get 102 million of us treasuries where do this extra cash come from come? we need to borrow from the parent so a source of cash we're borrowing 2 million from the parent
    - XVA will engage Repo Desk. so, they'll deliver cash to execute a street facing repo we need to Source 102 million of repo
      * We are not posting Cash anymore
      * We are not earning Fed funds – 15 anymore
      * We are borrowing $2 from parent
      * We are paying Fed Funds plus 25
      * Then pass transaction to the repo desk from the street to get us US treasuries for cash
      * **So we are lending cash , we are earning Fed Funds plus 7 on 102.**

net of all of that uh that does end up being a positive number and we end up making some cash $210,000

by doing this this is for a single counterparty. There are 7 flows. 3 to 4 decision points to be made for posting collateral to get the optimal solution, for just one counterparty. If we look across entire OTC derivatives, there might be 2k to 3k counterparties ( \* 4 decision points = 12k decision points) for just standalone. But in reality, it is more complicated as there are relationships.

**Rates =**

* **CSA1 = FEDFUND – 15**
* **UST Repo =FEDFUND + 7**
* **Unsec Borrow = FEDFUN + 25**
* **FEDFUND (8/8/2024) = 5.33%**

Currently Bank is meetings its obligations for derivatives VM on CSA1 with $100M of usd cash.

The counterparty will pay interest on this collateral according to CSA rate

**WF InterestIncomeT0 = 100M(FEDFUND – 15)pbs**

**WF InterestIncomeT0 = 100MFEDFUND – 0.15**

The CSA allows for UST Notes at 2% haircut. Based on market conditions, it is beneficial to substitute the cash collateral with UST collateral. The 2% haircut means that desk will need to borrow an extra 2m as USTs trade with no haircut in the bilateral repo market

**WF InterestIncomeT1 = 102M(FEDFUND + 7)pbs – 2M(FEDFUND + 25)**

**= 102F + 0.0714 – 2F – 0.005 = 100F + 0.0664**

**CarryPickup = InterestIncomeT1 – InterestIncomeT0 = 0.2164Million ( $210k)**

FedFund = 5.33% = 0.0533

15pbs = 0.0015

7 pbs = 0.0007

25 pbs = 0.0025

**Example #2: HairCut Optimization.**

If we examine 2 triparty repo trades, which are executed under different agreements, for serving the same MBS funding.

The 2 agreements take different view on riskiness (collateral haircut) of GNMA vs FNMA securities.

Currently, repo desk is funding agency collateral via Triparty Repo trades. There are mix of GNMA MBS bonds and FNMA MBS bonds. The desk can reorganize the collateral in a way that avoids 3% haircut on FNMA securities at shell 1. This will create an excess of inventory of 3M FNMA MBS.

this is the eligibility schedule and the haircuts that are charged by the clients.

for Counterparty shell one they take GNMA at no haircut ,FNMA at 3% and treasury is at no haircut but the other counterparty doesn't view a difference in riskiness between FNMA and GNMA, they're like

same to us we don't care so here we just look at well this counterparty is charging us a 3% haircut on FNMA but we have plenty of GNMA somewhere else to give them so what you could do is in this flow diagram we're going to take FNMA back from here give the FNMA over here notice we take out 103 and we deliver 100 because of that haircut difference and.

it raises our liquidity metrics like LCR (LCR it's like a ratio of your 30-day net outflows)

we're not looking at carry optimization at all .this is more LCR focused. I want to have more security. my outflows don't change

