

## Fiscal Risk Matrix for G20 Countries

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### Abstract

Risk matrix, as a well know tool for corporate finance, penetrates public finance as a simplified idea in budgetary guides in a small number of leading countries only. At the same time the complexity of socio-economic environment of public finance, needs of public finance manageability and high sovereign debt call for advanced the risk matrix design. The first step of the research is the observation of the leading countries' matrix examples and articles targeting the same topic to determine the risk matrix structure. The second step involves comprehensive reading of the most transparent countries to create a list of the matrix factors. The factors include key socio-economic events as sources of risks and key budgetary variables changes as types of risks. The third step ranges the matrix elements (cells) by their occurrence in G20 countries based on comprehensive reading of IMF countries' reports. The research result is a one-page risk matrix with 10x13 key factors and many ranging elements, designed as the compromise between the environment complexity and manageability needs for public finance.

**Keywords:** Risk management; Risk factors; Risk sources, Risk exposure; Public finance; Public budgeting system; Sovereign debt; Fiscal policy.

**JEL Classification:** F33, F34, G32, H61, H68.

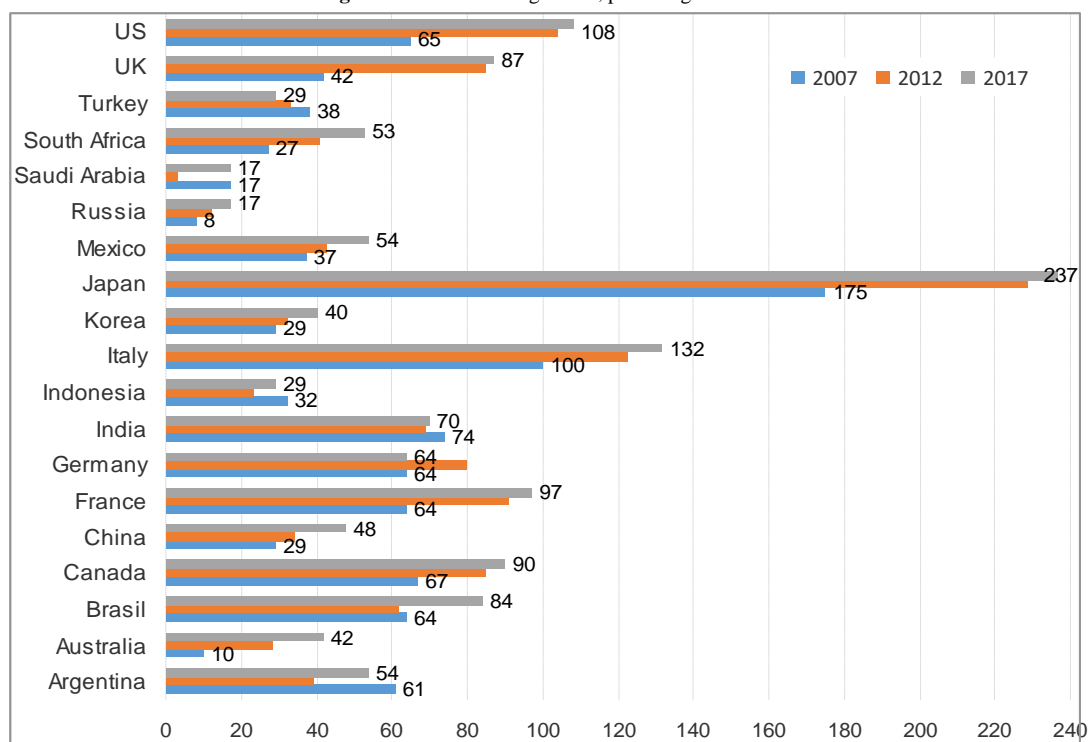


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### 1. Introduction

After 2008 many large countries face significant budget deficit, reflected in rapid growth of sovereign debt. The debt mounted (Figure 1) without significant wars or natural disasters (historically the most important debt drivers), only as a result of economic turbulence and fiscal policy. At the same time, G20 club members demonstrate various debt appetite and debt dynamics: the US, the UK, and Australia have nearly doubled sovereign debt over one decade; Russia, Saudi Arabia, Indonesia and Korea keep sovereign debt low.

