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The Use of Financial Account & Balance Sheet in Measuring Financial System Vulnerabilities

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Abstract: The main purpose of this paper is to identify financial imbalances, as reflected through financial inter-linkages among sectors and potential risk contagion in financial system, using National Financial Account and Balance Sheet (FABS). The FABS consists of balance sheets of each sector in financial system, namely the government, the financial sectors (the central bank, banks, and other financial corporations), the non-financial private sectors (corporations and households), and the external sector (rest of the world). There are 3 main tools used in measuring financial system vulnerabilities, namely sectoral analysis, network analysis and sensitivity analysis. Sectoral analysis shows that the financial system in Indonesia remained stable over third quarter of 2016. Further, the network analysis reveals the importance of external funding in Indonesia particularly through non-financial corporations channel. The sensitivity analysis discloses that the effect of exchange rate depreciation shock is relatively insignificant on non-financial corporations due to the high of foreign currency asset notably after tax amnesty policy, whereas the combined shock leads to the decrease in the value of net external position of non-financial corporations. However, the exposure from banks rise significantly as the non-financial corporations have to replace their foreign funding with domestic funding.

Keywords: National balance sheet, interconnectedness, macro prudential analysis

JEL Classification Number: C63, E01, G01

1. INTRODUCTION

The past global financial crisis indicated the necessity of integrated sectoral balance sheets that provide information of interconnectedness and risk transmission channel among sectors in financial system. Integrated Sectoral balance sheets, hereafter called National Financial Account and Balance Sheet (FABS), consists of balance sheets of each sector in financial system, namely the government, the financial

sectors (the central bank, banks, and other financial corporations), the non-financial private sectors (corporations and households), and the external sector (rest of the world). The availability of FABS data is very powerful for identifying the financial imbalances as reflected through financial inter-linkages among sectors and potential risk contagion in financial system. Better understanding of the build-up balance sheet imbalances and how shock affect both flow and stock data is very important in measuring the financial system vulnerability, hence the policy to mitigate the potential risk contagion could be taken timely.

In line with IMF data gap initiative, collaborated with other related institutions, Bank Indonesia has developed statistics of FABS since early 2014 and statistics of Regional FABS since 2015. Statistics of regional FABS covering the financial transaction and position in term of asset and liabilities at province level. The regional FABS are needed for further analysis to address the risk specific and uniqueness of each region and to enhance the spatial analysis, especially in identifying the regional financial imbalances. Bank Indonesia currently develop 3 main tools for measuring financial system vulnerabilities, financial inter-linkages and potential risk contagion by utilizing the national and regional FABS data, namely sectoral analysis, network analysis and sensitivity analysis.

According to Allen *et al.* (2002), the mismatches of the composition and size of the liabilities and assets on the balance sheet can be the source of vulnerability and trigger financial imbalances. Those mismatches, which are known widely as maturity mismatch, currency mismatch, capital structure problem, and solvency problem, can be assessed using balance sheet risk indicators built from FABS data. Those indicators can reflect the indication of the build-up of risks either come from a certain sector or the interconnection among sectors, which if materialized, will be potentially lead to the instability condition of financial system. In particular, the purposes of this paper are to identify financial imbalances that are originated from individual sector or interconnection among sector, as well as to complement macro-prudential assessment which mainly associated with cross-section dimension.

The rest of this paper proceeds as follows. Section 2 explains the brief review of the literatures used in this research. Section 3 describes the FABS data and methodologies that are applied here in the context of financial imbalances analysis. Section 4 portrays the result of the analysis over several periods. Section 5 contains the conclusion of the throughout analysis.

2. BRIEF REVIEW OF LITERATURE

IMF (2016) assessed macro-financial linkages in Indonesia using two complementary approaches, namely a Sector Level Balance Sheet Analysis, consisted of matrix analysis, network analysis and sensitivity analysis, as well as a Panel Vector Auto regression Approach. The result of those analyses showed the importance of external financing in Indonesia, notably through non-financial corporations. The net exposure of external sector with respect to non-financial corporation reached 57.57% of Indonesian GDP. In addition, the net exposure of banks with respect to non-financial corporation was also relatively high, as such the negative external shocks could plausibly propagate to domestic banking system through non-financial corporations. Sensitivity analysis using an exchange rate depreciation of 25% displayed that the external indebtedness of non-financial corporations rose by 14% of GDP. Meanwhile the combined shock, exchange rate depreciation of 25% and a 10% capital flow reversal, influenced the increase of

non-financial corporations' indebtedness by about 8% of GDP and also the exposure of bank to non-financial corporations by about 7% of GDP. The increase of banks' exposure to non-financial corporations along with corporations' need in replacing 10% of their foreign funding with domestic funding. Lastly, the result of a Panel Vector Auto regression Approach confirmed that non-financial corporations could be a source of financial system's vulnerability by way of transmitting external shock to the domestic economy.

The Federal Reserve has implemented Balance Sheet Analysis (henceforth BSA) since 1991 by involving some of economic sectors that recorded in FABS, namely Household, Non-farm Corporate Business, Farm Business, Non-Financial Corporate Business, Private Financial Institution, State and Local Governments, as well as the US Government. Generally, the analysis focuses on the economic sectors performance by using some balance sheet indicators i.e., financial interrelations ratio, credit market debt relative to tangible assets, distribution of private net worth, net foreign asset relative to total asset held by the private sector and ratio of business capital to household capital.

Exploiting national and sector balance sheet data for period 1950 to 1990, Goldsmith (1966) has showed that there was an increase in the value of financial interrelation ratio during that period. The high value of which indicated the high linkages between real and financial sector in the US. In addition, the credit market debt relative to tangible asset also rose significantly up to 11% (annual rate) during period 1983 to 1990. The high value of that ratio displayed the build-up of credit risk in the US funds market. Meanwhile, the sharp increase in the value of net foreign assets relative to total assets held by the private sector since 1980 represented the increase in the proportion of the US assets held by external sector and thus potentially lead to the build-up of external risks.