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | HairCutSchedules |  |  |  |  |
|  | Counterpaty | Security | HC |  |  |
|  | Shell1 | GNMA | 100 |  |  |
|  | Shell1 | FNMA | 97 |  |  |
|  | Shell1 | TSY | 100 |  |  |
|  | Shell2 | GNMA | 100 |  |  |
|  | Shell2 | FNMA | 100 |  |  |
|  | Shell2 | TSY | 100 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| T0 | Triparty Repo |  |  | Triparty Repo |  |
|  | MBS Shell 1 |  |  | MBS Shell 2 |  |
|  | Cash | $200M |  | Cash | $450M |
|  | FNMA | $103M |  | FNMA | $200M |
|  | GNMA | $100M |  | GNMA | $250M |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| T1 | Triparty Repo |  |  | Triparty Repo |  |
|  | MBS Shell 1 |  |  | MBS Shell 2 |  |
|  | Cash | $200M |  | Cash | $450M |
|  | FNMA | 0 |  | FNMA | $300M |
|  | GNMA | $200M |  | GNMA | $150M |
|  |  |  |  |  |  |
|  |  |  | Repo Desk Collateral ops | | |
|  |  |  | Excess $3M FNMA inventory | | |

so now imagine combining these two situations where you have multiple collateral agreements where you want to simultaneously say I want to

* make the best use out of my haircuts and
* then execute some Street facing trades to increase my pnl
  + so the number of decision points will quickly balloon.

that's sort of the motivation for we want to we want to automate that decision- making process via modeling

**Example: Revisit Scenario 1 with counterparty Credit Risk and Balance sheet considerations.**

To add complexity to the first simplified example: **PnL is not the only thing to consider when making decision**. The actions we take around collateral optimization and trading can **have impacts on key metrics like RWA and Asset Balance Sheet.**

* Cash may be pledged in lieu of securities **can lead to reduction of Asset balance sheet level**.
* Trading may not be possible because it elevates RWA CCR or RWA MR.
* we care about our rwa number that impacts our Capital withholding
* here we're just talking about counterparty credit risk not the market risk side

I think the model should not have the market risk side in scope because it makes it makes it very complicated model and not guaranteed to converge because it requires both optimization and simulation.

* **doing a swap of a cash asset for a security asset** and that **security asset on our balance sheet is treated as the haircut market value** for that trade.
* CSA number goes up. this is a variation margin in CSA so there's something called derivative liability netting which allows you to net cash assets against the derivative liability to bring down your asset level.
* **since we're taking cash out we lose that netting benefit**
* we're taking 100 million of cash back to the firm so **since we lost the netting our balance sheet goes up by 100** uh and then **borrowing 2M cash from the parent increases our balance sheet of CIB by 2M.**
* for borrowing cash at top of the house if they have to source that cash from the street like they have to sell a bond or take an unsecured line from the street , then at the top of the house you also see that now.
* On top of the house, we have visibility into their cash inventory .then this at the firm level would be flat :you would see CIB go up by two ,treasury you go down by two ….>Net Zero
* we see an increase of rwa there because we're delivering Securities which will have a volatility impact on the calculation for that derivative CCR
  + so this also helps you make decisions because since these are important metrics :we don't want our rwa to grow that much and we would like to keep our balance sheet in line

**so we want to be able to measure these things and constrain them** and that is very difficult to do by doing Excel calculation or napkin math to try to figure these things out on the fly

so this further motivates the need for a model to be able to run these calculations ,give out the result and **you just tell the model: hey don't make my rwa grow by more than 100 million** and if possible **keep my balance sheet flat**

* **Overview of the model**

**graph of relationships that meant to capture the flow of Securities and cash through the firm into the street**

under CIB

* CSA has a relationship back to the collateral desk(XVA)
* XVA has internal relationship to the Repo Desk
* the repo desk has a relationship to the Street Counterparty
* This is part of CIB
  + And CIB has relationship to the Corporate Treasury

**Graph Objects : class that represents nodes and edges**

* Legal Entity
* LOBS ( CIB Market, Corporate Treasury..)
* Counterparties
* Long Box
* Corporate Treasury
* Asset Objects

functions and classes that represent the nodes and the edges

the things that flow along those edges called assets (cash, securities)

you create in code in memory representation of the graph which models

* the initial State
* Delta State which is what the optimization operates over and
* then the final state