Figure-1. Gross Sovereign Debt, percentage of GDP



Source: Visualized by the author based on the IMF Data Mapper

English-speaking countries combine the debt doubling and pioneering the implementation of risk management practices into public finance. The US started broad implementation in the early 1990's, and now many open-access

documents guide risk management, such as Federal Manager's Financial Integrity Act (FMFIA, 1982), Implementation Guide for OMB Circular-123 (OBM, 2005), Enterprise Risk Management, Selected Agencies' Experiences (GAO, 2016), and many others. The UK Office for Budget Responsibility published Fiscal Risk Report (OBR, 2017), as the most detailed around the globe, HM Treasury issued Orange Book Management of Risks (Treasury, 2004), as a well-known benchmark for many countries. Canadian government and Treasury department issued detailed risk management guidance and reports (Government of Canada, 2016), Australia also put risk management issues into periodical budgetary review documents (Australian Government Department of finance, 2016), Non-English speaking countries do not disclose detailed risk management acts or reports as English speaking countries do. In 2016 IMF indicated that "existing fiscal risk disclosure and analysis practices tend to be incomplete, fragmented .." (IMF, 2016).

In the broad risk management aspects, the research focuses on risk matrix only, as a well-known tool in corporate finance, but not in public finance. The first review stage of the research identifies several respective attempts of risk matrix use for public finance and the matrix general design. Reviewed governmental and scientific literature mainly mentions the matrix nature without any details of the matrix factors and the matrix cells quantifications. The research second stage focuses on the details of the matrix factors: sources of risks (key socio-economic events) and types of risks (changes in key budgetary variables). The most important sources for the matrix factors include respective governmental issues, well known Davos Global Risk Report and IMF Fiscal Transparency Evaluations by selected countries. The research third stage ranges the matrix cells by the frequency of specific combination of sources and types of risks, written in observed bulk of IMF issues about G20 countries. This is an immense comprehensive reading of 19 country reports 70-100 pages each, with searching of about 10x13 probable combinations of risk sources and types.

The research result is a compromise between public finance complexity and manageability in a one-page matrix with the 10-13 most important risk sources and risk types, ranged by 0-1-2-3 exclamation marks. One-page risk matrix looks like an executive summary of the most important factors for decision-making, out of too complex unmanageable models. Also one page reflects cost-benefit principle of analyses or decisions, while the additional complexity does not always improve the quality of decisions. As a result, the matrix reflects important factors only, listed in at least two observed countries, and ignores many rare ones. The research ranges the combinations of risk sources and types (the matrix cells) by: one exclamation mark for the combination written at least in two countries, two marks – in five countries and three marks – in at least 10 countries. Also, exclamation marks possess as analogue of heat matrix, where the combination importance (or risky) is visualized by various colors.

## 2. Review Scientific Literature, Issues by International Organizations and Some Governments

Academia researchers do not fully neglect a risk matrix, but few of them briefly point a general idea of fiscal risk matrix only. Dvořáková demonstrated a typical avoidance of the matrix: "risk maps or risk matrixes are not usually created either, but the risks connected with the regional budgets are monitored" (Dvořáková, 2001, Abstract). Vasyunina mentioned about orientation of a fiscal risk matrix to the risks ranking, as probability of occurrence and character of impact, colored as typical heat map (Vasyunina, 2017), Gorlova also opinionated fiscal risk map as graphical description of fiscal risks and those level (Gorlova, 2017).

Scopus disclosures a hundred research articles about one of the key conventional fiscal policy challenges and tools without risks broad review and ranking. The research by Goncalves & Guimaraes linked together the interrelations of the past debt issues and current fiscal policy (Goncalves and Guimaraes, 2015), Shiamptanis pointed out nonlinear fiscal policy rule, which reduces the probability of a solvency crisis (Shiamptanis, 2015). Lloyd-Ellis & Zhu presented the other conventional fiscal risk management tool: "a set of international financial securities to identify exogenous shocks.. and hedging gains from diversifying the risk associated with tax changes" (Lloyd-Ellis and Zhu, 2001).

