Development of Financial Products Business Rules Using Business Intelligence Technology

David Macias and Jennifer Li, IRS: Large Business and International Division

In recent years there has been growing concern with the financial and tax compliance risks associated with use of complex financial instruments by large companies. The increasing complexity, sophistication and aggressiveness of these arrangements make them more difficult to detect using traditional return scoring and screening techniques, and also make it more important that the Internal Revenue Service (IRS) find improved methods for risk detection in this area. This paper discusses the Large Business and International Division of IRS (LB&I) use of advanced technology and availability of electronic data to improve risk identification and return selection for corporate taxpayers who are involved in these transactions.

The target audience for our paper is LB&I upper management. The message of our paper is that the Financial Products Filter Model can successfully be deployed as a production model for return selection. Two key algorithms developed for the Financial Products Filter Model can improve the performance of other LB&I filter models. The first algorithm consolidates the risk selection filter results from multiple IRS forms attached to the corporation's tax return. The second algorithm weights results from multiple risk assessment rule sets based on risk scores and the number of filter hits.

The Financial Products Filter Model will be combined with the results of other filters—such as international (Forms 5471, 5472, 8858) issues, partnership (Form 1065) issues, and 1120 Schedule M-3 issues—to arrive at a final risk assessment selection.

Why Financial Products Filters?[1]

The issues examined by Financial Products Specialists are among the most complex transactions encountered by the IRS. Complex Financial Products are used in every industry both domestically and internationally and are also used by wealthy individuals. In many cases Financial Products are at the heart of tax avoidance schemes. These schemes frequently attempt to use U.S. pass-through entities (disregarded entities, trusts, partnerships, and S corporations) and/or foreign entities in order to disguise the transaction or to attempt to gain a technical advantage. Issues examined by the Financial Products Team include: structured transactions (CARDS, BOSS, and Son of Boss), debt/equity issues, and foreign currency transactions. Financial Products Specialists also work in concert with other specialties within the IRS; such as International Examiners and Economists. One such issue that is often worked jointly between the Financial Products specialists and the International Examiner is a foreign tax credit generator transaction. The Financial Products specialists examine derivative instruments involved in these transactions, leaving the international law aspects to the expertise of the international examiners.

The LB&I Financial Products Specialist (FP) program and LB&I Planning, Analysis, Inventory and Research (PAIR) saw the need to develop a set of business rules to assist Case Managers and Financial Products Specialists to select suitable returns for examination by the FP program. With accurate business rules results, FP team managers would have one more tool in their arsenal to identify features of returns that require FP Specialists support. Other benefits include; improved risk identification, increased consistency in FP specialists involvement, improved capabilities to forecast FP specialists resource needs, and better use of FP specialists resources.

History of Financial Products Rules

In 2005, a team comprised of Financial Products specialists and LB&I Research analysts developed the Financial Products business rules using both SEC Form 10-K and tax return data. The rules were applied to

returns filed in processing years 2000, 2001 and 2002. The resulting hits were compared against issues raised by FP specialists in completed examinations. The team concluded that the rules identified LB&I cases with potential FP issues but did not identify the specific FP issues.

In 2009, PAIR was requested to revisit the Financial Products business rules with the goal of identifying productive returns for the program. A team of Financial Products Subject Matter Experts (SMEs) and Program Analysts (Analysts) from PAIR was formed to revise the prior financial product business rules and to suggest new rules. Each of the SMEs have over 10 years experience as a Financial Products specialists and enjoy a reputation of being leading experts in their field. The new rules were designed to respond to either tax law changes or enhanced data capture by IRS. We started with Form 1120.

Form 1120 Financial Products Rules

The Form 1120 Financial Products Rule Set was transformed from the steps an experienced Financial Products Specialists performs in putting together a risk assessment of an entity. These steps may include reading the SEC Form 10-K, looking for certain key words, performing comparisons between tax years, calculation of ratios and certain key statistics, such as implied interest rates and reviewing related party returns.

The Financial Products business rules by themselves cannot replace the intuition and experience of a Senior Financial Products Specialist. They can, however, narrow the population of returns that the specialists review so that they can select productive returns for examination.

The Form 1120 rule set was divided into many smaller rule sets according to form type. These form types included the Form 1120 itself, Schedule M-3, Form 5472, Form 8858, Form 8858M, Form 8886, Form 6781, and Form 8916A.

Initial Strategy

The SMEs and Analysts followed seven initial steps:

1. Updated existing or created new business rules for the tax year under study.
2. Assigned a risk level to each of the business rules.
3. Built Financial Product business rules on Blaze Advisor.
4. Ran each business rule separately on each tax return form analyzed to validate the rules using sample returns to test validity.
5. Aggregated risk scores across tax return forms to determine the "Highest Risk Return."
6. Selected a sample of returns to test the validity of the aggregate risk scores [the 1120 Financial Products Rule Set].
7. Sent information reports to the field for feedback.