**Market Objects:**

* Cash Rates
* Repo Rates
* CSA/CCP Lega Interest
* Fees that I will have to pay CSA, Counterparty, Street

**Optimization Class consumes Metric:**

* Specify Objective Metrics
* Specifigy Constraint Metrics
* Specify Other Metrics

Inputs:

* Graph
* Market

**Metric Class**

* metric is simply what you want to measure
  + PnL
  + RWA
  + Balance sheet

This has 2 functions:

* **it takes those calculations and puts them into an optimization consumable format**
  + can't simply just write a calculation that says oh this is the math and it produces the result I want and now Optimizer do something.
  + optimizer needs to consume things in a way where it can measure the changes in those metrics over the graph
* the other function to produce a report

you can create a graph at a market and just give it to the metric class and say Here's my initial State what's my balance sheet and what's my rwa.

or you can use it in the term of optimization where you're saying okay now

* I have a goal I'm going to optimize to that goal
  + given some constraints
    - I want to maximize the p&l metric
    - I want to constrain the balance sheet metric to not grow my balance sheet by $500M

given that your construction of the graph and the market results in a something called a **feasible region**

it's possible that you put in a bunch of numbers and it comes up with something that's not feasible: you ask it to reduce balance sheet but given the current state, it is not possible to reduce balance sheet; so, the optimizer will come back with a in infeasible region:

* it says not possible or will return in infinite solution

**Code Setup**

**cvxpy is a is an open-source** interface which allows you to construct optimization problems and pass them into your choice of solver. it supports a **lot of solvers.** The one that I use **is called ECOS** : it's a Stanford open source. But it solves some of the shortfalls of the Scipii packages,

**Asset Class**: are what flow along the graph: this is cash and securities

and these asset objects hold limited reference data associated with the asset.

you can calculate on the Fly by grabbing the information that's stored in that asset and not having to pause in your step and then look up uh the reference information

so the reference information is held in memory on the asset as it flows along the graph

the main goals is to get proof of concept :

* the main goals is to one have a python implementation that that works
* have a model documentation that covers the specifications of the model
* and you know all the things that go into it and
* then a data a data document to specify the data sources what type of data
* what are the sources and what key attributes we are looking to Source

thing that we may or may not have are like bond yields and bond prices

bond prices are also something we want to look at um for a couple reasons like

* one we want to make it an option to the model to sell and buy Bonds in the cash market
* and #2 legal agreements sometimes **specify notional restrictions** and you cannot specify a notional restriction to a model because that ends up being an integer number, which is hard to solve. So we need the market data to translate those notional limits into Market limits.

that way the optimizer can work with them

after you run the optimization, you can do attribution

* say I want to run my carry metric at every level so what happens at the repo
* how much did the repo lob make now? ( gain + $5M)
* How much did the XVA LOB lose? ( lost $5m)
  + it's going to say the repo line of business makes 5.4 million

you run this you can see at the legal entity : the legal entity wins. but under there, the lines of business : you'll have winners and losers so another key thing to doing this is you need somebody sitting on top of all of the collateral management: to say these are the losers these are the winners but we made this much .

everybody needs to be a winner nobody's going to want to participate in this if you can't properly measure which line of business is making and then allocate the costs and the benefits accordingly so that everybody ends up being a winner

you should also be able to do it at the counterparty level attribution so there's only two counterparties here but if you had like 50 counterparties you should be able to run across all the counterparties and then say how much attribution do I get from all the different counter parties and that lets you build like a big report ( building report is another whole game)

|  |  |  |  |
| --- | --- | --- | --- |
| Securuty type | Reassuming Maturity | Credit Rating | HairCut |
| TSY | <3 |  | 100 |
| TSY | <3 |  | 99 |
| TSY | <5 |  | 98 |
| TSY | <10 |  | 96 |
| TSY | <30 |  | 93 |
| CORP |  | AA | 80 |