Some research articles focused on specific sources of fiscal risks and their allocations to specific budgetary variables, which help to point out typical relations of the matrix elements. Cardona et al. "present the Disaster Deficit Index model and the results of its application to 19 countries of the Americas and aims to guide governmental decision-making in disaster risk reduction" (Cardona *et al.*, 2010), Bohn wrote about narrow specific source of fiscal risk and budgetary variable, combining together risk sharing and overlapping generation, productivity risk of future retirees and young risk tolerance (Bohn, 2009), Polackova investigated "fiscal obligations contingent on the occurrence of particular events, .. not budgeted.. in conventional fiscal analysis" (Polackova, 1999), Buettner "estimates the extend of smoothing of state-specific income shocks .. by federal fiscal institutions .. and interregional transfer mechanisms" (Buettner, 2002).

International financial organizations pay noticeable attention to matrix-kind presentation of risks and contribute more to the design of the research matrix. The first influential source is the Risk Map from The Global Risk Report 2017 (World Economic Forum, 2017), The second source is IMF Analyzing and Managing Fiscal Risks – Best Practices, which generalizes Fiscal Transparency Evaluation by countries and pointed "the variance-covariance matrix of historical shocks" (IMF, 2016). Several countries' specific Fiscal Transparency Evaluations contribute mostly to the list of the matrix factors and their interrelations (cells) (IMF, 2014).

HM Treasury's The Orange Book is a one of the influential issues from mid-2000s and contains several table-kind presentations of risks. The first table describes several main risk categories (1<sup>st</sup> column), then it shows the categories up to ten specific risks (2<sup>nd</sup> column) and finally it considers each risk (3<sup>d</sup> column), with a line per each

risk. The second table is a simple risk to tolerability matrix: Impact / Likelihood axes and colored cells for tolerability. The third table is the most complex one and is headlined as Documenting Risk Assessment: many lines per specific risk, 9 columns per managerial action and those assessments (Treasury, 2004).

Australian and Canadian government guides contribute to the research matrix design as well. Australian Department of Finance analyses risks by 'a matrix or 'risk heat map', [where] consequence and likelihood are plotted on the two axes of the matrix, with each corresponding cell assigned a level of severity [for each program, project, departmental unit]" (Australian Government Department of finance, 2016), Canadian government guides "... organizations to select a matrix size according to their needs ...". An example presents a table with three columns: strategic outcomes [per program], risk category [per type of risk for each program], Risk Description [per each risk category] and many lines for each program and risk (Government of Canada, 2016).

### 3. Risk Matrix Detailed Design and Factoring

The Global Risks Report of 2017 depicts for about 30 global social, geopolitical, economic, technological and environmental risks and trends. The Report contributes to the matrix by the following events: "energy price shock, failure of financial institutions, aging population, interstate conflicts, natural disasters" (World Economic Forum, 2017), The Report of 2012 contains similar risks to the ones in the Report of 2017, sometimes rephrased ("extreme volatility in energy and agricultural price" → "energy price shock") or ranked differently. The Report of 2007 was several times smaller by number of pages and events/risks considered, and the only actual economic risk from the Report of 2007 is "the US current account deficit/ fall in US\$, China economic hard landing" (World Economic Forum, 2007).

IMF report Analyzing and Managing Fiscal Risks – Best Practices quantifies the impact and probability of the 10 most influential events in terms of fiscal cost as percentage of GDP. Ten sources of risks are relevant to the research goal, but those allocations to GDP fall (one variable only) contradict with 13 key budgetary variables as the research goal. Also the IMF staff mentions only the most impressive one-off events, probably with the long tail, but not long lasting factors with a steadily accumulated impact (such as aging population). Thus, the IMF issue contributes to the research risk sources with the following: "macroeconomic shocks (sharp decline in nominal GDP), the financial sector rescue, legal cases (government compensations), subnational governments' rescues, state-owned enterprises and private companies' bailout, natural disasters" (IMF, 2016).

Exemplified the UK, Australian and Canadian risk matrixes contain socio-economic events and governmental outcomes per governmental departments and programs with narrow objectives and actions. The examples mainly specify the negative influence of unknown factors to budgetary variables and guide governmental solutions to minimize the result. The research matrix goes up from specific governmental functions or programs to budgetary variables and economic events, to those combinations ranged in the matrix cells. The combinations range looks like a heat map, but not of impact and likelihood, or of interrelations frequency between events and variables.