Tax Return Forms Analyzed

- Form 1120, *U.S. Corporation Income Tax Return*, reports a corporation's income, gains, losses, deductions, credits, and income tax liability.
- Schedule M-3 reconciles financial net income (loss) of a corporation to the taxable income on Form 1120, Page 1, Line 28.
- Form 5472 is an information return of a 25% Foreign-owned U.S. Corporation or a Foreign Corporation Engaged in a U.S. Trade or Business.
- Form 8858 is used by U.S. Corporations that own a foreign disregarded entity (FDE) directly, indirectly, or constructively.

- Form 6781 is used by taxpayers that report gains and losses on Section 1256 contracts under the mark-to-market rules and under Section 1092 from straddle positions.
- Form 8916A is a supplemental form for Schedule M-3 to provide detailed information for cost of goods sold, interest income, and interest expense.

Business Rules and Risk Score

The SMEs reviewed the prior Form 1120 rules and discarded some rules, modified other rules and added new rules. The decisions made by the SMEs were principally based on their professional judgment, years of experience, and audit results by issue. We also relied on SME experience to assign an initial risk score to each of the business rules.

The risk score is based on a risk formula calculated to determine if the rule was a "hit". For example, if we calculated the debt/equity ratio for a specific taxpayer, the risk score would be based on the debt/equity ratio hypothetically as follows:

Debt / Equity Ratio	**Risk Level**
>5 and < 10	1
>= 10 < 20	2
>= 20 < 30	3
>= 30 < 40	4
Over 40	5

In this example, the major issue we are concerned with is inbound financing transactions where the U.S. subsidiary pays material interest payments to a foreign parent, which offsets all or most of their U.S. taxable income. The issue is whether the interest payments are disguised dividend payments.

Initial Run of Each Form Rule Set

A Form rule set is the collection of analytical business rules developed to analyze a tax return form. Once the initial Form rule set was completed, the rules were input into Blaze Advisor. Each Form rule set was applied separately to validate the rules for that particular form. To validate the Form rule set, the scores for each business rule were summed together to arrive at the highest risk return.

This Financial Products risk assessment model generated a report that consists of a summary page, a listing of corporate returns ("hits") that are ranked by risk scores (categorized by "High Risk," "Medium Risk," "Medium-Low Risk," and "Low Risk") and risk level definitions. The summary page contained statistical information regarding number of hits, and risk score distribution, using bar and pie charts to present the statistics of filter hit distributions.

PAIR then selected sample returns that were scored high, medium, and low to forward to the SME for filter validation. The SMEs performed their normal risk analysis on each of the returns. They were not told which of the returns were scored high, medium, or low. They recorded whether or not the return should be selected for examination.

Some of the rules were working as expected and no further action was taken. That is, the SMEs would have recommended the returns ranked "high" as suitable for examination and the returns ranked "low" as not suitable for financial products involvement. Other business rules required adjustment to either the rule formula or risk score.

Combining the Form Rule Sets To Identify the Highest Risk Returns

Once each of the Form rule sets was validated as working correctly, the Form rule sets were combined into one rule set in Blaze Advisor. The rule set was applied to the entire LB&I filing Form 1120 population, and all

returns were ranked by summing the risk scores for each individual rule. The result was a ranking of all LB&I returns from highest to lowest risk score.

Once again, sample returns were selected for "high," "medium," and "low" risk scores and forwarded to our SMEs for review. A problem became immediately apparent in looking at the overall results. The SMEs were not always in agreement with those returns marked high risk versus those returns marked low risk. There were numerous instances where the SMEs would have given a return marked low risk a higher ranking based on their risk assessment of the return.

The problem was in combining the Form rule sets into one financial products rule set. When the Form rule sets were combined, those Form rule sets that had fewer rules were dominated by the rule sets with numerous rules. Those rule sets with many rules sometimes were identifying the same issue using different ratios or calculations. Other issues were identified by just a single rule.

To make sure that all issues contributed equally to the overall risk score of a taxpayer, each rule was given a weight. The filter weight solved the problem of one Form rule set skewing the overall results. The weighted results gave us a higher percentage of returns ranked high that had positive filter hits from the Form rule sets with fewer rules.

For example, the following filter hits were scored and weighted:

Filter	Rank	Weight	Filter Score
A	3	2	6
B	5	1	5
C	1	4	4
D	2	5	10
E	4	1	4
Total Return Score			29

In the above example Filter D has a higher probability of contributing to the overall risk assessment of the entity than Filter B because the raw score of D is weighted five times more than Filter B.

After the introduction of weights, a review of sample tax returns by the SMEs revealed that the overall results were in line with expectations. That is, the SMEs would recommend for examination those returns ranked "high" and the returns ranked "low" as not suitable for financial products involvement. The assignment of weights to each of the rules solved the problem in combining the Form rule sets.

Information Reports to the Field

Information reports were sent to the field using Microsoft Reporting Services. We selected returns in Status 10[2] that were deemed "high" or "medium" risk for field delivery.

The Information Reports were delivered to case managers through email. The reports contained a table of contents listing each filter that was a positive hit. Each filter is then discussed, listing the purpose of the filter and audit technique suggestions. The "purpose of the filter" and "audit techniques" were drafted by the SMEs based on their years of experience working the same issue. The report did not contain any information on how the return was selected, such as risk score, risk level, or risk formula. The SMEs did not want to taint the Financial Products Specialists' view of the significance of the issue by providing these statistics.

