Output Composition of Monetary Policy Transmission Mechanism in Indonesia

Akhsyim Afandi*

Abstract

This paper aims to investigate the role of each aggregate spending component in the monetary policy transmission in Indonesia. It assesses the relative strength of the role of each spending component in the monetary policy transmission. In so doing, this study employs the contribution analysis, which is calculated based on the cumulative impulse response of each component of GDP to a monetary policy tightening shock estimated from structural vector autoregressive (SVAR) models. This paper finds that on average consumption spending plays predominant role in the monetary policy transmission.

JEL classification numbers: C12, C22, C52
Key words: monetary policy, transmission mechanism, output composition channel, vector autoregression.

1. Introduction

Monetary policy transmission mechanisms, defined as processes through which monetary policy decisions are transmitted to real GDP and inflation, involve two stages. The first stage relates to monetary-induced changes in the financial markets that serve as the transmission channels and may take the form of changes in the financial market equilibrium prices or quantities (Taylor, 1995). The second stage of the transmission mechanisms -- the subsequently induced changes in aggregate demand -- is associated with responses of each component of aggregate demand. That is, a monetary tightening shock reduces the level of economic activity through a decline in investment, consumption, and the rest of aggregate spending, which in turn alters the price level. The overwhelming majority of empirical studies exclusively deal with the investigation of the first stage of monetary policy transmission and very few investigate the second stage, despite its

* A/Professor of Economics -Universitas Islam Indonesia, Yogyakarta, Indonesia

importance. The situation is worse as far as Indonesia is concerned. Not a single study tackles the second stage of monetary policy transmission.

Angeloni *et al.* (2003) note at least three benefits of studying the second stage of monetary policy transmission mechanism. First, it may improve the central bank's capacity in monitoring the economy. If consumption adjustments are found to be dominant, the consumer behaviour deserves at least equally careful attention to help determine the appropriate stance of monetary policy. Second, knowledge of the composition may help reveal structural factors behind the monetary transmission mechanisms. For instance, the different relative dominance of consumption and investment in responding to a monetary policy shock across different countries could be due to different institutional or legal constraints arising from structural differences in financial or labour markets, or in the degree of social security insurance. Third, this knowledge may help predict possible changes in the transmission mechanisms when structural changes occur. For example, changes in legal and institutional environments where labours become freer, employment security and minimum wage regulations are put in place and more people are covered by insurance will likely result in a declining role played by consumption spending in the monetary transmission mechanism.

This paper aims to investigate the role of each aggregate spending component in the monetary policy transmission in Indonesia. It assesses the relative strength of the role of each spending component in the monetary policy transmission. In so doing, this study employs what Angeloni *et al.* (2003) calls *contribution*, which is calculated based on the cumulative impulse response of each component of GDP to a monetary policy tightening shock estimated from structural vector autoregressive (SVAR) models. This paper finds that on average consumption spending plays predominant role in the monetary policy transmission. This result is more in line with the findings for the United States than for the European Area and Japan.

The remainder of this paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 discusses the empirical framework and data source. Section 4 presents the results and discussions. Finally section 5 concludes and offers policy recommendations.

2. Literature Review

Among the few studies on the second stage of monetary policy transmission mechanism Morsink and Bayoumi (2001) is a pioneer. It investigates which components of real private demand are most affected by monetary policy in Japan. They employ a simple four-variable VAR model that includes real private demand, consumer price index, broad money, and overnight call rate that serves as monetary policy instrument variable. Since the real private demand is broken down into five different components: consumption, business investment, housing investment, import and export, the VAR becomes an eight-variable VAR model, which is estimated with quarterly data from 1980Q1 to 1998Q3 using two lags. They find that monetary policy operates on the real economy largely through its impact on business investment.

Adopting a method similar to Morsink and Bayoumi (2001), Disyatat and Vongsinsirikul (2003) examine which components of real GDP are most affected by monetary policy in Thailand. Their basic VAR includes only three variables: real GDP, consumer price index and the 14-day repurchase rate (RP14). Since the real GDP is broken into four components: consumption, investment, export and import, the model becomes a six-variable VAR. Similar to Morsink and Bayoumi (2001) they also find that investment responds most strongly to the monetary policy tightening.

However, these studies have a drawback. They do not take into account the relative weight of each component of aggregate demand in the calculation. Since usually consumption accounts for a much bigger portion in the GDP than other components, the exclusion of this weight in the calculation produces a result that does not represent the actual effect of the monetary-policy-induced changes in each component on the real economy. To mitigate this drawback Angeloni *et al.* (2003) introduce what they call *contribution* of each GDP component to measure the output composition of the monetary transmission mechanism. Angeloni *et al.* (2003) define *contribution* as the ratio of changes in the components of GDP to the overall movements in GDP. Based on the SVAR estimation results, its computation relies on the cumulative impulse responses of each component so as to eliminate the distortion from temporal noise (Fujiwara, 2003)[1]. This contribution is computed as follows: the cumulative response of each component, measured relative to its respective baseline, is weighted by its respective share in GDP; then, the weighted cumulative response of each component is stated as a ratio relative to GDP response (which is the total responses of all components taken together).

