

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To: ANNE DAVIS BARRY  
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**PCT**

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) **07 FEB 2018**

Applicant's or agent's file reference  
DDP0001PCT

**FOR FURTHER ACTION**

See paragraph 2 below

International application No.

PCT/US2017/065041

International filing date (day/month/year)

07 December 2017

Priority date (day/month/year)

07 December 2016

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - G06Q 40/06; G06Q 40/08 (2018.01)

CPC - G06Q 40/06; G06Q 40/08 (2018.01)

Applicant **COOGAN-PUSHNER, DIANE**

## 1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

## 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Date of completion of this opinion  23 January 2018	Authorized officer  Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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## Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:
  - the international application in the language in which it was filed.
  - a translation of the international application into \_\_\_\_\_ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2.  This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).
3.  With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of a sequence listing:
  - a.  forming part of the international application as filed:
    - in the form of an Annex C/ST.25 text file.
    - on paper or in the form of an image file.
  - b.  furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
  - c.  furnished subsequent to the international filing date for the purposes of international search only:
    - in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
    - on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).
4.  In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-20 lack an inventive step under PCT Article 33(3) as being obvious over CROSBY et al. (hereinafter CROSBY) in view of HOLIAN et al. (hereinafter HOLIAN).

Regarding claim 1, CROSBY discloses a computer implemented method comprising: creating a municipal solvency (MSX) database (To determine the validity and reliability of the measures used in Michigan's fiscal indicator system, we created a database with all the necessary variables to measure each indicator for 270 cities, pg 533 para 1, To begin, we created a list of all the indicators, these indicators measure a city's ability to pay its bills today, tomorrow, and beyond [i.e. municipal solvency]; or cash solvency, budget solvency, long-run solvency, and service level solvency, which is defined as the government's ability to continuously provide the level of service demanded by its citizens. We focus on the first three – cash, budget, and long-run solvency – and argue that without solvency (i.e., the ability to meet obligations) in one or all of these three areas, municipalities will be hard pressed to meet citizen demands and therefore budget solvency is a redundant and unnecessary measure [i.e. creating a municipal solvency (MSX) database], pg 539 para 3), the creating comprising collecting and coding data from public sources about a plurality of municipalities (Using comprehensive annual financial reports from 2007, 2008, and 2009 for all Michigan cities that had available data, we created a database to calculate the results of the 39 different indicators, pg 539 para 4, Our system relies on public data available in CAFRs that is universal among local governments; administrators and residents of any Michigan city can replicate our system and accurately assess fiscal condition [i.e. the creating comprising collecting and coding data from public sources about a plurality of municipalities], pg 551 para 3). CROSBY does not specifically disclose generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities; and outputting the indices. However, HOLIAN is in the field of estimating default probabilities for bonds issued by cities (abstract) and discloses generating predictive models based on contents of the MSX database (a multiple regression model for predicting credit ratings. Since credit ratings are intended to convey information about the likelihood of default, exogenous variables that explain credit ratings could also be used as predictors of default, the following independent variables were predictive of the credit rating at the 10% significance level: • Percentage of Taxes Uncollected in the Previous Year • Ratio of Direct Net Debt to Assessed Valuation • Median Family Income • Full Valuation of the Property Tax Base • Overlapping Debt, pg 9 para 4, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model [i.e. generating predictive models based on contents of the MSX database], pg 9 para 5 to pg 10 para 1, To assess the applicability of the Cities Annual Report data to municipal default probability modeling, we compared data from the report to selected data obtained from four 2011 CAFRs, pg 123 para 1), the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities (a second model based on more recent data that enables us to test the relative significance of general fund surplus/deficit and general fund balance variables, which we hypothesize to be default drivers in the modern context [i.e. drivers of municipal solvency], pg 4 para 2, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model, pg 9 para 5 to pg 10 para 1, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults [i.e. material financial events]. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items [i.e. the predictive models describing drivers of municipal solvency and predictors of material financial events for each of the municipalities], pg 123 para 1); estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models (propose a model to estimate default probabilities for bonds issued by cities. The model can be used with financial data available in Comprehensive Annual Financial Reports that cities are required to publish. The study includes modeled default probability estimates for 261 California cities with population over 25,000 [i.e. estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models], abstract, the use of statistical and case study analysis to create a municipal bond default probability model targeted at California cities with population greater than 25,000, pg 3 para 2); creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 [i.e. creating indices

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that reflect solvency and a probability of an MFE for at least one of the municipalities] that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000, pg 4 para 4); and outputting the indices (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000 [i.e. outputting the indices], pg 4 para 4). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities; and outputting the indices as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 2, CROSBY further discloses that the data available from public sources include one or more of comprehensive annual financial report (CAFR) data, demographic data, economic data, and bond market data (Our system relies on public data available in CAFRs that is universal among local governments; administrators and residents of any Michigan city can replicate our system and accurately assess fiscal condition, pg 551 para 3).