Field Feedback

A survey was sent to Financial Products Specialists requesting feedback on the usefulness of the Financial Products Information Report for risk assessment purposes. Based on the number of responses received and the comments made by the Specialists, the Information Reports proved to be a valuable resource in performing the risk assessment phase of the examination.

The Specialists believe that the risk assessment is a quality document that will assist them in developing their audit plan and in more quickly identifying key audit issues. The project allows the Service to leverage the expertise of experienced financial products specialists (SMEs) in working with financial product issues. The SMEs also indicated that the Financial Products Information Report will expose issues to other financial product specialists who may not be familiar with a particular area. Example comments received from the field were:

1. "The report was useful in identifying the Financial Products potential audit areas. It showed the applicable Internal Revenue Code sections and other guidance."
2. "As always, I find the risk report very useful at the beginning of an examination. It indicates potential areas for audit."
3. "The topics covered by the Risk Report were interesting and offered me additional insights as far as possible Financial Product and International issues. I provided a copy to my [International Examiner] IE. My IE is currently preparing an Exam Plan. I don't have an FP [Specialist] assigned to this case and I am doing a limited scope exam."

How Technology Helped the Financial Products Filter Project

Overview of the Financial Products Rule Process[3]

We have developed and tested rules to apply to an automated process to identify potential noncompliant returns for examination by specialists in Financial Products. This process will also contribute to LB&I use of an overall risk scoring model built upon a set of specific risk assessment formulas.

This process uses the "Blaze Advisor" Business Rules Management System software. We grouped the related Financial Products rules into one group (we call it a ruleset).[4] We then designed and developed a scoring model to assess the risk of the entire LB&I corporate population and to identify high risk corporations. Once the score modeling has been defined and implemented, it is capable of receiving tax data on any given tax year and processes the data to generate reports. This automated process will bring a consistent approach to risk identification for Financial Products issues, which will increase the quality of issues raised by the program. This methodology has also been applied to other specific risk areas, including international characteristics that are examined by International Program Specialists.

The Use of Blaze Advisor

We built multiple Blaze Advisor rule projects for the Financial Products filters.[5] Each rule project contains all the code that supports running one set of Financial Products filters. Each rule project generally controls one rule process. In most cases, we built one rule project for each tax form type. We also put all the Financial Products rule projects into one rule repository.

Besides building the Financial Products Filters in a Blaze Advisor rule project, we also needed to develop code modules that support the rule process. The rule repository was structured based on reusability, maintainability and manageability. A few libraries were built based on reusability. A technical library contains the rule templates, providers and defined constants of the entities frequently used by rule developers. The business library contains RMA[6] instances that are built for SMEs. SMEs can change the rules through RMA web pages.

The Financial Products Rule Project connects to the database tables, which contain the Financial Products return data. The rule process reads the return data that relates to the Financial Products and it turns the return data into a data object. The rule process puts data objects into an array of objects. During this process, it eliminates any duplicated return data before it runs on the Financial Products filters. For instance, if Company A has filed multiple times for the same tax year, the rule process would eliminate all returns except the latest return object.

Next, the rule process passes one data object at a time and invokes the Financial Products ruleset (a group of related rules forms a ruleset). The rule engine runs on one filter at a time. If it is fired (the rule condition is met), the rule process collects a set of information and stores the information in multiple arrays. Those data

arrays contain the data objects of the filter results. For example, if a filter is invoked, the filter name will be recorded as well as the filter risk score, which is calculated based on the weight and risk level.

After the Blaze engine runs through all the rules for one return, it then builds the summary data, such as total number of filter hits and total risk score for this return. The total risk score for a return comes from the summation of the individual filter scores.

Finally, the rule process generates a risk assessment summary page for the output. By choice, it can output the filter result for individual returns, as well.

What To Do When a Taxpayer Files the Same Schedule Multiple Times?

For some Form 1120 returns, there is a special situation that must be handled differently. A U.S. corporation can have multiple schedules of Forms 8858, 8858M or 5472 attached to its Form 1120 return. There can be hundreds of the same schedules attached to a single return.

The Financial Products Form 8858 rule process does the same thing as other Financial Products rule processes do. It passes each Form 8858 return data object to the Form 8858 ruleset of Financial Products and collects information about filter hits, risk scores etc. However, the SMEs were not interested in individual filter results for Forms 8858 or 5472 returns, but the overall risks of all attached Forms 8858 or 5472 returns associated with a U.S. corporation. For example, SMEs want to know how many of Forms 8858 or 5472 returns associated with a U.S. corporation have been selected (selected means at least one filter has been triggered). They would also like to know the average risk score and the average number of hits, which are based on selected returns.