Moreover, Bank of Israel has also utilized FABS data. The data is complemented by foreign currency denominated balance sheet to analyze the Israeli economy's resilience to exchange rate risk. Various economic sectors that are recorded in the FABS of Israel were Bank, Institutional Investors, Government, the Bank of Israel, the Business Sector and Household. By using FABS data for period 1997 and 2005, Haim and Levy (2007) conducted a sophisticated balance sheet analysis to see the effects of the depreciation and appreciation of exchange rate and how these risks were transmitted to other sectors. Furthermore, the analysis showed that Israel economy was likely to be affected by exchange rate depreciation which occurred in 1997, whereas the economic sectors that were affected significantly by the depreciation in 2005 were the business sector and the government sector. In term of exchange rate appreciation, Israel economy tends to be more resilient in facing the appreciation in 1997 and 2005.

The study of BSA in developing countries (Ukraine, Latvia, Estonia, Hungary and Croatia) has demonstrated that BSA could be used to provide general information about sector risk profile and particularly about currency risk and maturity mismatches which are closely related to the liquidity risk. Besides that, BSA could also be used to analyze the shock amplification (South Africa) and the transmission of shock among sectors (Thailand and Peru).

Ukraine (2005) found that non-financial private sector has the greatest potential of liquidity risk as a result of large liabilities domination in foreign currency. Latvia (2005) explained that the large non-resident deposits and unstable currency denomination of those would cause the banking sector to be significantly exposed by maturity mismatch. The research of IMF (2006) which compares the balance

sheet of Estonia, Latvia, and Hungary has showed that the net positive position of the public sector could be used as a buffer in the event of shock. Meanwhile, a study in Croatia (2006) has portrayed that because of the sharp increase of external debt, the private non-financial corporate sector became vulnerable to the potential shocks, i.e. exchange rate depreciation and the increase of foreign interest rates.

South Africa (2007) conducted an assessment of economy resilience by using economic sectors balance sheet and applying a stress test method based on the potential shocks. The result showed that the South African economy, as reflected by the whole of economic sectors balance sheet, was relatively resilient to shocks. Meanwhile, Thailand (2003) demonstrated the improvements in addressing balance sheet mismatches since Asian crisis, particularly the potential of vulnerabilities in the corporate sector. The study analyzed how the vulnerabilities in corporate sector would affect the increase of credit risk in the banking sector and also influence public sector's contingent liabilities. Peru (2004) described how the exchange rate depreciation shock would be transmitted to non-financial and banking sector.

3. DATA AND METHODOLOGY

3.1. Scope Data

The data used to analyze the financial imbalances in this paper is quarterly data of National FABS from the first quarter of 2015 to the third quarter of 2016. Financial Account data (henceforth FA) provides a record of financial transactions (flows) in term of asset and liabilities, meanwhile the Balance Sheet data (henceforth BS) records financial and non-financial asset positions (stocks) as well as the liabilities position. In addition, BS data also consists of the beginning and closing position.

Both FA and BS can be represented in a single matrix form namely inter sector financial claim matrix or widely acquainted as whom-to-whom (henceforth WtW) matrix. WtW matrix is a consolidated matrix, which means that the matrix includes only bilateral exposure between two different sectors. The matrix is particularly utilized for studying the evolution of exposures and vulnerabilities in individual sector, as well as the cross sector linkages both in transaction and position context. Furthermore, in the position side, the matrix is also broadly known as BSA matrix which displays each sector's position vis-à-vis that of other domestic sectors as well as non-resident (inter sector asset and liabilities position). Meanwhile, in the transaction side, the matrix is acquainted as Flow Analysis matrix (IMF (2002)).

The FABS data is aggregated by various institutional sectors and financial instruments in term of asset and liabilities. The following table shows the sectors classification in FABS:

On the other hand, the financial instruments can be classified into Monetary gold and SDRs; Debt securities; Equity and investment fund share/units; Financial derivatives and employee stock options; Currency and deposits; Loans; Insurance, pension and standardized guarantee schemes and Other Accounts receivable/payable.

3.2. Methodology

Financial imbalances assessment framework in this paper refers to the study of macro-prudential policy framework of Bank Indonesia, especially relating to the financial system monitoring through the identification of the source of potential risk. The framework has revealed that the potential build-up of

Table 1
Sectors Classification in FABS

Institutional Sectors	*Scope of Institutions*
1. Non-Financial Corporations (NFC)	Public and Private Non-Financial Corporation
2. Central Bank (CB)	Bank Indonesia
3. Deposit taking other than central bank (ODC) / Banks	- Conventional Bank - Islamic Bank - Conventional Rural Bank - Islamic Rural Bank
4. Other Financial Corporations (OFC)/ Non-bank Financial Institutions	- Pension Funds - Insurance - Finance Companies - Financial Auxiliary (Financial Service Authority, Indonesia Central Securities Depository and Indonesia Stock Exchange)
5. Central Government (CG)	Central Government (not include Social Security)
6. Local Government (LG)	Local Government (Provincial Government)
7. Households (HH)	Households including non-profit institutions serving households
8. Rest of the World (ROW) / External	All of non-resident

Source: Bank Indonesia (2015)

risks may trigger financial imbalances. These risks can be originated from domestic and/or global macro-economy as well as inside (endogenously) and/or outside (exogenously) the financial system.

Financial imbalances could be identified by tools geared towards in addressing the time-series dimension and tools that focus on the cross-sectional dimension. Particularly, cross-sectional dimension captures the spill-over of risk at a point in time due to common exposures, in the context of concentration risk, and high interconnection among economic sectors within the financial system, as such these sectors exposed by risks and eventually it may trigger the joint failure (contagion risk). On the other side, time series dimension relates to the build-up of financial imbalances as well as the evolution of interaction between financial system and macro-economy over time, i.e. the pro-cyclicality risk (Borio (2010), Harun & Rachmanira (2014) and Galati & Moessner (2011)).

