Risk Factors of Fund

... creating a risk number associated with a fund that can be tested against data

- creating a formula that can produce a weighted risk factor for the fund, e.g. an "oversight risk measure" (weighting of MG) that can be used across the product and business
  - oversight risk factors in a fund are based on *fund construction*, *operations on fund holdings*, and *current market behaviour*
  - oversight risk factors are not considering a *portfolio strategy* (the way fund managers are composing their portfolios and are obliged to disclose this strategy to investors), *portfolio risk*, *investment risk*, and a *concentration risk*
- user experience
  - organisations will be able to identify the amount of risk that their *intended actions are incorrectly executed or misinformed* due to some operational risk elements (their execution risk, not investment risk)
  - *operational professionals and fund managers*, who are trying to make investment decisions, will be able to identify the risk if something goes wrong in their day-to-day operations and business activities (operational risk perspective)

Categories of Risk Factors

- market uncertainty
- challenging holdings
- manual entries
- fund outliers

market uncertainty

- identification of "market uncertainty" risk in funds
- market uncertainty is a risk that is inherent to the entire market (systematic) and market segments (unsystematic)
  - **systematic risk** (market risk / undiversifiable risk / volatility) is about impacts of economic, geo-political, and financial factors on market
  - **unsystematic risk** is about impacts on specific industry or security

pheno menon	observation	data	approach

market instability in market sectors	• these are market sectors that fund has invested into
	  • events in volatile or emerging markets
	  • but some sectors may not be affected
	• company announcements of their result and dividends (pay days) can cause the market movement and volatility of the sector
	• the effect on fund is dependent on holdings weightings in the fund for the particular sector and on objective of the fund (we are not looking into fund objective)
		• news data
		  • articles from news feed subscriptions
		  • not available (yet to be collected from clients)
		• fund oversight data from pControl
		  • data enrichment for impacts and returns
		  • not available from client's raw data
		  • investment holdings impacts on change of value holding (base point impact on NAV equal to X point)
		  • return is base points / percentages (changes of value)
		  • not using beta, looking at change of dollar value (percentage movement)
		• investment data
		  • **fund data**
		  • asset code in pControl
		  • to know what securities the fund have (SEDOL, ISIN, and CUSIP)
		  • to know what weighting of the asset has in the fund, i.e. to figure out the composition of fund
		  • U100 table for asset code (fund code in pControl)
		  • effective date field is needed to know how to calculate the price (on Wednesday in Australia you calculate the Tuesday price from different market)
		  • P202 table for the weighting
		  • instrument type in pControl
		  • the instrument type is next level down from asset group or class
		  • market sector in pControl
		  • u180_security sector
		  • l080_product_master sector_l1, sector_l2, sector_l3, sector_l4 (Energy, Energy Oil, Gas & Consumable Fuels Integrated Oil & Gas, etc.)
		  • **industry classifications**
		  • GICS in Bloomberg data
		  • GICS (industry-level) are not in pControl, but clients may give us GICS in spreadsheets about their fund
		  • GICS may be in our Bloomberg feed interface we are building for FVC now, but we will need to get it from client as they limit the amount of securities with current license (DEV)
		  • **benchmarks**
		  • benchmark in pControl
		  • u280_benchmarks gics_code (sub-industry i.e. 35101010)
		  • clients are not using this table much is a placeholder for now unless benchmark has listed its constituents (those will have the GICS)
		  • the data in u280 depends on what client gives us, but we need to first look at what they give us (they may have all benchmarks)
		  • benchmarks can validate our market risk approach
		  • a benchmark can be a measure of volatility a representative benchmark / indexes for each industry classification can be picked
			1. identification of market sectors the fund invested into
			2. determination of industry-weighting for the fund that is invested in the industry (or sector)
			3. identification of news about the market sectors that fund is invested in
			  • Topic Modelling
			  • Sentiment Analysis
			  • Named Entity Recognition
			4. correlation of news to securities that are affected by such market events (volatility)
			  • if interest rates goes down or up, the price of stock will follow
			  • there are specific standard market events, employment figures, mortgages
			5. generation of statement about the market risk
			  • "50 % of fund has invested in this industry, and this industry has moved that much, those were some market news that significantly impacted the fund (significant amount of fund)"
			6. we can use beta (we do not have it in pContorl, we have to calculated ourselves or get it from client / Bloomberg) + this news measurement
			  a. base point movement from the beta on the fund (or individual holdings) that movement is the return using the return we can derive the impact on the fund
			  b. (that should measure the return of individual holding and fund level, then derive the impact from return)
			7. creation of market risk level (high, low, medium)