**different carry calculations work**

|  |  |
| --- | --- |
| Collateral Aggrement Carry |  |
| **OTC** |  |
| Cash Legal Interest Index | Fed Fund, SOFR, ESTR |
| Legal Interst Spread | -10,-25,+10 |
| Cap | 650pbs |
| Floor | pbs |
| Apply a model penalty for operational management | -2pbs |
|  |  |
| **Cleared** |  |
| Cash Legal Interest | Clearing House publishes a Rate (CME Rare, lCH rate) |
| Cash Legal Interest Spread |  |
| Collateral Management Fees | -7pbs, -11pbs, the CCP will publish fee |
|  |  |
| **Triparty** |  |
| fixed fee | you pay them a fixed fee every year for collateral management. Not considered because you have to pay it anyway |
| intraday lines of Credit | not considered |

|  |  |
| --- | --- |
| Trading agreements | MV |
|  | Carry = MV\_Security/Cash \* ( Market Rate - Fees - Spread) |
|  |  |
| Repo/Revese Repo |  |
| Repo Rate | 540PBS |
| Security leg | Carry = 0 |
| Cash leg | Carry = - repoRate \* CashMove |
|  |  |
|  |  |
| Collateral Swaps |  |
| Sell Security Leg1 | Repo Rate 1 |
| Buy Security Leg2 | Repo Rate 2 |
|  | Carry = (Repo Rate 1 - RepoRate 2)\* Base Notiaonal |
|  |  |
|  |  |
| FX Forward |  |
| swapping USD ..> JPY | Carry = USD Notional \* Tonar\_FXBasisAdjusted- SOFR |
| uSD funding leg is handled internally |  |

different carry calculations work and you'll kind of see how uh how those are considered okay um so let's let's start with uh so I had a couple of different so we start with collateral agreements okay so and then I'll break it out into OTC cleared and tri party yeah okay so for OTC uh things you need to consider are the cash legal interest index yeah so these things could be like fed funds suur eser Etc y uh then there is the uh legal interest

(29:39) spread so this could be like whatever the index isus 10us 25 plus plus 10 something like this yeah um and then you also have to consider uh cap and floor so cap might be 650 basis points uh floor will probably be zero basis points y so there is no there is no uh legal interest on Securities in OTC agreements so when you pledge Securities uh basically your carry from that agreement is zero yeah if you were to swap cash for security then your carry is negative because you were earning interest and now you're no longer earning interest in

(30:41) that agreement y so like the simple example I walked through before what you're really doing is playing the spread between the repo market and the the CSA legal interest yeah so in cleared um you also have this cash legal interest uh but it's typically not defined by an index um it may be tied to an index but what actually happens is the uh Clearing House publishes a rate yeah uh for lch they actually link them to indices uh so it will be like Sofer and then uh the lch publishes to spread this over so cash they'll pay you so for

(31:29) minus like 40 yeah uh so there's also like the cash insur spread if it is index link so like at CME they just publisher rate so they have a CME obfr rate uh it's typically obfr minus 25 but that spread moves around so really you just want to consume the rate that CMD publishes um and then you also have collateral management fee this is something like minus s basis points minus 11 basis points the Clearing House will publish a fee yeah and a tri party uh the uh it's fixed fee yeah uh so you don't you don't really

(32:34) have to consider uh anything for the tri party uh you pay them you pay them a fixed fee every year for for the collateral management the only things that you would consider is like uh intraday lines of credit if they need to extend you an intraday line of credit but that's not in scope for this model this is this is something you run like uh end of day okay uh so you don't need to consider this and then you also don't need to consider this because no matter what you do you pay a fixed fee y so this is where you can kind of like

(33:16) capture your optionality uh so in terms of like pledging security collateral it from a p&l perspective it is equivalent between OTC and tri party they're usually are not fees in OTC and then this is fixed so you don't have to worry about that now this one is operationally more difficult so what you can do is uh apply a model penalty okay for operational difficulty and you can say okay I'm going to pledge uh every time I want to change something at an OTC counterparty uh I'm going to lose two basis points so