To accommodate this scenario, we developed a special module that uniquely addressed this issue after all the return data objects went through the filters. The module consolidates the filter results of all selected Forms 8858 or 5472 returns and proceeds according to the following steps:

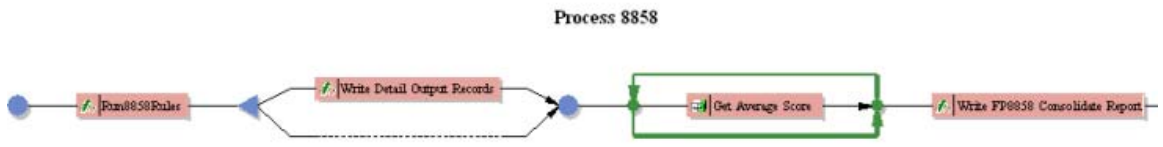
Step 1: Blaze runs Form 8858 filters on each Form 8858 attached to a return and then it gathers information on those selected returns (at least one filter hit) for that U.S. corporation.

Step 2: Once the selected Form 8858 returns are collected, it then calculates the average risk score and the average number of hits based on all the *selected* Form 8858 returns of that U.S. corporation.

Step 3: The rule process prepares the final consolidated output, which includes a company's information, an average number of hits, and an average risk score of the Form 8858 returns of that U.S. corporation.

This Form 8858 process is illustrated in Figure 1.

FIGURE 1



The Financial Products Filter Reports

There are many ways to direct the rule output. While we were developing and testing the Financial Products filters, we printed out information about the rule process for debugging and testing purposes in the output pane of Blaze Advisor IDE (Integrated Development Environment). After we verified that the rule process ran as we expected, we enabled the rule process to write the results to a database table. For various reasons, we can print out the filter results in the output pane in Blaze IDE and write the filter results to a database table simultaneously.

Building the RMA for the Financial Products Specialists

After the Financial Products rule process was built and tested we then turned our attention to build the Rule Maintenance Application (Web Rule Editing application).

A key aspect of the Blaze Advisor business rules management system is the ability to develop an RMA that allows business experts to edit the rules in an intuitive, domain-specific environment. An RMA allows the rule writers to focus on the business rules while the rule developers focus on the technical details of the service implementation. The RMA application enables the Financial Products Specialists to change the Financial Products filters through a web browser.

As mentioned in the second section, the Financial Products filters use the data that comes from many different tax forms or schedules. We have built multiple Blaze Advisor rule projects for the Financial Products filters. Each rule project contains all the code that supports running one set of Financial Products filters. Each rule project generally controls one rule process. In most cases, we built one rule project for each tax form type. We also put all the Financial Products rule projects into one rule repository.

We built a decision table for the Financial Products filters project as illustrated in Figure 2 and Figure 3. The decision table enables us to configure the settings for the report generation. Anyone who has edit rights in the FP RMA website can select reports they would like to be generated.

FIGURE 2

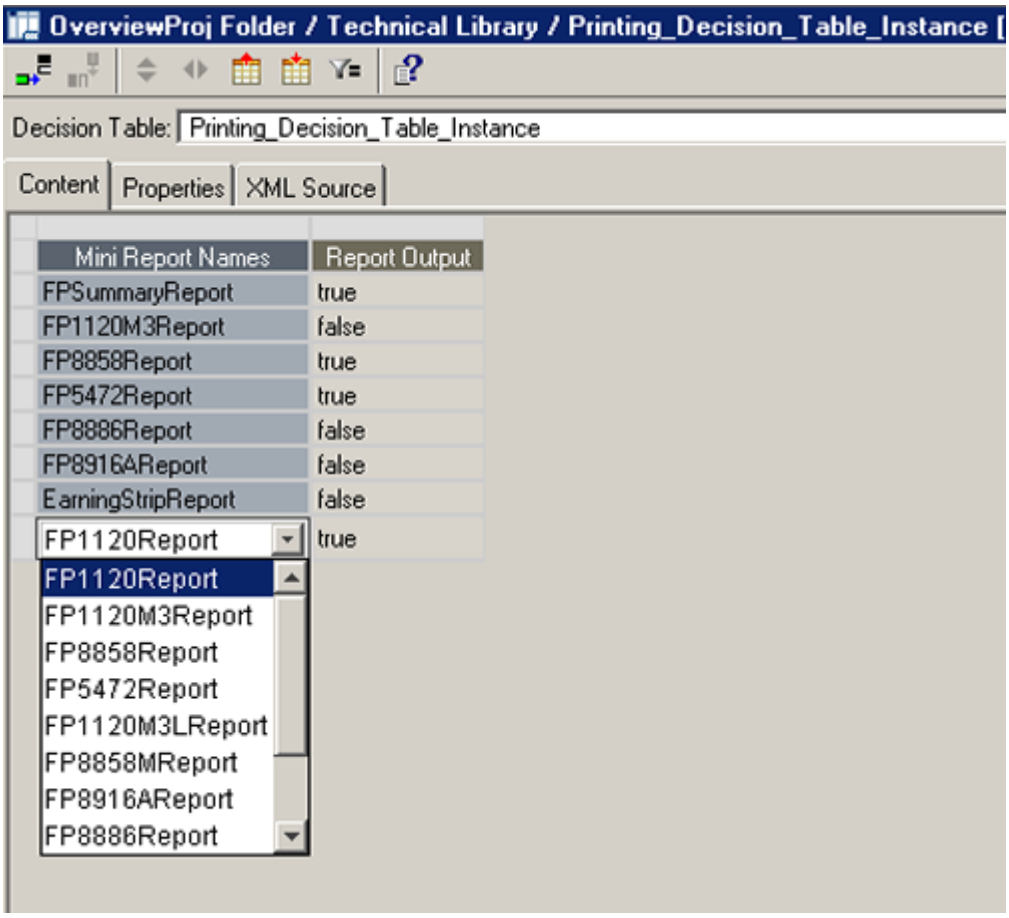
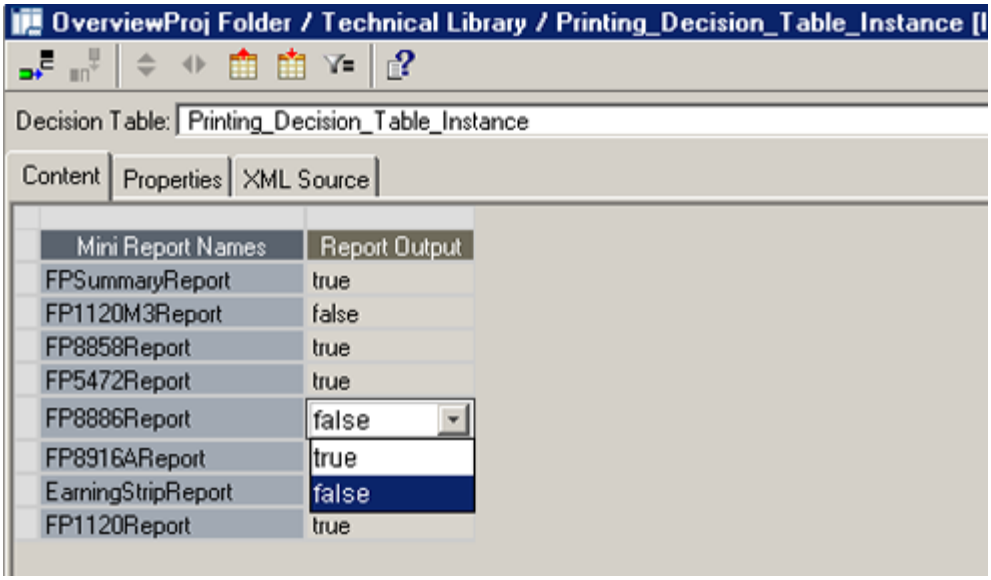