The availability of FABS data can be useful to observe financial imbalances in the context of cross-sectional dimension through interconnectedness assessment among economic sectors, including non-financial corporations, banks, non-bank financial institutions, households, general government (central and local government), central bank and external sector. The assessment using FABS data is known as Balance Sheet Analysis (BSA), which is defined as an overarching analysis to identify the concentration risk and interconnection among sectors that may influence the build-up of systemic risk (IMF (2015)).

In order to disclose the complete picture of macro-financial linkage in Indonesia as well as the potential of financial imbalances in individual sector or the financial system as a whole, the BSA tool is divided by three complementary approaches which are Sectoral Analysis, Network Analysis, and Sensitivity Analysis.

Sectoral analysis provides the information about sector risk profile based on balance sheet risk indicators that are associated to particular risk, such as liquidity risk, credit risk, external risk, market risk

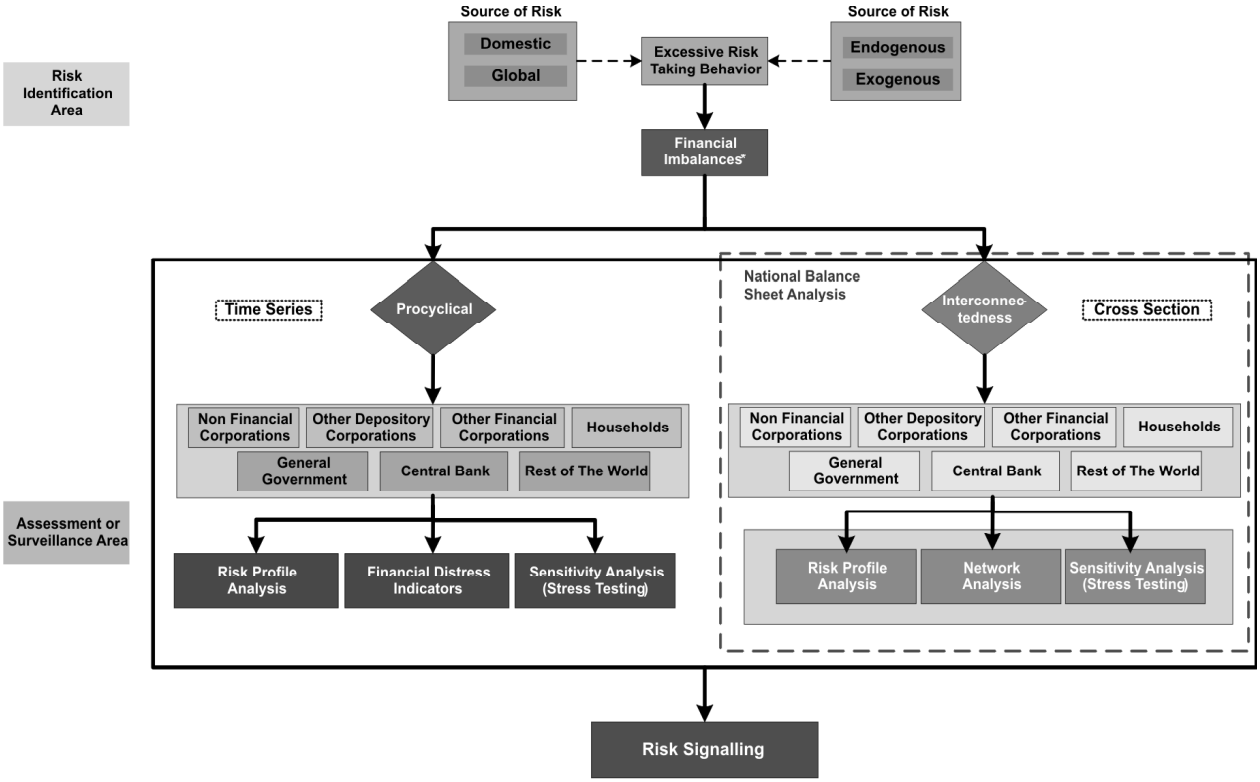

Chart 1: Assessment Framework of Financial Imbalances

and solvency risk. Literally, liquidity risk is closely related to maturity mismatch and it will appear when the liquid asset of sectors cannot cover the liabilities due in the short term. Hence, the sector is unable to fulfill its contractual commitments, especially when the debt cannot be rolled over and that sector is also exposed to the risk of rising interest rate.

Meanwhile, credit risk refers to the risk that a borrower or counterparty may fail in performing the obligation. For financial institutions, particularly banks, the largest and most obvious source of credit risk generally comes from loan instrument. However, there are other sources of credit risk, *inter alia*, financial instrument that is recorded both on and off the balance sheet.

Further, external risk is closely associated to withdrawal risk, which is the risk of drawing down the asset too aggressively by external investors (non-resident). The drawing is mainly influenced by the loss of external investor confidence because of heightened risk perception or general liquidity squeeze. The build-up of external risk is also resulted either from excessive short-term debt or a temporal concentration of repayments on long-term debt, possibly exacerbated by insufficient reserves (Connolly (2009)).

Market risk refers to the sensitivity of portfolio that is written both on and off balance sheet to overall market price movements, such as currency, interest rate, inflation, equity, and property. Due to the lack of data, this research only accommodates the effect of currency movements that henceforward will be called as currency risk. The last risk is solvency risk which arises when total assets (including the present value of future revenue streams) are inadequate to cover liabilities (including contingent liabilities) (Allen *et al.* (2002) and Santoso & Sukada (2009)).

These risks could be analyzed using some balance sheet risk indicators derived by FABS data. Those indicators can be representing the financial imbalances indicator since those portrays the potential of financial imbalances either in individual sector or financial system as a whole.