(34:00) you set a you set a hurdle you set a hurdle rate if I can't make more than two basis points doing this I don't want to do it oh makes sense okay uh so this is where like you can capture like which one is more expensive and that so like just from a pure like looking at Market rates everything looks the same but then when you drill into the legal agreements there are like these fees and spreads that tack on top of that yeah and because you're trying to maximize p&l and fees are something you consider when you're doing the p&l

(34:40) calculation um if that Fe is too large then it will not make the recommendation oh makes sense uh and then the actual calculations are all very uh simple so all of the instruments that are being considered in the optimizer whether it be collateral uh agreement carry and fees or um trading like Street facing trades they're all linear instruments so all of the calculations are just like carry equals um you know let's say the market value of the security or cash times market rate minus fees minus spread but the way you arrive in market

(35:44) rate fees and spread it was different for every agreement y but this calculation is is essentially the same across all of the agreements okay uh when you look at trading agreements so let's talk about repo repo reverse repo so you have a repo rate so let's just say I'm know 540 basis points now whether you do repo or reverse repo you will either earn this or pay this you do repo your sourcing cash uh so you will pay you pay this and if you're doing reverse repo you will earn this Y and this value is is tacked onto

(36:35) the cash leg of the trade so there's like a security leg the carry on the security leg is equal to zero and then there's a cash leg so the carry is equal to negative the repo rate times the cash oh okay so if you sourcing cash that means I'm having positive cash into the firm uh which means I have to pay so it's it's the sign is flipped y if I'm sourcing security I've cash out of the firm so negative cash uh but I'm let the cash y uh then you get into things on the collateral swaps so in a collateral swap you are uh

(37:27) cell security leg one and buy security leg two so these are these are cash free transactions so you'll have a you'll have a repo rate and another repo rate so you have like repo rate one and repo rate two Y and the carry is equal to umate oneus repo rate to times your uh base notional so the notional of these two Securities will be different but in a collateral swap there is an implied there's an implied cach notional which ends up netting to zero so the way a collateral swap works is actually it's a

(38:18) combination of a repo trade and a reverse repo trade but in in a single in a single trade so you agree on a cash notional you calculate the haircuts for the security is based on that cash notional and then you exchange and you exchange them okay so that that carry is based on that implied cash notional but there is in fact no cash on this trade yeah uh and then we have like the FX forward now the way if you think about FX forwards like you're you're swapping US dollar for JPY so your carry might look something like

(39:01) uh J uh Tona FX basis adjusted minus suur but this is a this is implying um this is not how we view it in the model uh so in the model because all of the flows of cach and security are track uh we don't actually consider the Sofer leg of of this trade on on the agreement itself so the carry from the FX for is just based on the FX basis adjusted rate of the non-dollar currency H and the reason we do that is because the funding leg of the US the US dollar funding leg is handled internally so it's not quite right to

(39:57) compare it to because the model is actually going to look at the real the real cost of sourcing that um of sourcing that US dollar so if if we go back to uh here so let's let's imagine that instead of swapping USD cash for notes we want to swap USD cash for yet so the original funding for this US Dollar Cash has already been handled we've done it somewhere and from the models perspective it's a black box we just know that we have US dollar cash however it was funded we don't care but how how much interest it's earning right

(40:34) now is fed funds minus 15 so if I were to go and take this cash and do an fx forward to yet I'm not going to use Sofer as my base Benchmark for the US dollar link because I know the real cost of where I got it from I know that I'm getting fed funds minus5 so that that cost of sourcing that cash is already handled in the carry calculation for the CSA if I take that cash out I am losing fed funds minus 15 I'm not losing suur I'm losing fed funds minus 15 and I'm earning Yen FX basis adjusted