market instability in local markets	• regional market news
	  • news about market in a specific country
	  • articles about unemployments, country catastrophes, etc.
	• market specific data
	  • economic data
	  • rates
	  • GDP figures		

market instability in global market	• news about geopolitical events		

challenging holdings

- identification of "challenging holdings" risk in funds
- challenging holdings are risky or complex holdings
  - risky funds include large amount of holdings, manual entries in the system, and discrepancies between fundamental NAV data and validations
  - complex assets are derivatives, OTC, etc.
- difficult fund are funds that are determined by fund manager as difficult
  - complex attributes defined by BNP Lux may be used as a guide to define this)
  - it can be also funds with certain type and combination of assets, e.g. number & size of holdings and transactions and number of assets that are difficult to value

phenomenon	observation	data	approach

difficult holdings to value	• number of securities that are difficult to price
	  • Illiquid securities
	  • OTC derivatives
	• funds that are determined by fund manager as difficult
	
	  • BNP Lux defines their own complex attributes defined (it may be used as a guide to define this)
	• **fund manager definition of their difficult funds**
	  • this information from clients can be used to validate our results of experiments
	  • BNP Lux defines their own complex attributes defined (it may be used as a guide to define this
	  • but this phenomenon is something we should be able to come up with on our side
		investment data
		
		• **fund information**
		  • input data (u100, u101, u107, u108, u104, u250, u200, u109, u110, u113)
		  • u100_investment_holdings
		  • u175_security_prices
		  • u180_security
		  • a fund is represented by "pcontrol_code" field in tables
		  • a fund will have share classes (they will start with the same naming for the same fund)
		  • list of funds can be retrieved with 'select distinct prontrol_code from u100' there are no share classes
		  • pControls code + effective date + asset code (can be hold by multiple pCotnrol codes) + price run type
		  • asset_code in u100_investment_holdings with fund code (pcontrol_code)
		  • select derivative_position from u200_asset_transactions
		• **type of difficult holdings to value**
		  • l220 table with "instrument types" field
		  • instrument types can identify OTCs, derivatives, and can have some other category that may be possible to identify as more difficult to value
		  • OTC exchange code can represent derivates (not available yet)
		  • private equity
		  • property funds have property assets, which will get valued only once or few times a year
		  • and other stuff on private markets
		  • the "internal instrument type" field may be indicating a derivative
		  • l245 table has illiquid securities (can be any security of any type)
		  • l245 for suspended, zero prices, went bankrupt, priced weekly, and other scenarios
		  • this table has a "stale type"
			• we will put all the 8 topics with equal weight contributing to the risk of challenging holdings

new instrument type	previously unprocessed holdings
	
	• securities that are coming into the fund oversight product for the first time
	• new instrument type (specific setup in pControl)
	• new instruments require instrument type
		fund oversight data (from pControl)
		
		• **instrument types**
		  • l202 table has a "last_updated_date" column, which can be used to retrieve the new instrument type
		  • l220_instrument_type_mappings, date
		  • l220 table is providing with all types of new instruments, but it is under a scenario that items have to be added to this table in order to be loaded (it will fail the first time it tries to get here)
		  • we do the lookup against l202 (it fails)
		  • it updates the "p_description" in u100 (may say some description like "instrument type not valid")
		  • updates the p135 (take on file-level)
		  • user will investigate and add the entry for new instrument type into l220 (or our team will add it)
		  • client will rerun the validation
		  • p135 table indicates new instrument types that are yet to be imported (when data comes in and we can't map it)
		  • those are the "not imported" instrument types the first day that you have particular instrument type
		  • p135 records the status of every file load
		  • file may have all investment holdings or one fund with more holdings
		• **asset category**
		  • assets category code is the category code (FI or equity)
		  • the next level down is the instrument type
		  • "cat_code" (i.e 'FI', 'EQ', etc.) in "u100_investment_holdings" mapping to "l220_instrument_type_mappings"
		  • asset type is not the same as the asset category (cat_code in u100)
		
		investment data
		
		• previously unprocessed holdings
		
		`select u100.pcontrol_code from u100_investment_holdings u100`
		
		`inner join t101_node as t101 on t101.node_code = u100.pcontrol_code and t101.node_type_id = 12 -- process entity type node`
		
		`inner join t311_unit_price as t311 on t311.node_id = t101.node_id and t311.effective_date = to_date(u100.effective_date, 'YYYYMMDD') and t311.unitp_status_type_id <> 5 -- not delete`
		