Several financial imbalances indicators that have been built in this research, namely liabilities to currency asset[1] as a proxy of liquidity risk indicator; capital structure position (equity minus debt), debt to equity ratio, debt to financial asset ratio, debt to asset ratio, and debt to net wealth ratio represent leverage ratio of economic sectors and can reflect the credit risk of counterparty.

Other indicators such as net external financial position (external asset minus external liabilities)[2], external liabilities to liabilities ratio, external liabilities to financial asset ratio, external liabilities to external financial asset ratio, external liabilities to asset and external liabilities to GDP can capture external risk, i.e. withdrawal funding by nonresident; whilst, solvency risk could be represented by net wealth (asset minus liabilities), net financial wealth (financial asset minus liabilities), liabilities to financial asset ratio, liabilities to asset ratio, and liabilities to GDP ratio. Regarding the currency risk, the proxy indicators used in this research are net foreign currency position (asset in foreign currency minus liabilities in foreign currency), foreign currency liabilities to financial asset ratio, and foreign currency liabilities to asset ratio.

Network analysis assess the interconnection and risk transmission among economic sectors in the financial system, either through debt or equity channel, by using network graph as an alternative representation of inter sector financial claim matrix or WtW matrix. The structure of network consists of nodes and links that connecting sectors. Nodes in financial network represent distinct entities or sectors, whereas a link going from sector i to sector j indicate sector i's claim (exposure) vis-à-vis sector j. The size of the link lines relies on the weight of bilateral exposure between two sectors, whilst the size of nodes proportionally depends on sector's holdings of liabilities in a given financial instrument. As such, the systemically important sector in financial system could be explicitly identified through the network (Almeida (2015)).

The last approach is sensitivity analysis which quantifies vulnerability of economic sector to macro shocks, i.e. exchange rate depreciation, capital flow reversal, the increase of foreign interest rates, and so forth. In addition, the sensitivity analysis allows propagation of a shock from one sector to other sectors, thus possibly would impact the sector's asset and liabilities position. Importantly, the analysis employs BSA Net financial position matrix which portrays financial position of sector relative to others. Net financial position is calculated by subtracting total asset and liabilities. A large negative financial position indicates a solvency problem, specifically if sector's non-financial assets are insufficient to cover its open financial position. Following the IMF (2016), the analysis in this research focuses on assessing the plausible impact of exogenous shock to non-financial corporations sector and also analyzing the propagation of which from those corporations to other sectors and vice versa.

Regarding to IMF (2016), the analysis involves two scenarios; the first one is an exchange rate depreciation of 25% and the second one is an exchange rate depreciation of 25% followed by a capital flow reversal. The second scenario assumes that non-financial corporations sector should replace 10% of external funding with domestic funding either by drawing their assets or by acquiring new loan from banks. These assumptions have the same implication to the net financial position, especially an increase of banks' net financial position (net financial asset) with respect to non-financial corporations sector.

Nevertheless, the analysis couldn't capture second round effect to other sectors, hence, the impact of the impairment on corporate sector's balance sheet to bank lending or Non-Performing Loan (NPL) could not be fully depicted. An increase in the value of NPL could be implicitly reflected in the BSA Net financial position matrix when there is a write off reducing the stock of loans (IMF (2016)).

4. RESULT

4.1. The Composition of Indonesia's Financial Asset and Liabilities

The composition of Indonesia's asset and liabilities at the end of third quarter of 2016 in Chart 2 shows that Indonesia's assets was dominated by financial assets (53.72% of the total national assets). Currency and deposit instrument remained as the most valuable financial assets, especially in non-financial corporations and central government sector, nevertheless, the value of which relatively decreased over third quarter of 2015 to third quarter of 2016. In the liabilities side, the equity was constantly higher than other instruments. It reflected that equity was the main source of financing, mainly for non-financial corporations sector activities.

The assets side of sector's financial balance sheet mostly consisted of holdings of currency and deposits instrument, as well as equity. Financial institutions (banks and non-bank financial institutions)