1- Cumulating up to time *t* the responses to a one-off shock occurring in *t-k* can also be interpreted as observing, at time *t*, the response to a shock sustained from *t-k* to *t*. The noise can be present in the level responses, particularly in the initial periods. See Angelono *et al.* (2003).

Angeloni *et al.* (2003) attempt to compare the relative importance of GDP components in channelling the monetary policy effects to output level between the United States and the European area. For ach country they use four different sets of VAR models[1]. To obtain the relative importance of each component of output they decompose the GDP into three different components: consumption, investment and the rest of GDP. They find the consumption channel as the predominant driver of output changes in the United States and the investment channel in the Euro area.

Fujiwara (2003) also applies similar approach to investigating the monetary transmission mechanisms from the point of view of output decomposition in Japan. He also employs four separate VAR models, which are the same as those used by Angeloni *et al.* (2003) for the United States[2]. For the first three models he assumes that the contemporaneous relations follow a recursive structure, while for the last case a non-recursive structure is imposed. Using two sets of quarterly data, he finds the result for Japan similar to that of Angeloni *et al.* (2003) for the Euro area, in that the investment channel is predominant in driving the output changes.

3. Empirical Framework and Data

3.1. Contribution Analysis Based on SVAR Model

This study employs the *contribution* analysis, which is calculated based on the cumulative impulse response of each component of GDP to a monetary policy tightening shock estimated from the selected SVAR model. Following Angeloni *et al.* (2003) and Fujiwara (2003), the quarterly SVAR is used. As in Angeloni *et al.* (2003) and Fujiwara (2003), GDP is decomposed into private consumption (*PCONS*)[3], investment represented by Gross Fixed Capital Formation (*GFCF*), and other GDP components (*Y_PC_INV*) (net exports and government spending, henceforth called "the rest of GDP"). Accordingly, the model becomes a nine-variable SVAR model. The SVAR system is as follows.

1-The models for the United States include VAR models developed by Christiano, Eichenbaum and Evans (1998); Gordon and Leeper (1994); Christiano, Eichenbaum and Evans (2001); and Erceg and Levin (2002). These models are estimated with quarterly data from 1960Q1 to 2001Q4 and from 1984Q1 to 2001Q4. For the Euro area, they employ two VAR models of Peersman and Smets (2003), with one including M3 and the other without M3; Gali (1992) and Christiano, Eichenbaum and Evans (2001) modified to suit the Euro data, which are quarterly data from 1980Q1 to 2000Q4.

2 -He excludes the VAR of Christiano, Eichenbaum and Evans (1999) and replaces it with the VAR developed by Leeper, Sims and Zha (1996).

3- Although *PCONS* is found to be non-stationary its inclusion in the model does not cause the system to be unstable as explained in the next sub-section.

$$A_0X_t = A(L)X_t + B\varepsilon_t{}^{1} \qquad 1$$

where X_t is a ($n \times 1$) vector of the endogenous Indonesian economy variables with the following order: *PCONS*, *GFCF*, *Y_PC_INV*, *CPI*, *M2*, *RCWCRP*, *RWC*, *R1*, and *E*; A_0 is an invertible ($n \times n$) matrix of coefficients of contemporaneous relations on the endogenous variables; $A(L)$ is a k^{th} order matrix polynomial in the lag operator; ε_t is assumed to be mutually uncorrelated or orthogonal so that the dynamic impacts of each individual structural shock can be assessed in isolation. Thus, ε_t is a ($n \times 1$) vector of the structural shocks assumed normally distributed with zero mean and normalised diagonal variance-covariance matrix $\Omega=I$.

System (1) is not directly observable and cannot be directly estimated to derive the true value of ε_t and coefficients in A_0 and $A(L)$**.** However, these parameters are recoverable from the estimated reduced form (2).

$$X_t = C(L)X_t + u_t \qquad 2$$

where $C(L)= A_0^{-1}A(L)$ is the matrix of the coefficients on the lagged variables in the reduced form model; u_t denotes the reduced-form VAR residual vector uncorrelated with lagged variables in X_t and normally independently distributed with full variance covariance matrix, $\Sigma = E(u_t u_t^{\prime})$.

Note that u_t is linked to ε_t by $u_t = A_0^{-1}B\varepsilon_t$ or $A_0u_t=B\varepsilon_t$, from which the structural form parameters in (1) can be recovered by imposing enough restrictions on either matrix of parameters A_0 or B or both. For the system to be just identified, it requires $2n^2 - n(n + 1)/2$ restrictions on both A_0 and B[2]. Following Fujiwara (2003) both recursive and non-recursive structures for the contemporaneous relations are attempted. The results from recursive structure of the contemporaneous relations are compared to those from non-recursive structure. While the former assumes the matrix of the contemporaneous relations (A_0) to be lower block diagonal with the order of variables as mentioned above, the latter relies on Kim and Roubini (2000)'s non-recursive structure. The following are the detailed non-recursive restrictions imposed on the equation $A_0u_t=B\varepsilon_t$.