		`inner join t645_unitp_status_type as t645 on t645.unitp_status_type_id = t311.unitp_status_type_id and t645.unitp_status_type_description != 'Approved'`	

new general ledger accounts	• previously unseen GL accounts by fund oversight product	**fund oversight data** (from pControl)
		
		• **new general ledger accounts**
		
		  • GL is a different representation of assets should be correlation with asset movements in u100 etc. TPAs do this
		  • u104
		  • p208 (A09)
		  • u795_gl_export
		  • u100_investment_holdings with account_import	

securities with stale prices	• number of securities with zero values
	• stale prices can be caused by trading volumes that are zero
		investment data
		• **securities with stale prices**
		  • *stale price include securities with zero value (zero price), suspended, when market didn't move previous day, etc.*
		  • l245_stale_priced_securities, stale_type='Zero'
		`select * from u100_investment_holdings where asset_code in (select asset_code from l245_stale_priced_securities where stale_type='Zero')`	

fair value securities	• number of securities with fair value movement
	• pricing of fund is impacted by news after the market is closed
		fund oversight data (from pControl)
		• **fair value securities**
		  • u107_price_adjustment, column (fair_value_adjustment_type, fair_value_adjustment_param)
		  • or from p256_fair_value_master, p257_fair_value_fund_detail, p258_fair_value_master_rec
		  • data can be retrieved from u107, tells us if we are running the expected pricing
		  • p256, p257, p258 is the FVC (control) are the tables, but those not in production with clients yet (UAT)
		  • two types of FV
		  • we can get it from market
		  • ICE is the data provider that can tell us which security based on region would need FV
		  • client have to tell us: brand new security, infrequently, hard to price asset	

large amount of securities	• number of securities in fund
	  • asset type
	  • number of assets
	• size of holdings
	  • number of transactions
	  • size of transactions (type of fund / per client investment strategy) arrive at metrics what is abnormal more transactions increases the risk
		investment data
		• **large amount of securities**
		  • the number & size of holdings is the same with the number of assets in one fund (u100)
		  • the number & size of transactions is the same with the number of assets in one transaction (u200 is the transaction table)
		  • the number of assets can be retrieved by the "count of assets by pcontrol code, effective date, price run type, and run id"
		  • not by the number of different asset_code (security / holding) in holdings mean same (u100)
		`select pcontrol_code, count(asset_code) from u100_investment_holdings group by pcontrol_code order by count (asset_code) desc`	

corporate actions on holdings	• holdings in fund
	• corporate actions on holdings in fund
	  • mergers, splits, spin-offs, dividends, etc.
		investment data
		• **corporate actions**
		  • we retrieve data with same pcontrol_code
		  • (u100.pcontrol_code=u210.pcontrol_code)
		  • u210 will most likely not be available with only oversight clients
		  • u200 will tells us what CAs are in the market (not about what CAs has been applied on fund)
		  • ca_type in u210_corporate_action (= u100. pcontrol_code)
		  • ('DIVIDEND', 'EXCHCASH', 'EXCHCOMP', 'EXCHNEW', 'EXCHSEC', REVSPLIT', 'SPINOFF', 'SPLBONUS', 'STOCKDIV')
		`select * from u210_corporate_action where pcontrol_code in (select pcontrol_code from u100_investmenet_holdings)`	

single source securities	• number of securities with price from only single source
	  • price from single source increases the risk to value the security (not able to verify by other sources)
	  • bonds pricing (#1 one price source, #2 average priced source, or #3 fair value pricing)
	  • clients have price hierarchy and TPA follow that, we will get the filed what source of price
		investment data
		• **single source securities**
		  • we will have to ask clients
		  • at instrument type level we can tell the price source and by region (depending what clients trust, we would configure / mirror what they do)
		  • we are usually looking at the primary source, but for single source securities we have to know this for stuff like FVC	

manual entries

- identification of "manual entires" risks in funds

phenomenon	observation	data	approach

funds with manual entries in the system	• files from TPAs should never be manually changed
	  • this is not about manual entries in client raw data as well (that is TPA stuff)
	• changes done by users increase a probability that they were manual
	  • values in the last "updated date" and "by" columns in static tables will show if there was a change today and by whom (user)
	• manual entries in pControl are mostly from Backup NAV and Expected Pricing perspective, less from NAV and Oversight
	  • *from the oversight side*, only mapping tables and static reference tables will have manual changes
	  • such tables could be loaded from file or manually
	  • *from expected prices side*, we allow clients to make adjustments (u107)
	• users (clients) cannot change the result of validation, they can only accept or reject the validation result
	  • if rejected new data has to be loaded
	  • going back to TPA and wait for them to provide a new file
	  • Generali do validations during day
	  • they can only accept
	  • Invesco do it early in the day
	  • they may reject
	• there will be always be a comment when users are "transitioning the status stream"
	  • this is what it is about
		• u101m_manual_unit_prices
		• u178m_manual_fx_rates
		• u290_sam_detail_manual
		• u107_price_adjustment
		• p135_import_register
		  • manually_modified_batch=0
		  • import_type='validate'	