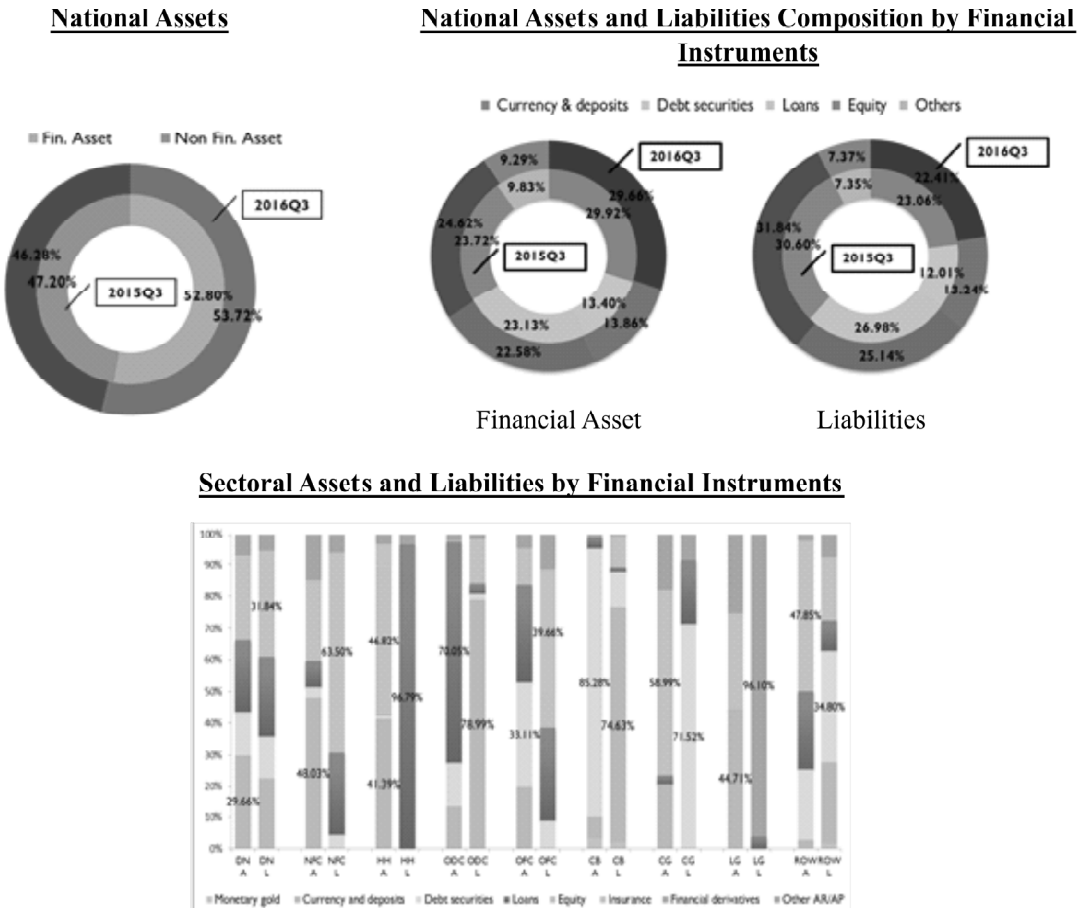

Chart 2: The Composition of Assets and Liabilities

also expanded a large amount of financial assets through loan instrument, in particular to real sectors (non-financial corporations and households sector). Furthermore, the liabilities side of sector's financial balance sheet exhibited more distinct characteristics, in which non-financial sector's financing structure was relatively tough at the end of third quarter of 2016 as reflected by the high portion of equity instrument (63.50%). Meanwhile, the financial imbalances were occurred in non-bank financial institutions' capital structure since the value of loan instrument (29.70%), contributed either by external sector (56.89%) or by banks (42.66%), remained higher than equity. The sizable loan exposure of non-bank financial institutions represented that those institutions were overleveraged.

4.2. Sectoral Analysis

Balance sheet risk indicators which are constructed by utilizing Sectoral Balance Sheet data shows that financial system in Indonesia remained stable over third quarter of 2016 as reflected by the decline in the value of several risk indicators, such as currency risk, credit risk, and the solvability risk. Net foreign currency position (net foreign asset) is remained positive since previous period and significantly increasing over third quarter of 2016 which was driven by the improvement in non-financial corporations' net foreign currency position. The improvement was mainly affected by the sharp increase of foreign currency assets as the impact of tax amnesty policy implementation. Currency risk exposure, nonetheless, remained high in several sectors particularly in non-financial corporations (45.82%) and central government (44.73%). As such, those sectors were exposed by exchange rate fluctuation that would make severe losses when domestic currency is depreciated.

Moreover, Indonesia's net external position was negative (net external liabilities), due to the domestic sectors' asset placed abroad was lower than external sector's financing to domestic sectors. In addition, net external liabilities of Indonesia was particularly contributed by the sizable net external liabilities of non-financial corporations and central government. The share of external liabilities to total liabilities, as the other proxy indicator of external risk, tended to rise from the previous quarter as represented by the increase in aggregate indicator to 28.14% of total liabilities. The increase in aggregate indicator was mostly driven by central government and banking sector. In consequences, those sectors were possibly exposed by withdrawal risk.

Leverage ratio, as a proxy of counterparty credit risk, was relatively lower than the previous period. The small value of aggregate debt to asset ratio (0.42%) has represented that aggregate assets were sufficient to cover liabilities. Debt to equity ratio, nevertheless, remained high and reached 2.14 that particularly driven by the reliance of non-bank financial institutions and banking sector on debt financing. Therefore, those sectors were highly leveraged and exposed to funding risk. Further, the lower value of equity buffer could lead to financial distress when those sectors encounter a shock.

Liabilities to asset ratio as representative of solvency risk indicator showed the improvement in the the repayment capacity of several sectors as reflected by the decline in the ratio to 62.11% of total asset. The aggregate value of net financial position remained negative (net liabilities), that indicates that domestic financial assets were insufficient in meeting domestic sectors' financing needs, hence, foreign funding are still needed.

4.3. Network Analysis

4.3.1. BSA Net Financial Position Matrix

Table 3 exhibits net financial position matrix of economic sector relative to others, in which the net values in columns indicates net assets and while the net values in rows represents net liabilities. In general, households were the domestic sector with the largest financial surplus and the net asset of those reached 38.74% of GDP. Besides that, households also had a large of financial assets accounted for 29.96% of aggregate financial assets. These financial assets was mostly distributed through equity instrument to non-financial corporations as well as currency and deposits to banks. The substantial financing of households sector to non-financial corporations was indicated by the value of households' net exposure with respect to non-financial corporations reached 28.64% of GDP in the third quarter of 2016. In this context, households sector acted as a net debtor while non-financial corporations sector as a net creditor.

Furthermore, net external liabilities of non-financial corporations represented the reliance of those sectors on external funding. The values of net external liabilities reached 19.32% of GDP which is lower than previous period (27.99% of GDP). The decline in the net value was due to the increase in foreign currency assets as the consequence of tax amnesty policy. Non-financial corporations also had net liabilities position with respect to banks. The majority of assets distributed by banks was in loans instrument, as such banks exposed by non-financial corporations' credit risk.