Regarding claim 3, CROSBY further discloses that standard reporting classifications and standard legal entities are defined across a plurality of municipalities in the MSX database, thereby allowing CAFRs of different formats and contents to be compared (the current SOM indicator system be revamped to include some of the more popular indicators utilized by other authors and governments as well as data that conform to the new GASB 34 reporting standards, pg 539 para 2, We scored the ten indicators 1 or 0 first for comparison purposes to the SOM method and second because they measure different parts of the entire government as well as measure the financial factors discussed by Nollenberger (cash, budget, and long-run solvency). Unlike the SOM's focus on the general fund, we included total expenditures and total revenues for all governmental funds as well as measures for business-type activities, pg 540 para 4).

Regarding claim 4, modified CROSBY discloses the invention above, but CROSBY did not disclose that the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall. However, HOLIAN discloses that the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall (Investors are still wondering how much risk they actually shoulder when purchasing municipal bonds issued by California cities and how much extra interest they should expect to receive in compensation for taking on this risk. The question of the appropriate interest rate resonates far beyond the municipal bond market, since it directly affects municipal debt service costs, which in turn impact tax rates, service levels and cities' ability to add infrastructure by borrowing, pg 1 para 4 to pg 2 para 1, pension underfunding is not a new phenomenon, pg 2 para 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 5, CROSBY further discloses that the MSX database is updated on a periodic basis, and the generating, estimating and creating are performed in response to the MSX database being updated (when we monitor these eight cities over a four year period), only one city (Manistique) shows up on the State's fiscal watch radar. In 2007 and 2008 Manistique's fiscal label was watch but then it moved back to neutral in 2009. The four cities (Standish, Flint, St. Ignace, and Jackson) categorized by the SOM as fiscally stressed in 2009 are either labeled the same in our method or on the fiscal watch list, pg 543 para 3 to pg 544 para 1).

Regarding claim 6, modified CROSBY discloses the invention above, but CROSBY did not disclose that each index corresponds to a single municipality. However, HOLIAN discloses that each index corresponds to a single municipality (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers., pg vi para 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine each index corresponds to a single municipality as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 7, modified CROSBY discloses the invention above, but CROSBY did not disclose that each index corresponds to a plurality of municipalities. However, HOLIAN discloses that each index corresponds to a plurality of municipalities (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers., pg vi para 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine each index corresponds to a plurality of municipalities as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 8, CROSBY further discloses that the MSX database includes data for each municipality that spans a plurality of years (Using comprehensive annual financial reports from 2007, 2008, and 2009 for all Michigan cities that had available data, we created a database to calculate the results of the 39 different indicators, pg 539 para 4).

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Regarding claim 9, modified CROSBY discloses the invention above, but CROSBY did not disclose further comprising determining financial events to be included as MFEs. However, HOLIAN discloses further comprising determining financial events to be included as MFEs (Our model relies on case study evidence, logistic regression analysis of major city financial statistics from the Great Depression – the last time a large number of cities defaulted – as well as logistic regression analysis of more recent city financial statistics. Independent variables in our model include (1) the ratio of interest and pension expenses to total revenue, (2) the annual change in total revenue, (3) the ratio of general fund surplus (or deficit) to general fund revenues and (4) the ratio of general fund balance to general fund expenditures, abstract, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items, pg 123 para 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine determining financial events to be included as MFEs as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 10, modified CROSBY discloses the invention above, but CROSBY did not disclose that the determining is based on an analysis of the data in the MSX database. However, HOLIAN discloses that the determining is based on an analysis of the data in the MSX database (Our model relies on case study evidence, logistic regression analysis of major city financial statistics from the Great Depression – the last time a large number of cities defaulted – as well as logistic regression analysis of more recent city financial statistics. Independent variables in our model include (1) the ratio of interest and pension expenses to total revenue, (2) the annual change in total revenue, (3) the ratio of general fund surplus (or deficit) to general fund revenues and (4) the ratio of general fund balance to general fund expenditures, abstract, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items, pg 123 para 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the determining is based on an analysis of the data in the MSX database as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