system parameters	• changes in system parameters
	  • tolerances are static data, but can be changed via file load as well
	• an increased risk that something goes wrong arises with mapping whenever new type of something comes in
	  • transaction
	  • account
	  • instrument
	  • share class
	  • change in fund structure
	• oversight clients do expected pricing, but Invesco and Generali does not
		• static tables with suspended securities
		• static tables with zero prices based on events in market
		  • so that they do not keep getting exceptions
		• mapping tables can be changed when something new has happened
		  • new security
		  • instrument type
		  • entity
		• static tables
		  • reference tables
		  • tolerances
		  • security master table
		  • l245 infrequently priced securities
		  • mapping tables
		  • instrument type mappings
		  • account code mappings
		  • code mapping
		  • transaction code mapping	

user commentary on exceptions	• commentary will give us a hint to what users looked at
	  • different type of exception commentary
	  • comments format has changed
	  • Generali and Invesco may be on the old system
	• commentary will help us to understand
	  1. patterns (fixed comments)
	  2. highlight where efficiencies are (same issue happening over and over again)		

fund outliers

- identification of "fund outlier" risk in funds

phenomenon	observation	data	approach

fund component (bottom-level)	• fund component behaviour
	  • **presumed relationship** *"identical or similar fund components and categories (dependent variable) behave more alike across different funds with the greater usage and application of the same market data (independent variables)."*
	  • **anticipated change** *"If the market data change, the behaviour of fund components and categories will change as well."*
	  • **example** *"The same components in different funds will have lot of discrepancies in their behaviour when the market data is applied differently* to those components or different valuation point is applied**."*
	• commercial objective
	  • *"Knowing the behaviour of fund components helps clients with the oversight analysis on their funds and the resolution of oversight exceptions in funds."*
	  • clients will be able to see their other funds with the same components that had the same issue
	  • components can be assets, corporate action, fees, hedging, etc.
	  • we currently have share class comparison (looking at share class component), but there may be another insights
	  • we expect certain funds to behave certain way (fund group), but with the share class it is a seperate case that should behave identical
	• fund components
	  • the bottom level of fund with individual holdings (securities)
	  • individual holdings
	  • assets
	  • corporate actions
	  • corporate actions can be applied in different way to different funds, e.g. voluntary corporate actions for dividends with stock or cash
	  • market data at different time can be applied to fund, i. e. they are not applied differently as the valuation point can be taken as a snapshot at different time (midday VS close to EOD, etc.)
	  • fees (GL related)
	  • hedging
		• fund components
		  • we should look at P tables if available (data has been processed), else use U tables (import / buffer data)
		  • data are at different places depending where the component is
		  • the available pControl attributes are the market data, which are applied differently to fund components (or different valuation point is applied)
		• individual holdings
		  • u100
		  • u202
		  • each row of the u100 is an individual holding
		  • derivatives may have multiple rows (multiple leg holding with unique asset code)
		  • there is a field tying them together
		  • most funds belong to at least one holding, but some funds will have no holdings
		  • funds can only have seed money they start with and need to invest in
		  • or funds that close down, waiting for distribution from someone else
		• corporate acton
		  • status of corporate action on the **fund components** about knowing if the corporate_action has been applied (or not) and how
		  • expected pricing used only (not used by oversight clients)
		  • the relationship of fund component and corporate action is about knowing which corporation action is related to each security
		  • corporate actions (voluntary and mandatory) by asset code (asset_code in u210) business decision
		  • voluntary will be joined by p control code, asset code, and date
		  • mandatory will be asset based (everyone holding that asset will take the action as presented)
		  • `select pcontrol_code, count(asset_code) from u100_investment_holdings`
		  • `group by pcontrol_code`
		  • fund - asset - coporation action
		  • u210_corporate_action
		• fees
		  • stored in GL
		• hedging
		  • stored differently per client
		  • could be looking at forwards (representing hedging)
		  • or in GL
			• fund outlier can be any discrepancies between market, trading, and fund data
			• we think it is based on the
			  • funds component
			  • funds category
			  • funds group
			  • market behaviour

fund asset category (middle-level)	• fund categories
	  • the middle level of fund with groups of holdings (categories)
	  • or middle category with share classes, income, accumulation, different currencies
	  • categories have their own individual holdings inside each of them
	• category-level comparison
	  • funds that have the same distribution date are expected to behave alike
	  • for instance, their category level (income-expense) should move alike across different funds
	  • also, prices of fund categories could be similar when there are no big movements in FX rates and the same valuation point is used
		• fund category
		  • this is the category code in A03 (p202) and u100 (cat_code)
		  • l220 mapping table is defining the derivative, if price includes income, etc.
		  • instrument_type data filed is slightly lower than the category
		  • similar share classes may move the same
		  • what is 'cat_type' in u210?	