The UK Fiscal Risk Report of 2017 broadly specifies main economic events and types of fiscal risks as well, contributing to the matrix elements the most. The UK report specifies the following fiscal risks in terms of key budgetary parameters: "revenue risks in general, by types of tax bases and by key tax payers, primary spending risks, spending rise on individual programs, balance sheet risk, debt interest risk, local authorities requirements of greater funding". It also points out the main socio-economic challenges as sources of fiscal risks, such as "financial crisis and recession, interest rate and inflation, Brexit and peacetime, productivity growth weakness, North Sea oil production fall, cleaning up nuclear power stations, aging population and proportion of the population working, increased costs due to technological advances [for public spending on medicine], risk from the housing market" (OBR, 2017).

The research matrix noticeably simplifies a presentation of impact / likelihood / tolerance for interrelations of many economic events and budgetary variables. Some economic events have long-lasting nature (like key industry changes or demographic shifts), while others occur ones per many years (like bank crises or natural disasters), and putting all together into one page would be too complex. Even IMF simplifies presentation of likelihood / impact of key economic events in terms of years between similar events and as percentage of GDP losses, does not allocate the events to many budgetary variables. The range of matrix cells by number of exclamation marks reflects the multiplication of both likelihood and impact of key economic events to key budgetary variables. No risk tolerance is depicted in the research matrix, because governments have no option of risk avoidance as creditors or regulators of last instance.

The research matrix does not include several conventional influential events and challenges, resulted in other ones or combined into broader group. For example, the research matrix ignores inflation, one of the most common macroeconomic events, for being rather small for the vast majority of G-20 countries, also as a secondary factor resulted in worsening of the foreign trade, economic growth, and demography. At the same time, interest rate and exchange rates are put into the matrix, because their growing trends and significant volatility are less manageable by a single country, as it is affected by large foreign trade and investments. Various information sources and country reports highlight different key industries, exported or imported goods (oil or electronics), and demographic groups (aging population or young unemployment), which are combined.

## 4. The Matrix Cells/Risks Ranking

### 4.1. The Most Significant Fiscal Risks

The UK Fiscal Transparency Evaluation is a good example of a country centric disclosure of the most important risks (*financial sector, oil and gas sector, and aging population*). The report states that “the fiscal risks created by banks are among the most important, as the government bail out a failing bank, guarantees deposits.. and the effect of financial crises have on the wider economy and thus the government’s revenues (2008-2015 was about 38 percent of 2015 GDP)”. “The government has large liabilities and also valuable financial assets, amounted to 114 and 30 percent of GDP”. “North Sea oil and gas is no longer an important source of revenue“ and according to Figure 4.1 government oil revenue falls several times in 2015 compared to the mid 2000’s average, due to sharp decline in global oil prices and shrink of oil production. “The aging of the population is expected to create large, uncertain fiscal costs” (IMF UK, 2016), Hereinafter, the countries reports’ findings are sorted by risks sources types, not by countries, that allow comparing similar descriptions and better ranging of the matrix cells.

*The US contributes the most to global risks by monetary policy tightening and reshaping of global trade.* Generalization of the US uncertainties contributes to such the matrix sources of risks as foreign trade, national currencies, banking sector, interest rates and GDP growth. The majority of the IMF country reports mention the US as the largest source of risks - even the US country report points “strengthening of US dollar.. and higher interest rates” as important risks (IMF US, 2017), Mexico report broadly emphasizes “.. economic relations with the U.S., monetary policy tightening .., the risk of renewed volatility in global financial markets, increased risk premium, and a sharp pull-back of capital from emerging markets” (IMF Mexico, 2017). Canadian report also mentions: “U.S. policies on trade and tax reform. Protectionism and economic fragmentation, and.. the rise in U.S. treasury yields” as risk for Canada (IMF Canada, 2017).