Table 2
BSA Net Financial Position Matrix in the Third Quarter of 2016

Issuer of the Liability (Debtor Sector)	Holder of Liability (Creditor Sector)							
	NFC	HH	ODC	OFC	CB	CG	LG	ROW
	(In Trillions of rupiah)							
TOTAL	(7,283.62)	4,721.48	159.39	124.26	95.17	(1,971.70)	415.92	3,739.11
NFC		3,491.30	774.92	192.61	(206.24)	571.18	105.37	2,354.48
HH	(3,491.30)		(720.24)	(272.29)	(232.82)	(17.85)	13.03	-
ODC	(774.92)	720.24		99.39	(859.43)	(233.48)	307.53	581.28
OFC	(192.61)	272.29	(99.39)		(14.13)	(305.86)	-	215.45
CB	206.24	232.82	859.43	14.13		38.91	7.71	(1,454.42)
CG	(571.18)	17.85	233.48	305.86	(38.91)		(17.72)	2,042.31
LG	(105.37)	(13.03)	(307.53)	-	(7.71)	17.72		-
ROW	(2,354.48)	-	(581.28)	(215.45)	1,454.42	(2,042.31)	-	
	(In percent of GDP)							
TOTAL	-59.76%	38.74%	1.31%	1.02%	0.78%	-16.18%	3.41%	30.68%
NFC		28.64%	6.36%	1.58%	-1.69%	4.69%	0.9%	19.32%
HH	-28.64%		-5.91%	-2.23%	-1.91%	-0.15%	0.11%	0.00%
ODC	-6.36%	5.91%		0.82%	-7.05%	-1.92%	2.52%	4.77%
OFC	-1.58%	2.23%	-0.82%		-0.12%	-2.51%	0.00%	1.77%
CB	1.69%	1.91%	7.05%	0.12%		0.32%	0.06%	-11.93%
CG	-4.69%	0.15%	1.92%	2.51%	-0.32%		-0.15%	16.76%
LG	-0.86%	-0.11%	-2.52%	0.00%	-0.06%	0.15%		0.00%
ROW	-19.32%	0.00%	-4.77%	-1.77%	11.93%	-16.76%	0.00%	

The sizable net liabilities of non-financial corporations with respect to all domestic sector or external sector points the reliance on external financing than internal funding. Hence, non-financial corporations are vulnerable to a shock, i.e. withdrawal risk and exchange rate fluctuation. Vulnerabilities in the non-financial corporations sector could propagate to banks and would deteriorate banks' loan quality and liquidity, as such could also potentially affect financial system stability.

The central government sector was also net creditor to both domestic and external sector in the third quarter of 2016. Net liabilities of central government was mainly contributed by the high level of external financing through holdings of government bonds, which increased as foreign investor's positive sentiment towards Indonesia's economy condition; the implementation of tax amnesty policy as well as the uncertainty of global economy, such as the Fed's plan in raising the FFR and the uncertainty of european economy. In addition, net liabilities of central government was also supported by the high investment portfolio of non-bank financial institutions in government bonds in order to meet the FSA regulation.

4.3.2. Network Visualization

Network analysis using balance sheet data, broadly known as gross exposure network, shows several sectors that had net financial asset in the third quarter of 2016, i.e. households, banks, non-bank financial institutions, central bank, local government and external sector. Meanwhile, central government and non-financial corporations had net liabilities position. The main source of central government financing was external funding, whereas sectors that contribute in financing non-financial corporations' activities were external sector, households and banks. These circumstances reflect the high interconnection among those sectors that would lead to the build up of contagion risk, especially when a sector that has large exposure encounters a shock.

Net financial asset position of external sector, which is Indonesia's net liabilities position, indicates that the entire of domestic financial assets has not been able to meet all of domestic sectors' financing needs. The share of domestic financing from external sector reached 28.14% of the total financing, of which 59,86% distributed to non-financial corporation and 26,40% placed in central government while the rest completely used by other domestic sectors. Moreover, non-financial corporations' external liabilities which reached 40% of GDP has implied that those corporations plausibly exposed by withdrawal risk and currency fluctuation.

Regarding central government sector, the net liabilities value tended to increase, especially after the implementation of tax amnesty policy, as reflected by the increase in the value of government bonds owned by foreign investor. Non-financial corporations were the sector with the highest value of net liabilities during the period of 3rd quarter of 2015 to 3rd quarter of 2016. The largest increase in the net value occured in the 2nd quarter of 2016 due to the increase in foreign investment through equity instrument, as a positive response of Indonesia's tax amnesty policy plan. The net liabilities value, however, declined in the 3rd quarter of 2016 owing to the significant increase in the value of foreign currency asset which was part of repatriated funds in the first phase of tax amnesty policy.

Network visualization utilizing financial account data clearly displays the economic sector that has surplus of funds (net lending) or shortage of funds (net borrowing) in the financial system. The structural

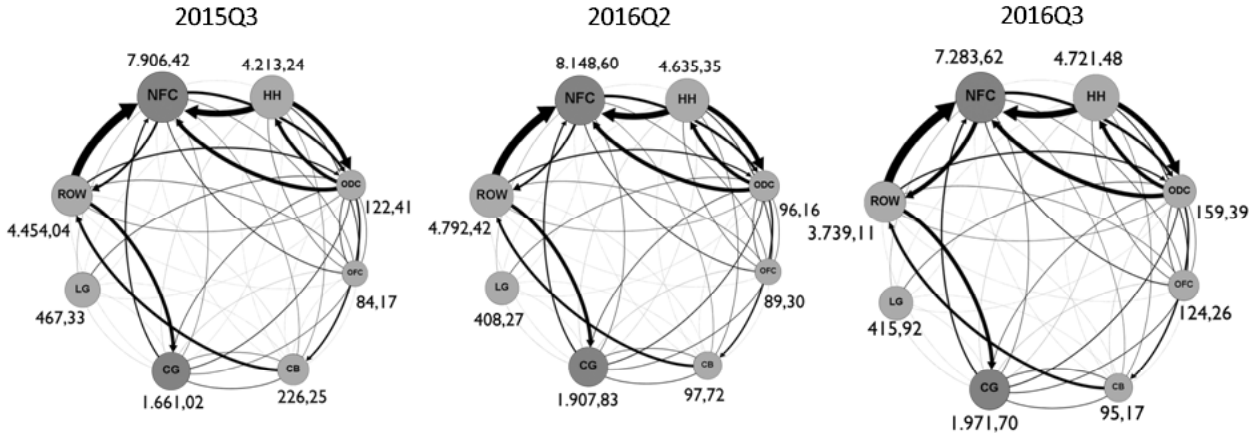

Chart 3: BSA Matrix in Network Form (Gross Exposure, Trillion IDR)

changes of sector's net transaction may potentially leads to the build up of financial imbalances risk. This changes are thoroughly identified based on the changes in economic sectors' characteristic. For instance, the evolution of non-financial corporations and central government characteristics which are structurally a net borower meanwhile households, banks and non-bank financial institutions generally known as a net lender.