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Regarding claim 11, CROSBY discloses a system comprising:

a memory having computer readable instructions (governments, scholars, practitioners, and citizens once more have great expectations for financial benchmarking and monitoring, and in some instances, a deep desire for such monitoring systems to predict fiscal stress [implicitly, the monitoring system using computer having memory to store programs], pg 523 para 1); and

one or more processors for executing the computer readable instructions, the computer readable instructions including (governments, scholars, practitioners, and citizens once more have great expectations for financial benchmarking and monitoring, and in some instances, a deep desire for such monitoring systems to predict fiscal stress [implicitly, the monitoring system using computer having processor to execute programs], pg 523 para 1):

creating a municipal solvency (MSX) database (To determine the validity and reliability of the measures used in Michigan's fiscal indicator system, we created a database with all the necessary variables to measure each indicator for 270 cities, pg 533 para 1, To begin, we created a list of all the indicators, these indicators measure a city's ability to pay its bills today, tomorrow, and beyond [i.e. municipal solvency]; or cash solvency, budget solvency, long-run solvency, and service level solvency, which is defined as the government's ability to continuously provide the level of service demanded by its citizens. We focus on the first three – cash, budget, and long-run solvency – and argue that without solvency (i.e., the ability to meet obligations) in one or all of these three areas, municipalities will be hard pressed to meet citizen demands and therefore budget solvency is a redundant and unnecessary measure [i.e. creating a municipal solvency (MSX) database], pg 539 para 3), the creating comprising collecting and coding data from public sources about a plurality of municipalities (Using comprehensive annual financial reports from 2007, 2008, and 2009 for all Michigan cities that had available data, we created a database to calculate the results of the 39 different indicators, pg 539 para 4, Our system relies on public data available in CAFRs that is universal among local governments; administrators and residents of any Michigan city can replicate our system and accurately assess fiscal condition [i.e. the creating comprising collecting and coding data from public sources about a plurality of municipalities], pg 551 para 3).

CROSBY does not specifically disclose generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities; and outputting the indices.

However, HOLIAN discloses generating predictive models based on contents of the MSX database (a multiple regression model for predicting credit ratings. Since credit ratings are intended to convey information about the likelihood of default, exogenous variables that explain credit ratings could also be used as predictors of default, the following independent variables were predictive of the credit rating at the 10% significance level: • Percentage of Taxes Uncollected in the Previous Year • Ratio of Direct Net Debt to Assessed Valuation • Median Family Income • Full Valuation of the Property Tax Base • Overlapping Debt, pg 9 para 4, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model [i.e. generating predictive models based on contents of the MSX database], pg 9 para 5 to pg 10 para 1, To assess the applicability of the Cities Annual Report data to municipal default probability modeling, we compared data from the report to selected data obtained from four 2011 CAFRs, pg 123 para 1), the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities (a second model based on more recent data that enables us to test the relative significance of general fund surplus/deficit and general fund balance variables, which we hypothesize to be default drivers in the modern context [i.e. drivers of municipal solvency], pg 4 para 2, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model, pg 9 para 5 to pg 10 para 1, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults [i.e. material financial events]. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items [i.e. the predictive models describing drivers of municipal solvency and predictors of material financial events for each of the municipalities], pg 123 para 1); estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models (propose a model to estimate default probabilities for bonds issued by cities. The model can be used with financial data available in Comprehensive Annual Financial Reports that cities are required to publish. The study includes modeled default probability estimates for 261 California cities with population over 25,000 [i.e. estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models], abstract, the use of statistical and case study analysis to create a municipal bond default probability model targeted at California cities with population greater than 25,000, pg 3 para 2); creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 [i.e. creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities] that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000, pg 4 para 4); and outputting the indices (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000 [i.e. outputting the indices], pg 4 para 4). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a

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probability of an MFE for at least one of the municipalities; and outputting the indices as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 12, CROSBY further discloses that the data available from public sources include one or more of comprehensive annual financial report (CAFR) data, demographic data, economic data, and bond market data (Our system relies on public data available in CAFRs that is universal among local governments; administrators and residents of any Michigan city can replicate our system and accurately assess fiscal condition, pg 551 para 3).

Regarding claim 13, CROSBY further discloses that standard reporting classifications and standard legal entities are defined across a plurality of municipalities in the MSX database, thereby allowing CAFRs of different formats and contents to be compared (the current SOM indicator system be revamped to include some of the more popular indicators utilized by other authors and governments as well as data that conform to the new GASB 34 reporting standards, pg 539 para 2, We scored the ten indicators 1 or 0 first for comparison purposes to the SOM method and second because they measure different parts of the entire government as well as measure the financial factors discussed by Nollenberger (cash, budget, and long-run solvency). Unlike the SOM's focus on the general fund, we included total expenditures and total revenues for all governmental funds as well as measures for business-type activities, pg 540 para 4).