European, Asian and other countries follow the concern from North America countries reports. “Anti-globalization sentiment in Europe or the U.S. would hurt Germany’s exporting industries” (IMF Germany, 2017), “Global policy uncertainty... around trade policies and post-Brexit negotiations, ... higher interest rates” contributes to risks for France (IMF France, 2017), In Italy “uncertainty on the scope of U.S. policy shifts, monetary tightening ... could raise debt sustainability and financial stability concerns” (IMF Italy, 2017), In Indonesia “the main risks are external, including a reversal in capital inflows, triggered by global financial volatility or uncertainty around U.S. monetary and fiscal policies” (IMF Indonesia, 2018), Indian report points out that “the impact from global financial market volatility could be disruptive, including from U.S. monetary policy normalization or weaker-than-expected global growth” (IMF India, 2017), China highlights “higher trade barriers be imposed by trading partners, .. faster-than expected normalization of U.S. interest rates” (IMF China, 2017).

Many countries’ reports widely emphasized *banking sector* and foreign capital volatility in advanced to risks caused by the US monetary and trade policy shifts. Bankers’ troubles could trigger government contingent liabilities and one-off budgetary expenditures; could weaken economic growth and cause general revenue under collection. For Korea “monetary tightening in the US could pose a risk to asset quality and banks’ external financing risks” (IMF Korea, 2018), Indonesian “banks are exposed .. to the corporate sector, which is vulnerable to FX and external rollover risks” (IMF Indonesia, 2018), South Africa is “vulnerable to tightening global financial conditions ... and from exchange rate fluctuations” (IMF South Africa, 2017).

Some countries’ reports mention banking sector risk itself, i.e. without global turbulence originated from the US. “China now has one of the largest banking sectors in the world at 310 percent of GDP.. have resulted in sharply rising risks”. Chinese “total non-financial sector debt reached about 235 percent of GDP in 2016.. A funding shock could come from interbank wholesale market.. short-term asset management products ..” (IMF China, 2017), “Given strong trade and commodity linkages, Australia is strongly exposed to economic and financial risks in China. A large negative shock, most likely external, could .. trigger a sharp house price correction,..negative feedback .. to the financial sector” (IMF Australia, 2018), Indian government’s control of large banks, resulted in “.. weakened capital, profitability and asset quality of many PSBs [public sector banks], slow corporate deleveraging, .. and further weakening of bank asset quality” (IMF India, 2017).

Saudi Arabia points out “tightening of banking sector liquidity” (IMF Saudi Arabia, 2017), while Italy emphasizes “nonperforming loans .. at about 21 percent of GDP” (IMF Italy, 2017), French report points out “banks’ profitability through higher wholesale funding costs, the large share of mortgage .. at low fixed rates, .. two thirds of French companies’ debt contracted at variable rates” (IMF France, 2017), “The German banking sector must accelerate its restructuring and shore up profitability” (IMF Germany, 2017), Japan “financial institutions continued to increase their risk-taking in search of higher yields, by expanding real-estate and overseas lending” (IMF Japan, 2017), South Africa faces “significant gross external financing needs .., as gross external liabilities are large at 128 percent of GDP at end-2016” (IMF South Africa, 2017).

The third most popular risk is *demographic shifts*, including: (1) population aging and following growth of non-funded future social expenditures, (2) youth and female structural unemployment resulted in under collection of budgetary revenues, (3) low labor productivity in SMEs and informal sector with shortening general government revenues. Korea typically points out demographic risks: “working age is expected to drop to 50 percent in 2050, .. non-regular workers over 20 percent, .. small firms .. less productive, the share of youth unemployment .. is large at 18 percent, the share of women in regular jobs remains at 40 percent” (IMF Korea, 2018), Germany adds quantitative projections, that “pension outlays in relation to GDP rising between 1.9 and 2.7 percentage points by 2050, and health and long-term care costs adding a further 1.3–2.1 percentage points” (IMF Germany, 2017), Large youth and female unemployment or their small labor forth participation are emphasized by France, Saudi Arabia, Italy, Mexico, Indonesia, and Japan. Aging population is a crucial risk for Japan, Korea, Italy, China and Canada.

Large informal sector, following lower governmental revenues, lower productivity and weaker GDP growth are pointed out in the following countries' reports: Mexico, India, Korea, and Italy.