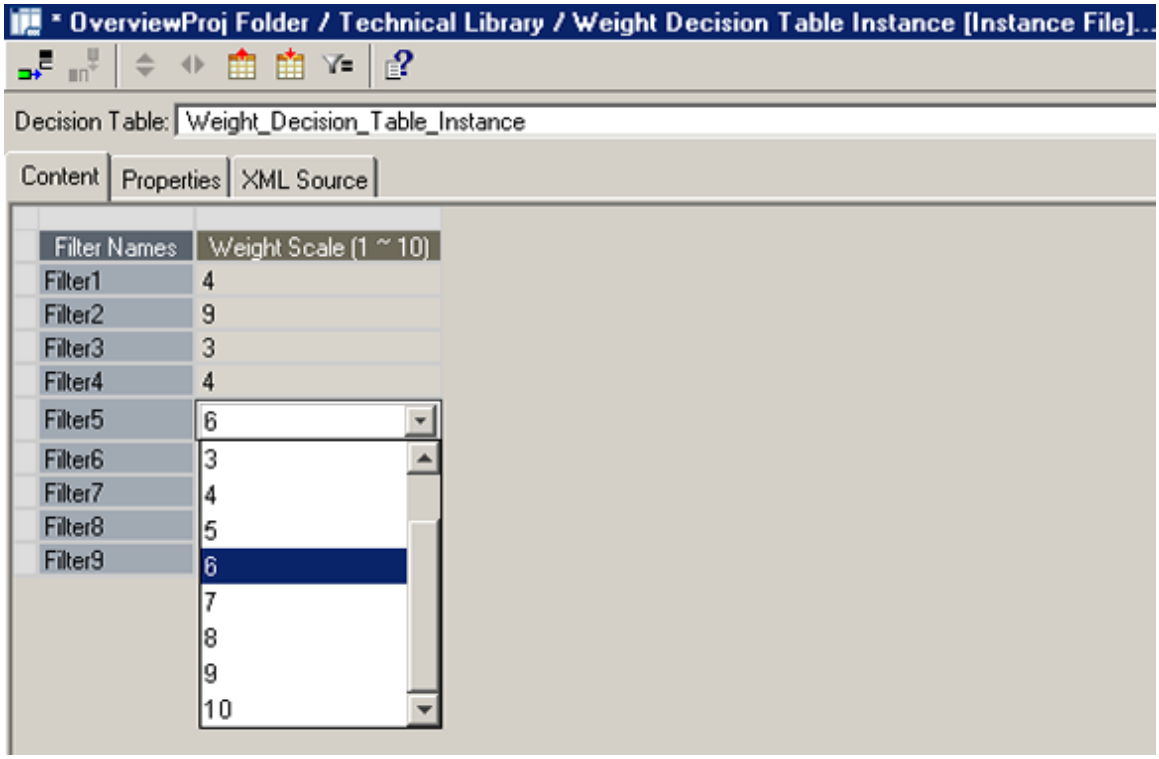
FIGURE 3



Another feature of the RMA allows SMEs to add or modify the filters. This allows us to update the rules to accommodate tax laws changes.