fund group (top-level)	• dynamic fund group
	  • **presumed relationship** *"The fund group characterises its funds (dependent variable) better with the more consistent behaviour among its funds in the market (independent variables)."*
	  • **anticipated change** *"If the fund and market behaviour change, the dynamic fund group will change as well."*
	  • **example** "*A fund will behave more consistently with respect to other funds in the same dynamic fund group when all funds in this fund group share similar characteristics at the current market conditions."*
	• fund grouping
	  • groups for funds are identified via different approaches
	  • funds can be grouped by the same valuation point when we expect them to use the same prices
	  • funds can be grouped by looking from top down perceptive since they are peers and we expect them to move the same way
	  • funds are usually categorised into 4-5 different groups, including peer group, multi asset, and FI funds
	• user experience
	  • this can feed into fund benchmarking, including peer group comparisons (pensions funds moving in line, etc.)
	• fund group outlier
	  • **presumed relationship** *"The outlier in fund group (dependent variable) is easier to detect when the greater number of funds are characterised into groups, which are considering fund and market behaviour (independent variables)."*
	  • **anticipated change** *"If the fund groups, fund behaviour, and market behaviour change, the fund group outlier will change as well."*
	  • **example** *"An outlier in fund group will be harder to spot when other funds are not part of any group."*
	• funds are expected to behave consistently if they can be classified into the same group (funds and classes tend to sit within certain classifications with some common characteristics)
	  • an outlier in a fund group is a fund that does no longer behave the same (or similar) to other funds in that group
	  • for instance, a fund holds inconsistent assets (currency, forward rates, etc.) since the fundamental data were not applied consistently
	  • highlighting outliers within a fund classification based upon historical correlations with certain data points that change over time
	• fund-level with attributes for fund
	  • funds are usually categorised into 4-5 different groups, including peer group, multi asset, and FI funds
	  • goal-based investors may look for goals-related attributes in their portfolio, which can be evolving across their life / saving cycle
	  • portfolio construction for lower risk, higher alpha, lower down-capture, higher long-horizon return, etc.
	• category of fund
	  • money market, FI, mutual fund, OEIC, SICAV
	  • active vs passive
	• pricing frequency of funds may have effect on outlier
	• price movement
	  • it is a validation looking on funds that should move in line
	  • it is used in share classes and can be also used to look at similar funds
	• our observations (for fund to fund structure)
	  • life and pension companies should move in the same way
	  • or they are investing into same external funds
	  • using same underlying funds
	  • or SF, life insurance
	  • the same underlying assets should track the same
		• news data
		  • fund calendar can influence the performance of fund
		• fund oversight data
		  • fund performance (return) characteristics
		  • correlation
		  • tracking errors
		  • R
		  • volatility
		• investment data
		  • fact sheets to highlight fund characteristics (kind of prospectus summary)
		  • asset managers have their fact sheets for their funds (for marketing and regulatory purposes)
		  • transaction data (buying and selling)
		  • increase buying and selling in the market
		  • rebalancing dates will generate transactions (index or tracking fund may rebalance every week or month)
		  • corporate actions (can see them in the market, but no effect on fund anomaly probably)
		• peer group
		  • we have a concept of peer group funds in pControl
		  • peer groups are defined by clients
		  • clients can setup on their own peer groups in pcontrol
		  • we have implemented this as a benchmarks (composite, dynamic, or peer group) and pControl will calculate the average of peer group
		  • it is a validation that looks at returns across funds and highlighting an outlier among a peer group
		  • currently, we use templates (to tell us if it is a class) and only have NAV group that groups funds by valuation points
		  • we should define some characteristics for funds, including base currency, valuation point, etc.
		  • important fund characteristics (features) to fund group from the available pControl attributes
		  • one example, attributes based fund group
		  • `select * from t160_attributes where process_entity_node_id in`
		  • `(select node_id from t101_node where node_code='TST_UP_Daily_017')`	