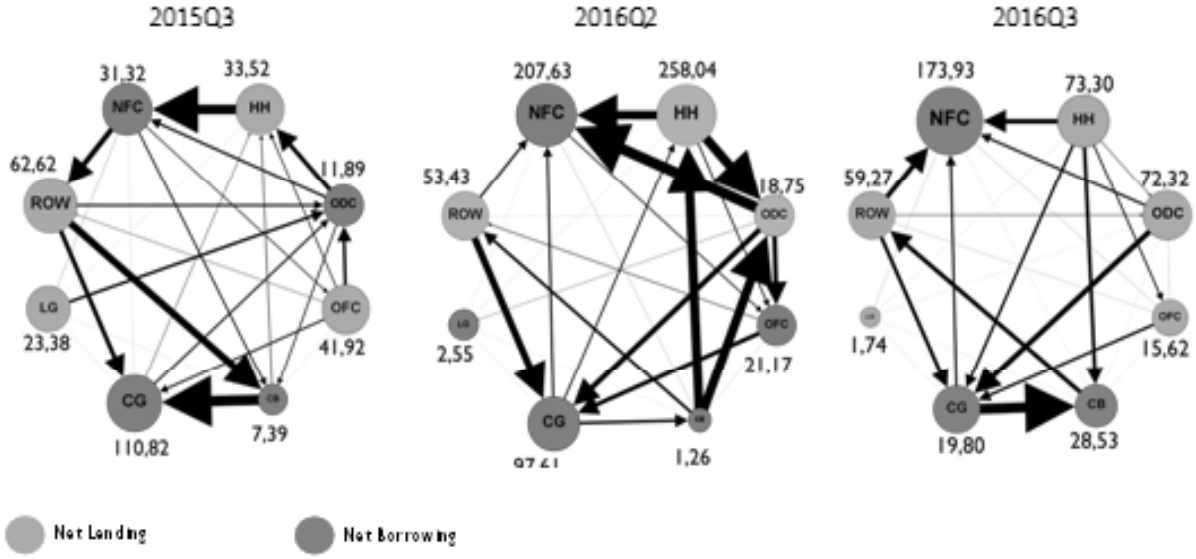

Chart 4: BSA Matrix in Network Form (Net Transaction, Trillion IDR)

Chart 4 shows that there was a sizable inflow of funds from external sector to meet domestic sectors's financing needs that inclined to rise than the previous period. The higher figure of external financing represents the foreign investors' positive perception on the Indonesian economy prospect in the middle of the global economic uncertainties. On the other hand, higher reliance on external financing would make domestic sectors become more vulnerable to a shock, i.e. exchange rate depreciation and capital flow reversal.

In the sectoral context, non-financial corporations, central bank, and central government experienced shortage of funds (net borrowing). The shortage on non-financial corporations was mainly due to the inflow from households and external sector through equity instrument. Meanwhile, the inflow of funds on government bonds from external sector (40,60%), household (31,54%), and non-bank financial institutions (30,67%) have caused the central government become more indebted in the third quarter of 2016. The high contribution of non-bank financial institutions on government bonds market represents the high participation of these intitutions in order to comply FSA regulation relating to the investment in the government bonds portfolio. The bulk of funds was distributed to central bank by central government in the form of currency and deposits instruments, hence, central bank's net transaction become negative (net borrowing).

4.4. Sensitivity Analysis

Non-financial corporations in Indonesia are likely to depend on external funding in order to cover their financing needs. Hence, such condition highlights that those corporations are vulnerable to capital flow reversal. Furthermore, the corporations' external indebtedness was relatively high at around 40% and the majority of which is equity instrument (71.38%). Loans and debt securities instrument, denominated either in foreign or domestic currency, were also the valuable source of financing for non-financial corporations in the third quarter of 2016. The proportion of foreign currency denominated loans accounted for 49.58% of the total loans, whereas foreign currency denominated debt securities reached 78.47% of total debt securities. Importantly, the high percentage of foreign currency liabilities may cause corporations facing the difficulties to service their debt, particularly if domestic currency was depreciated.

Against these facts, this paper attempts to explore a way of further assessing non-financial corporations' vulnerabilities that especially aimed at gauging sensitivity of those corporations to exchange rate depreciation as well as capital flow reversal. The result of these assessments should be the suggestion for regulator in mitigating the build-up of systemic risk materialized by negative spill over from non-financial corporations to other sectors, notably banks through credit risk channel.

The sensitivity analysis using 25% exchange rate depreciation scenario reveals that depreciation leads to an increase proportionally in the value of foreign currency denominated asset and liabilities. Therefore, sectors' net external liabilities position may arise along with the reliance on borrowing from external sector. Net external liabilities of central government rise by 1.37% of GDP owing to the lower value of foreign currency asset (4.22%) than foreign currency liabilities (21.25%). In contrast, non-financial corporations suffer a minimum loss in net position as reflected by the decline in the value of net external liabilities by 1.75% of GDP. The relatively small impact of exchange rate depreciation on the corporations contributed largely by the high exposure of foreign currency asset (57.86%) and the high value of domestic currency denominated equity on the liabilities side (63,50%). Therefore, the negative impact of depreciation could be effectively dampened.