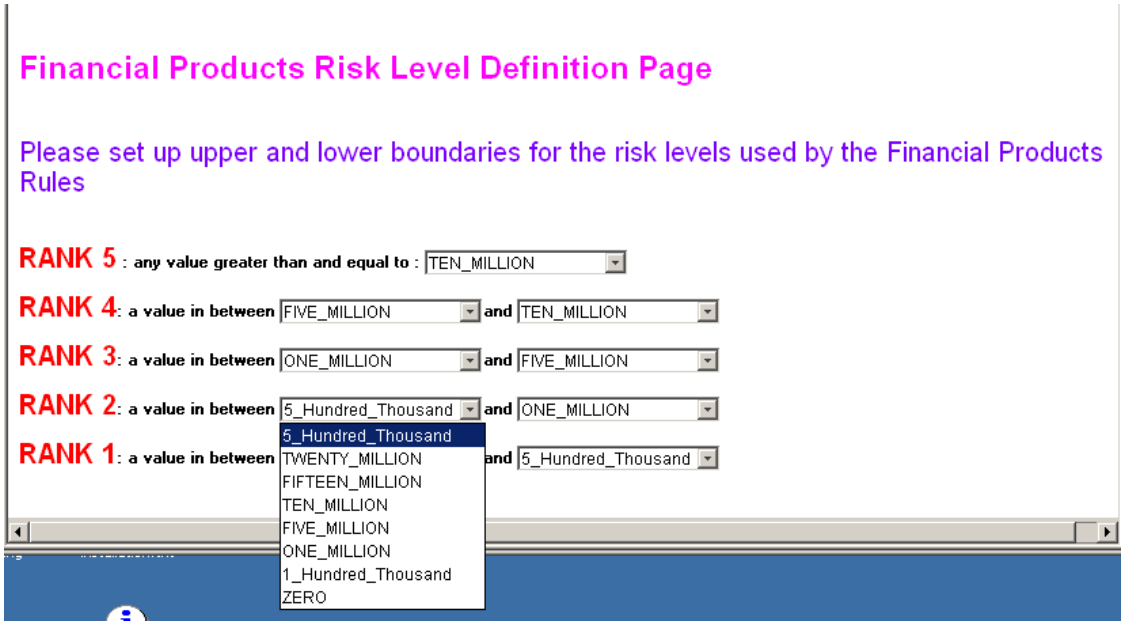
We built a decision metaphor that allows the Financial Products Specialists to change the weight of a filter. Currently we define the weight scope value as ranging from 1 to 10, where '1' is the lowest weight, and '10' is the highest weight. Because of this mechanism, SMEs are able to change the weight of any filters that need to be updated, as illustrated by Figure 4.

FIGURE 4



We also built the Financial Products Risk Level Definition web page, which enables SMEs to reconfigure the risk levels for each rank, as illustrated by Figure 5.

FIGURE 5



Future Plans

Emerging Issues

The Financial Products SMEs will be aware of emerging issues being developed by the Field. When an emerging issue becomes promising, the SMEs will propose that a rule be developed to identify other taxpayers who may have similar issues.

Enterprise Risk

The limitation of current filters is that they look at one tax return at a time. They do not take into account the risk that can be identified only when the entity is looked at in a holistic manner over several years. LB&I SME's routinely compare information found in related tax returns and financial statements when risk assessing a specific tax return, and a major task for PAIR is to find a way to expand data access and the application of rules to include related returns and financial information in order to replicate the risk identification process used by experts. Some of these are described below.

Prefiling Risk Assessment

PAIR performs a prefiling risk assessment of selected SEC Registrants, paying particular attention to the income tax footnote disclosures required by FIN 48. PAIR particularly seeks to indentify those taxpayers with a high likelihood of having a requirement to report a material Uncertain Tax Position (UTP) on Schedule UTP. These Pre-filing risk assessments will give us a better picture of the taxpayer's income tax risk characteristics than a filter report by itself.

Schedule UTP

PAIR captures Schedule UTP information that enables the identification of specific types of issues. We have cross-referenced UTP concise descriptions that identify specific types of issues associated with financial products risk to validate that our filters are working.