## 4.2. Medium Fiscal Risks

In 2008, 2014 and 2016 *fall in oil prices* affected budgetary revenues, call budgetary aid to energy sector companies and banks, but less than half of the countries' reports possess commodity prices fluctuations as significant source of fiscal risk. The US report states that "lower energy prices ..., solvency risk in the oil sector would rise" [IMF US \(2017\)](#), In Mexico "... oil production from aging oil fields .. decreases", at the same time PEMEX's profitability and efficiency improves ([IMF Mexico, 2017](#)), In Canada "growth forecasts have been gradually marked down since the oil shock" [IMF Canada \(2017\)](#), as well as Australia still "rebalancing after the end of the large mining boom of the 2000s" [IMF Australia \(2018\)](#), South Africa emphasizes "... decline in agricultural and mining production, owing .. low commodity prices" [IMF South Africa \(2017\)](#), In opposite, India benefits from low commodity prices with "the remaining commodity subsidies" [IMF India \(2017\)](#), and Italy - from "favorable commodity terms of trade" [IMF Italy \(2017\)](#), as well, but the benefits are at risks as the prices could temporary rise.

Similar to commodities, the IMF country reports represent *real estate* as the frequent source of risk, mainly because of the sector overheating. The sector bubble blowing up could trigger government aids to construction companies and mortgage exposed banks, and affect budgetary revenues from the sector, then cause negative spillover for economy and general budget revenues. In Canada "the main risk on the domestic side is a sharp correction in the housing market", because "household debt-to-disposable income has reached nearly 170 percent, which is among the highest in G-7 economies" [IMF Canada \(2017\)](#), Australian "housing market imbalances and higher household vulnerabilities [are combined with] commercial banks' housing exposure .. at over 50 percent of total assets" [IMF Australia \(2018\)](#), In Korea "household debt exceeds 90 percent of GDP, increasing vulnerability to both a housing price correction and a sharp rise in interest rates" [IMF Korea \(2018\)](#), In Germany "housing prices [demonstrate] some hot spots" [IMF Germany \(2017\)](#), as well as in Japan some "segments of the real estate market seem to be moderately overvalued" [IMF Japan \(2017\)](#), Chinese "authorities started tightening macro-prudential measures for the real estate sector" [IMF China \(2017\)](#),

The third non-financial sector mentioned as a risk source is manufacturing, but with less disruptive effect to public budgetary system as commodities and real estate sectors. India highlights "sharp contraction in merchandise exports" [IMF India \(2017\)](#), "in manufacturing.. France has been losing its comparative advantage" [IMF France \(2017\)](#), Korean "shipbuilding.. is undergoing restructuring" [IMF Korea \(2018\)](#), Besides manufacturing, Japan [IMF Japan \(2017\)](#), and Indonesia [IMF Indonesia \(2018\)](#), point out structural reforms or required diversity from agriculture and energy sectors. The US particularly points out "cyber risks to the financial system" [IMF US \(2017\)](#).

Interestingly, but only reports of 5 countries mention *exchange rate* as source of risks, while statistics points out significant exchange rate volatility for more countries in recent history. Nothing is written about direct influence of the volatility on budgetary variables; at least the volatility affects balance sheet positions, some sources of budgetary revenues and debt payments to non-residents. "Non-energy exports.. disappointed despite a 15 percent depreciation of the Canadian dollar since mid-2014, [as the result of] Canadian dollar .. overvalue" [IMF Canada \(2017\)](#), In India "ongoing appreciation of the rupee real effective exchange rate causes sharp contraction in merchandise exports" [IMF India \(2017\)](#), As well as in France "the appreciation of the euro .. affected competitiveness of manufacturing" [IMF France \(2017\)](#), Chinese report states that "administrative control over FX flows and the exchange rate has increased" [IMF China \(2017\)](#), and the report of South Africa highlights "vulnerabilities from exchange rate fluctuations" [IMF South Africa \(2017\)](#).

Only few countries particularly point out *growing interest rate* or high interest expenses on sovereign debt. Even the highly indebted the US and the UK avoid the sharp angle, also Canada shields high gross debt by significantly lower net ones. In India "the interest cost of public debt is one fourth of general government revenues" [IMF India \(2017\)](#), Japan doubts "fiscal sustainability could lead to a jump in the sovereign risk premium" [IMF Japan \(2017\)](#), In France "a sudden increase in interest rates could have negative balance sheet effects" [IMF France \(2017\)](#), Indonesia highlights "larger fiscal financing needs due to higher interest rates" [IMF Indonesia \(2018\)](#).