The result of the analysis implementing the second scenario, 25% exchange rate depreciation followed by 10% capital flow reversal, points that despite there is a decline on the non-financial corporations' external indebtedness, the bilateral exposure between banks and those corporations increase proportionally along with the 10% capital outflow. The insignificant effect of the exchange rate depreciation to non-

Table 3
Difference of Inter Sectoral Net Financial Position: Scenario 1

		Holder of Liability (Creditor Sector)							
		NFC	*HH*	*ODC*	*OFC*	*CB*	*CG*	*LG*	*ROW*
		(In percent of GDP, after 25 percent depreciation shock)							
Issuer of the Liability (Debtor Sector)	**NFC**		0.04%	0.41%	0.14%	0.00%	0.00%	0.00%	-1.75%
	HH	-0.04%		-0.43%	0.00%	0.00%	0.00%	0.00%	0.00%
	ODC	-0.41%	0.43%		0.00%	-0.48%	-0.18%	0.00%	0.35%
	OFC	-0.14%	0.00%	0.00%		0.00%	0.00%	0.00%	0.42%
	CB	0.00%	0.00%	0.48%	0.00%		0.07%	0.00%	-3.01%
	CG	0.00%	0.00%	0.18%	0.00%	-0.07%		0.00%	1.37%
	LG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%
	ROW	1.75%	0.00%	-0.35%	-0.42%	3.01%	-1.37%	0.00%	

financial corporations sector, as the consequence of the high possession of foreign currency asset, creates a larger decline on corporations' net external liabilities by 6.02% when there is a 10% capital flow reversal shock.

On the other hand, net exposure of banks to non-financial corporations rise significantly by 4.59% of GDP because those corporations should cover 10% loss of external funding by drawing asset or issuing new credit from banks. An increase in the net exposure value makes banks more exposed to corporations sector and thus vulnerable to a shock, *inter alia*, corporates financial distress that would influence banks' loan quality and liquidity.

Regarding the result of both scenarios, those reflect that non-financial corporations sector in Indonesia are relatively solvent in facing a shock, either an exchange rate depreciation or a combined shock, that will exacerbate the balance sheet. Nonetheless, close monitoring and granular analysis on those corporations' risk profile are still needed in order to prevent the build-up of contagion risk, mainly spreads to banks, that would influence banking system and financial system stability as a whole.

Table 4
Difference of Inter Sectoral Net Financial Position: Scenario 2 (Combined Shock)

		Holder of Liability (Creditor Sector)							
		NFC	*HH*	*ODC*	*OFC*	*CB*	*CG*	*LG*	*ROW*
		(In percent of GDP, after combined shock)							
Issuer of the Liability (Debtor Sector	**NFC**		0.04%	4.59%	0.15%	0.00%	0.00%	0.00%	6.02%
	HH	-0.04%		-0.46%	0.00%	0.00%	0.00%	0.00%	0.00%
	ODC	-4.59%	0.46%		0.00%	-0.51%	-0.20%	0.00%	0.37%
	OFC	-0.15%	0.00%	0.00%		0.00%	0.00%	0.00%	0.45%
	CB	0.00%	0.00%	0.51%	0.00%		0.08%	0.00%	-3.22%
	CG	0.00%	0.00%	0.20%	0.00%	-0.08%		0.00%	1.47%
	LG	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%
	ROW	6.02%	0.00%	-0.37%	-0.45%	3.22%	-1.47%	0.00%	

5. CONCLUSION

Financial system in Indonesia is remained stable over third quarter of 2016 as reflected by the result of sectoral analysis that there is a decline in the value of several risk indicators, i.e. currency risk, credit risk, and the solvability risk. By contrast, the value of external risk indicators are relatively higher than previous period contributed mainly by the increase in the value of non-financial corporations sector's external debt. In addition, there are still potential build-up of currency and external risk, notably on corporations and central government sector, owing to the high exposure denominated in foreign currency as well as the large external indebtedness. The ratio of foreign currency liabilities to financial asset reaches 45.82% on corporate sector, followed by central government (45.82%) and non-bank financial institutions (18.99%). Further, the ratio of external debt to total liabilities aggregately reaches 28.14% contributed by central government (54.77%), non-financial corporations (38.97%), and non-bank financial institutions (16.67%).

Network analysis reveals the importance of external funding in Indonesia, particularly through non-financial corporations channel. The corporations sector is the most exposed sector to external risk, i.e. withdrawal risk and currency risk due to the high reliance on external debt (38.27% of GDP). The deterioration on non-financial corporations sector's financial condition, as the impact of external risk shock, would issue the contagion effect that potentially transmitted to other sectors including banks through balance sheet channel.

The sensitivity analysis discloses that the effect of exchange rate depreciation shock is relatively insignificant on non-financial corporations due to the high level of foreign currency asset that is particularly contributed by the sizable amount of repatriated funds in the first phase of tax amnesty policy. Meanwhile, the analysis using the combined shock, an exchange rate depreciation followed by capital flow reversal, depicts the decrease in the value of net external position of non-financial corporations. The exposure from banks, nevertheless, rise significantly as the non-financial corporations are forced to replace 10% capital outflow with domestic funding.

NOTES

The views expressed here are those of the authors and do not necessarily reflect those of Bank Indonesia or Bank Indonesia policy. This research is published to elicit comments and to further debate.

1. This indicator is a proxy of current liabilities to current asset since the current liabilities data is still not available
2. External asset is the other term of domestic sector's asset that placed in external sector or non-resident, whilst external liabilities is the other term of domestic sector's liabilities from external sector or non-resident.

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Appendix

Balance Sheet Risk Indicators by Economic Sectors Classification 3rd Quarter 2016