Form 1065 Partnership Filters

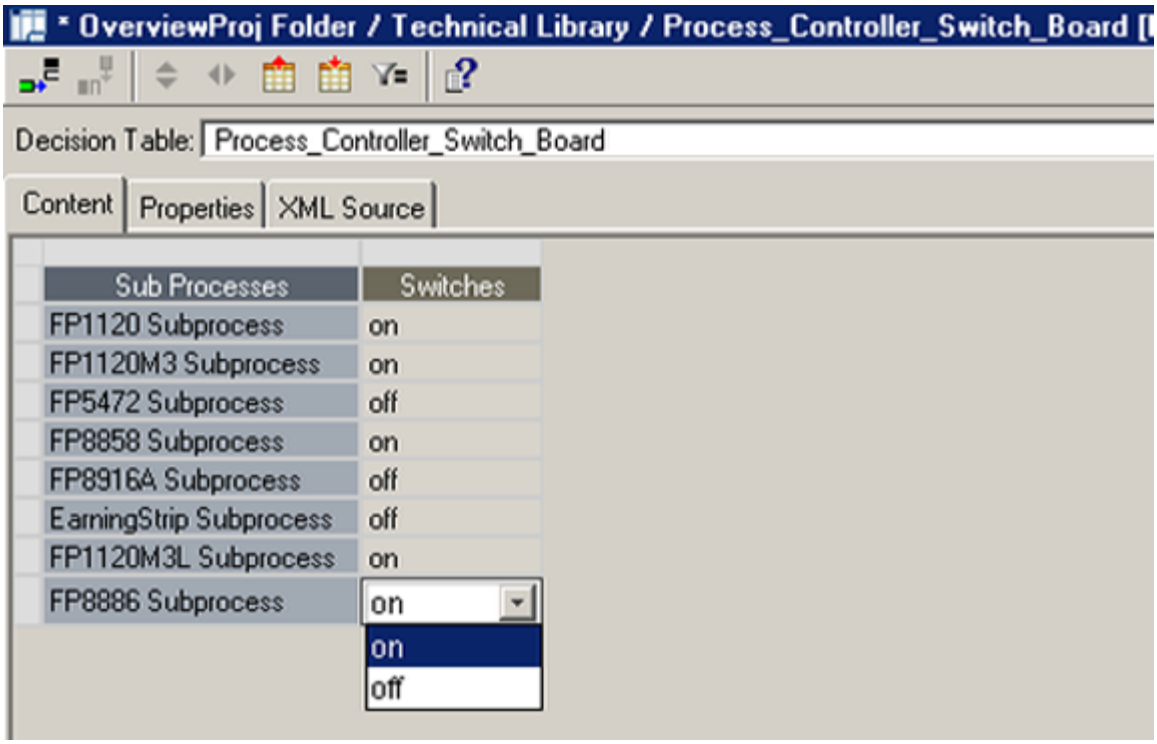
For 2010 returns, we are expanding the financial products filtering effort to include Partnership Returns (Form 1065). LB&I has experienced a large growth of partnership returns in the last ten years. LB&I is placing higher emphasis on the selection and examination of partnership returns that truly warrant examination. One tool is the link analysis/multi-tiered ownership structure (Yk-1) software program. Yk-1 displays a diagram of a taxpayer's ownership structure including subsidiaries of the taxpayer as well as flow-through entities. Yk-1 also gives selected line information from the respective tax returns, including taxable income, total tax, total assets, etc.

Technology Issues

We have successfully built all the Financial Products filters based on the requirements of the Financial Products Specialists. As mentioned earlier, we have created multiple rule projects, and each rule project in general controls one rule process and runs on the filters related to a particular tax form. We can generate filter output by running an individual subprocess. In addition to all these rule projects, we built a rule project which compiles all the output from each subprocess and marshals all Financial Products filter results to a final integrated result set. The final result set is sorted based on risk scores and number of filter hits. From the integrated output, our SMEs are able to identify those returns with high risk scores regardless of which tax forms the corporation has filed.

As we move forward, we will build a web application that allows SMEs or a filter administrator to control subprocess running. As hypothetically illustrated by Figure 6, SMEs can turn switches 'on' or 'off' to enable or disable an individual Financial Products subprocess.

FIGURE 6



A special decision node will be built based on the configuration of subprocessing. See a hypothetical illustration in Figure 7.