*Unstable GDP growth* is one of the popular issues for economists, but statistics contradicts the conventional wisdom and shows that the growth itself is not risky. Turkey FTE contains the "Figure 3.1. Indicators of Macro-Fiscal Risk in G-20", "(a) Standard Deviation of Growth of Nominal GDP, (b) Standard Deviation of Growth of Government Revenues" [IMF Turkey \(2017\)](#), According to the figure, only three countries (Saudi Arabia, Turkey and Russia) demonstrate the deviation (a) about 10-13% and the deviation (a) about 2-4% for vast majority of countries. Large deviation (b) is demonstrated only by Saudi Arabia (~30%), the following 5 countries general revenues fluctuate about 8-14% as the result of GDP growth fluctuation. In 2016 "The Brazilian economy is exposed to significant macroeconomic uncertainty, which, in turn, create high uncertainty on fiscal outturns" [IMF Brazil \(2017\)](#), Adding to FTE, four countries' reports point out weak global growth: the US [IMF US \(2017\)](#), South Africa [IMF South Africa \(2017\)](#), India [IMF India \(2017\)](#), and Italy with domestic "low nominal growth ..." [IMF Italy \(2017\)](#).

## 4.3. The Smallest Fiscal Risks

Risks of *state owned enterprises* (SOE) are not frequently mentioned by the IMF staff. For example, Turkish FTE estimates, that "financial institutions have been historically the biggest beneficiaries of Treasury guarantees", but risk exposures from SOEs liabilities estimated by only 23% of GDP ([IMF Turkey, 2017](#)), In opposite, Russia demonstrates "financial activity of various classes of government-controlled enterprises with net exposure of at least 29% of GDP and liabilities of at least 127% of GDP in 2012" [IMF Russia \(2014\)](#), mainly in oil&gas and banking

sectors. Several countries' reports point out **banking sector government ownership** of regional governments (Germany, Canada) or as the result of emergency bailouts (Britain).

China "SOEs have been structurally less efficient than the private sector.. SOEs account.. half of corporate debt and 40 percent of industrial assets but less than 20 percent of industrial value added, SOEs account for 50 percent of zombie debt outstanding" IMF China (2017), In South Africa, "sovereign ratings have weakened, and the rating actions reflected .. sizable contingent liabilities in state-owned enterprises (SOEs)" IMF South Africa (2017), In Brazil "public corporations create significant risks, the biggest risks .. relate to Eletrobras and Petrobras .. with gross liabilities of 1.9 and 11.4 % of GDP, Petrobras - financially stressed" IMF Brazil (2017), Sizable state ownership in oil sector is mentioned in the reports of Saudi Arabia, Mexico, Indonesia, in energy sector - in India.

One of the easiest rankings is a risk of **regional indebtedness**. It is statistically small in the vast majority of G20 countries, mainly originated from changes in key regional industries or market bubbles, paid by federal budgets. Turkish FTE contains a figure that describes sub-national liabilities in the vast majority of G-20 countries IMF Turkey (2017), as simplified heat map for ranging the matrix cells. Canada, Japan, Germany and the US demonstrate the largest liabilities, other countries' regions borrow about or less than 10% of GDP. Turkish and Russian FTE explain the phenomena by legal restrictions for borrowing by sub-national governments.

"In Brazil several states and municipalities are financially troubled .." IMF Brazil (2017), "Local governments in China have the highest share of national spending responsibility in the world yet very limited revenue autonomy... some vertical imbalance will likely remain" IMF China (2017), Canadian "provincial governments need to be more cautious in .. higher debt burden" IMF Canada (2017), In Germany "investment needs are concentrated at the municipal level" IMF Germany (2017), France points out "rapid growth in social, wage bill, and local government spending" IMF France (2017), In Indonesia "challenges remain in the coordination between central and local governments" IMF Indonesia (2018).