Regarding claim 14, modified CROSBY discloses the invention above, but CROSBY did not disclose that the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall. However, HOLIAN discloses that the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall (Investors are still wondering how much risk they actually shoulder when purchasing municipal bonds issued by California cities and how much extra interest they should expect to receive in compensation for taking on this risk. The question of the appropriate interest rate resonates far beyond the municipal bond market, since it directly affects municipal debt service costs, which in turn impact tax rates, service levels and cities' ability to add infrastructure by borrowing, pg 1 para 4 to pg 2 para 1, pension underfunding is not a new phenomenon, pg 2 para 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the MFEs include one or more of a tax increase, an expenditure cut, a service deterioration, a cash flow shortfall, and a pension shortfall as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Regarding claim 15, CROSBY further discloses that the MSX database is updated on a periodic basis, and the generating, estimating and creating are performed in response to the MSX database being updated (when we monitor these eight cities over a four year period), only one city (Manistique) shows up on the State's fiscal watch radar. In 2007 and 2008 Manistique's fiscal label was watch but then it moved back to neutral in 2009. The four cities (Standish, Flint, St. Ignace, and Jackson) categorized by the SOM as fiscally stressed in 2009 are either labeled the same in our method or on the fiscal watch list, pg 543 para 3 to pg 544 para 1).

Regarding claim 16, CROSBY further discloses that the MSX database includes data for each municipality that spans a plurality of years (Using comprehensive annual financial reports from 2007, 2008, and 2009 for all Michigan cities that had available data, we created a database to calculate the results of the 39 different indicators, pg 539 para 4).

Regarding claim 17, modified CROSBY discloses the invention above, but CROSBY did not disclose that the determining is based on an analysis of the data in the MSX database. However, HOLIAN discloses that the determining is based on an analysis of the data in the MSX database (Our model relies on case study evidence, logistic regression analysis of major city financial statistics from the Great Depression – the last time a large number of cities defaulted – as well as logistic regression analysis of more recent city financial statistics. Independent variables in our model include (1) the ratio of interest and pension expenses to total revenue, (2) the annual change in total revenue, (3) the ratio of general fund surplus (or deficit) to general fund revenues and (4) the ratio of general fund balance to general fund expenditures, abstract, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items, pg 123 para 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the determining is based on an analysis of the data in the MSX database as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

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**Supplemental Box**

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Continuation of:

Regarding claim 18, CROSBY discloses a computer program product comprising a computer readable storage medium having program instructions embodied therewith, the program instructions executable by a processor to cause the processor to perform (governments, scholars, practitioners, and citizens once more have great expectations for financial benchmarking and monitoring, and in some instances, a deep desire for such monitoring systems to predict fiscal stress [implicitly, the monitoring system using computer having processor to execute programs], pg 523 para 1):

creating a municipal solvency (MSX) database (To determine the validity and reliability of the measures used in Michigan's fiscal indicator system, we created a database with all the necessary variables to measure each indicator for 270 cities, pg 533 para 1, To begin, we created a list of all the indicators, these indicators measure a city's ability to pay its bills today, tomorrow, and beyond [i.e. municipal solvency]; or cash solvency, budget solvency, long-run solvency, and service level solvency, which is defined as the government's ability to continuously provide the level of service demanded by its citizens. We focus on the first three – cash, budget, and long-run solvency – and argue that without solvency (i.e., the ability to meet obligations) in one or all of these three areas, municipalities will be hard pressed to meet citizen demands and therefore budget solvency is a redundant and unnecessary measure [i.e. creating a municipal solvency (MSX) database], pg 539 para 3), the creating comprising collecting and coding data from public sources about a plurality of municipalities (Using comprehensive annual financial reports from 2007, 2008, and 2009 for all Michigan cities that had available data, we created a database to calculate the results of the 39 different indicators, pg 539 para 4, Our system relies on public data available in CAFRs that is universal among local governments; administrators and residents of any Michigan city can replicate our system and accurately assess fiscal condition [i.e. the creating comprising collecting and coding data from public sources about a plurality of municipalities], pg 551 para 3).

CROSBY does not specifically disclose generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities; and outputting the indices.