FIGURE 7

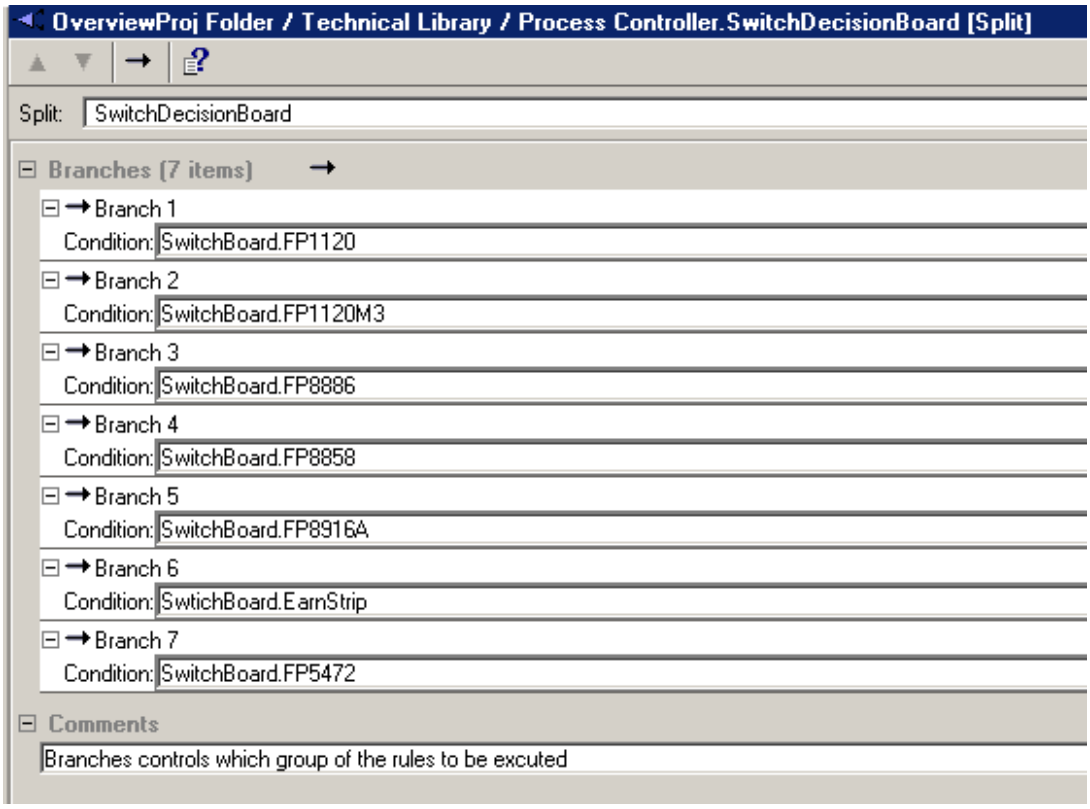
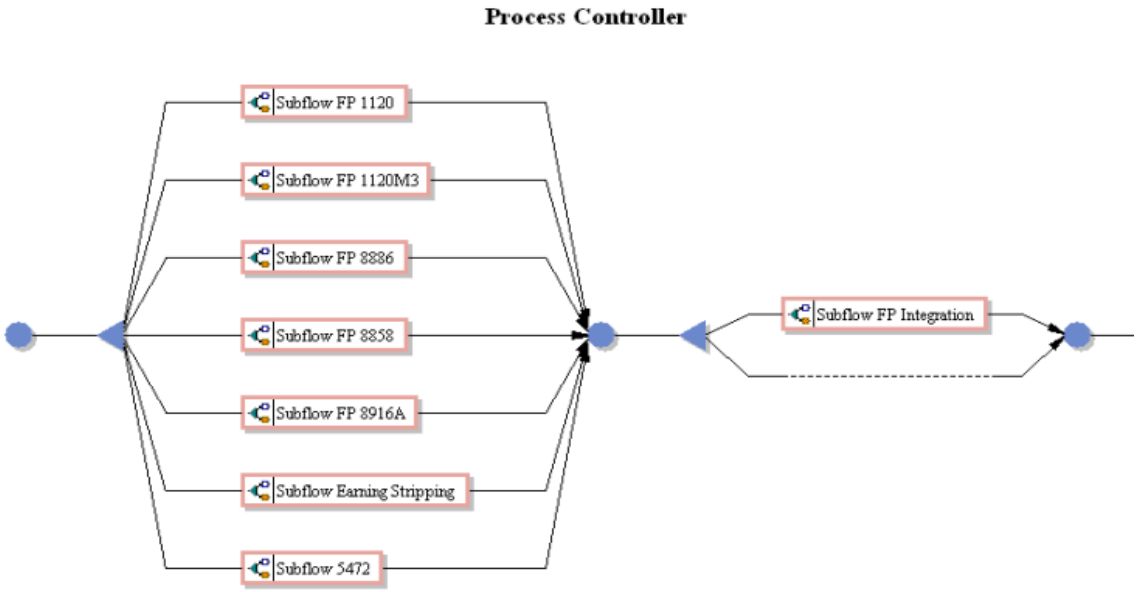


Figure 8 is illustrates the Process Controller flow chart. The main process starts from the left, and runs towards the right. A triangle is a decision node. The decision node determines which branch(es) to run. Each branch contains one sub-process. Multiple subprocesses can run at the same time. The second decision node from the left determines whether it needs to run the Financial Products Integration subprocess. If it runs, then the final integrated result set will be generated.

FIGURE 8



Conclusion

The development of business rules for return selection reflects the complexity of LB&I tax returns themselves. The design and testing of rules to detect Financial Products risk is one of several similar projects, which include other major risk areas such as international activity, book-to-tax differences, and transactions reported on related passthrough tax returns. These various rule sets need to be combined into an overall "rules engine" for return selection The rules engine must also be able to accommodate rules calibration and weighting processes for factors such as industry, size and actual examination results. This ongoing effort is a major challenge for LB&I and PAIR researchers and experts as they seek to improve IRS ability to address the compliance risk associated with increasing tax and financial complexity.

Endnotes

[1] Filter has the same definition as rule; we use the terms interchangeably.

[2] Status 10 is an unopened tax return sitting in an examination field group.

[3] A rule process is a business process that parses data objects, executes ruleset(s) and generates rule results.

[4] A ruleset is a group of related rules in Blaze Advisor.

[5] A rule project in Blaze Advisor is an entity in Blaze Advisor that holds other entities such as Folders, Business Object Models, Rulesets, functions etc.

[6] RMA: Rule Maintenance Application.