Turkish FTE especially highlighted worsening terms of public **capital projects**, where one of the figures depicts the overspending about 7,2 t.l.bil. from planned 5,4 t.l.bil. without any reasons (IMF Turkey, 2017), Saudi Arabic ".. capital spending multipliers to .. quite low in the short-term, .. have high import content" IMF Saudi Arabia (2017), Indonesia "mobilizes revenues to finance development spending .., but growth remains constrained by a large infrastructure gap" IMF Indonesia (2018), The US mentions on the first page of the country report ".. a need for a significant increase in public spending on infrastructure projects" (IMF US, 2017), and "the proposed Canada Infrastructure Bank (CIB), expected to be operational by late 2017, will leverage private capital for public infrastructure" IMF Canada (2017).

Few countries allocate significant budgetary funds to defense and stay in **military conflicts** (the US, Russia, Saudi Arabia and Turkey) and only two specially highlight the risks. The countries defense spending stays in long-term trends and limitedly challenge federal expenditures, even rising weapons export support federal tax revenues in the US and Russia. French and British participation in the US coalition in the Middle East insignificantly reflects in the countries defense spending and fiscal risks, not mentioned in the countries' IMF reports. "Regional geopolitical shocks would generate significant spillovers to the Japanese economy" IMF Japan (2017), and Saudi Arabia faces "the ongoing conflicts in Syria and Yemen" (IMF Saudi Arabia, 2017).

Another easiest ranging is fiscal risks from **natural disasters**, broadly presented in Turkish FTE: "average annual costs of natural disasters and number of events in G-20 (percent of GDP, 1993-2012)" (IMF Turkey, 2017). The figure points out that even China, which was affected the most, loses less than 1% of GDP per annum, and Japan and Turkey lose less than 0,5% of GDP. Fiscal risks are mainly covered by "compulsory earthquake insurance" IMF Turkey (2017), and by "emergency reserves of up to 3 percent of the budget" IMF Russia (2014), Japan, Italian, the US and Indonesian reports rarely mention earthquakes, hurricanes and floods in small number of regions and states, with very rare influence the regions' debts and federal emergency or recovery aids.

## 5. Conclusion

The research matrix (Table 1) expands the best examples from highly respective publications for World Economic Forum, of the UK and US governmental units, IMF Fiscal Transparency Evaluations and many other governmental and scientific issues. In particular, the research present and compare the ideas and design of about 10 the most influential risk matrixes and risk maps.

The research matrix looks like a compromise between the complexity and manageability of public finance, like one-page executive summary. So, the research matrix contains the 10 most important sources of fiscal risks (socio-economic events) and the 13 most important types of fiscal risks (affected budgetary variables). The other respective risk matrixes or risk maps depict many types of risks as they are (without disclosure of casual relations) or link together many sources of risks and only one generalized variable or one risk to many variables.

The research discloses steps of the matrix design, factors choice and content ranking in noticeable details, while the other listed influential publications present theoretical examples or simplified results only. So, about 20 IMF country reports 70-110 pages each lay on the ranking of the matrix cells, and more than a hundred citations prove the ranking.

The research matrix could be a useful benchmark for:

- a. Government officials at federal and regional levels for budgetary calculations and debates;
- b. Financial sector analysts, who judge sovereign credit ratings and bonds portfolio limits;
- c. Real sector finance officers, who choose businesses locations or build budgetary relations

Table-1. Fiscal risk matrix

Source of fiscal risks	Instability of economic growth	Changes in GDP structure	Changes in the country key industry	Shifts in demographic structure	Worsening of foreign trade	Instability of national currency	Growth of domestic interest rates	Instability of banking sector	Geopolitical tensions	Natural disasters
Undercollection of general budgetary revenue	!!	!		!!	!!					
Decline of revenue from key industries		!	!		!!!	!!		!!		
Decline of revenue from key taxes	!!	!	!!		!	!				
Increase in general budgetary expenditures		!				!			!	
One-off increase in budgetary expenditures			!		!			!!!		!
Increase in non funded future expenditures	!!!			!!				!!		
Emergency cuts of budgetary expenditures		!	!	!	!	!	!	!		
Increase costs of sovereign debt	!			!		!!	!!!			
Worsening terms for public capital projects						!	!	!		
Deterioration of financial assets value	!		!		!!			!		
Imbalance of non-budgetary social funds	!!		!			!	!			
High indebtedness of regional governments			!							!
Default probability of state owned enterprises			!!		!!	!	!	!!	!	

Note: this table summarizes the research result based on number of evidences from review governmental guides, scientific articles and IMF country reports.

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