However, HOLIAN discloses generating predictive models based on contents of the MSX database (a multiple regression model for predicting credit ratings. Since credit ratings are intended to convey information about the likelihood of default, exogenous variables that explain credit ratings could also be used as predictors of default, the following independent variables were predictive of the credit rating at the 10% significance level: • Percentage of Taxes Uncollected in the Previous Year • Ratio of Direct Net Debt to Assessed Valuation • Median Family Income • Full Valuation of the Property Tax Base • Overlapping Debt, pg 9 para 4, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model [i.e. generating predictive models based on contents of the MSX database], pg 9 para 5 to pg 10 para 1, To assess the applicability of the Cities Annual Report data to municipal default probability modeling, we compared data from the report to selected data obtained from four 2011 CAFRs, pg 123 para 1), the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities (a second model based on more recent data that enables us to test the relative significance of general fund surplus/deficit and general fund balance variables, which we hypothesize to be default drivers in the modern context [i.e. drivers of municipal solvency], pg 4 para 2, Overlapping Debt refers to the indebtedness of other issuers who rely on the same tax base. This variable, along with Median Family Income and Full Valuation of the Property Tax Base, would have to be restated as a ratio to be useful in a default prediction model, pg 9 para 5 to pg 10 para 1, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults [i.e. material financial events]. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items [i.e. the predictive models describing drivers of municipal solvency and predictors of material financial events for each of the municipalities], pg 123 para 1); estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models (propose a model to estimate default probabilities for bonds issued by cities. The model can be used with financial data available in Comprehensive Annual Financial Reports that cities are required to publish. The study includes modeled default probability estimates for 261 California cities with population over 25,000 [i.e. estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models], abstract, the use of statistical and case study analysis to create a municipal bond default probability model targeted at California cities with population greater than 25,000, pg 3 para 2); creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 [i.e. creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities] that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000, pg 4 para 4); and outputting the indices (we have created an empirically-based methodology for assigning credit scores to municipalities, using quantitative techniques that are resistant to bias. These scores take the form of default probabilities and are based on a modeling procedure often applied to corporate borrowers. Using this methodology, we have assigned default probability scores to over 260 California cities with population over 25,000 that have filed 2011 or 2012 Comprehensive Annual Financial Reports, pg vi para 3, investigates the possibility of using data from the California State Controller's Office Cities Annual Report as a basis for municipal bond default probability estimation and the final appendix provides our default probability scores for 261 California cities with population greater than 25,000 [i.e. outputting the indices], pg 4 para 4). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine generating predictive models based on contents of the MSX database, the predictive models describing drivers of municipal solvency and predictors of material financial events (MFEs) for each of the municipalities; estimating probabilities of one or more MFEs for each of the municipalities, the estimating based on the predictive models; creating indices that reflect solvency and a probability of an MFE for at least one of the municipalities; and outputting the indices as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

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Continuation of:

Regarding claim 19, CROSBY further discloses that standard reporting classifications and standard legal entities are defined across a plurality of municipalities in the MSX database, thereby allowing CAFRs of different formats and contents to be compared (the current SOM indicator system be revamped to include some of the more popular indicators utilized by other authors and governments as well as data that conform to the new GASB 34 reporting standards, pg 539 para 2, We scored the ten indicators 1 or 0 first for comparison purposes to the SOM method and second because they measure different parts of the entire government as well as measure the financial factors discussed by Nollenberger (cash, budget, and long-run solvency). Unlike the SOM's focus on the general fund, we included total expenditures and total revenues for all governmental funds as well as measures for business-type activities, pg 540 para 4).

Regarding claim 20, modified CROSBY discloses the invention above, but CROSBY did not disclose that the determining is based on an analysis of the data in the MSX database. However, HOLIAN discloses that the determining is based on an analysis of the data in the MSX database (Our model relies on case study evidence, logistic regression analysis of major city financial statistics from the Great Depression – the last time a large number of cities defaulted – as well as logistic regression analysis of more recent city financial statistics. Independent variables in our model include (1) the ratio of interest and pension expenses to total revenue, (2) the annual change in total revenue, (3) the ratio of general fund surplus (or deficit) to general fund revenues and (4) the ratio of general fund balance to general fund expenditures, abstract, General fund exhaustion seems to be a significant driver of recent city bankruptcies and their attendant bond defaults. Other factors accounting for recent default activity such as adverse court judgments and the dissolution of redevelopment agencies should be less relevant for the purpose of modeling major city defaults. Cities below the 25,000 population threshold are more vulnerable to lawsuit-driven defaults or bankruptcies because their revenue base is less able to absorb multi-million dollar awards, pg 72 para 3, Standing at the intersection of financial modeling and political analysis, we suggest that a model based on fiscal indicators can improve our ability to predict municipal credit crises, pg 105 para 3, Since our proposed model is driven in part by interest expenses, pension contributions and total revenues, we investigated these data items, pg 123 para 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the determining is based on an analysis of the data in the MSX database as taught in HOLIAN with the invention of CROSBY, in order to estimate default probabilities for bonds issued by cities (HOLIAN abstract).

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.