1-This system comes from $A_0X_t = A(L)X_t + \upsilon_t$, where υ_t is a ($n \times 1$) vector of the structural error terms assumed to be linearly related to structural shocks, denoted by ε_t, so that $\upsilon_t = B\varepsilon_t$, where B is a ($n \times n$) matrix.

2- This identifying method is introduced by Amisano and Giannini (1997). Another strategies impose $B=I$ so that $A_0u_t = \varepsilon_t$; or impose $A=I$ so that $u_t = B\varepsilon_t$; or impose prior information on the long-run effects of some shocks. See Breitung *et al.* (2004).

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21}^0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31}^0 & a_{32}^0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{41}^0 & a_{42}^0 & 0 & 1 & 0 & 0 & 0 & 0 & a_{49}^0 \\ a_{51}^0 & a_{52}^0 & 0 & a_{54}^0 & 1 & 0 & a_{57}^0 & 0 & 0 \\ a_{61}^0 & a_{62}^0 & 0 & 0 & 0 & 1 & a_{67}^0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & a_{78}^0 & 0 \\ 0 & 0 & 0 & 0 & a_{85}^0 & 0 & 0 & 1 & a_{89}^0 \\ a_{91}^0 & a_{92}^0 & a_{93}^0 & a_{94}^0 & a_{95}^0 & a_{96}^0 & a_{97}^0 & a_{98}^0 & 1 \end{bmatrix} \begin{bmatrix} u_t^{PCONS} \\ u_t^{GFCF} \\ u_t^{Y\_PC\_I} \\ u_t^{CPI} \\ u_t^{M2} \\ u_t^{RCWCRP} \\ u_t^{RWC} \\ u_t^{R1} \\ u_t^{E} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & b_{88} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & b_{99} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{PCONS} \\ \varepsilon_t^{GFCF} \\ \varepsilon_t^{Y\_PC\_I} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{M2} \\ \varepsilon_t^{RCWCRP} \\ \varepsilon_t^{RWC} \\ \varepsilon_t^{R1} \\ \varepsilon_t^{E} \end{bmatrix} \quad (1)$$

where u_t^{PCONS}, u_t^{GFCF}, $u_t^{Y\_PC\_I}$, u_t^{CPI}, u_t^{M2}, u_t^{RCWCRP}, u_t^{RWC}, u_t^{R1}, and u_t^{E} are the residuals in the reduced form equations, which represent unexpected movements (given information in the system) of each variable; and ε_t^{PCONS}, ε_t^{GFCF}, $\varepsilon_t^{Y\_PC\_I}$, ε_t^{CPI}, ε_t^{M2}, ε_t^{RCWCRP}, ε_t^{RWC}, ε_t^{R1}, and ε_t^{E} are the structural shocks associated with the respective equations.

For the system to be just identified, it requires $2n^2 - n(n + 1)/2$ or 117 restrictions on both A_0 and B. Since B is assumed to be a diagonal matrix, 72 exclusion restrictions are imposed on it. Likewise, another 45 restrictions on A_0 are required for the system to be just identified. Since the non-recursive structure imposes 58 restrictions on A_0 the system is over-identified and 23 free parameters in A_0 and 9 in B have to be estimated.

3.2. Data

This study employs quarterly data that cover the period 1984Q4–2003Q4. All data except interest rates (*R1* and *RWC*) are in natural logarithms. In addition, two shifts dummies, *SD98* and *SD99*, are included to capture the financial crisis. Table 1 presents the description and sources of these data.

Table 1: Description and Sources of Data

No	Variable	Description	Sources
1	E	Nominal exchange rate (Rp/$US)	IFS-IMF
2	R1	Interbank call-money rate	IFS-IMF
3	RWC	Bank working capital landing rate	IFS-IMF
4	RCWCRP	Real bank working capital rupiah loan	IFS-BI
5	M2	Broad money (M1 + saving and time deposits)	IFS-BI
6	CPI	Consumer Price Index (1993 =100)	IFS-IMF
7	Y	Real Gross Domestic Product (1993 =100)	BPS
8	PCONS	Real Private Consumption Spending (1993 =100)	BPS
9	GFCF	Real Gross Fixed Capital Formation (1993 =100)	BPS
10	Y_PC_INV	GDP – PCONS - GFCF	Author's calculation

Notes: BPS = Badan Pusat Statistik (Central Bureau of Statistics) Indonesia, IFS-IMF = International Financial Statistics – International Monetary Fund (IMF) (CD-ROM database), IFS-BI = Indonesian Financial Statistics – Bank Indonesia (Published monthly and at < http://www.bi.go.id >)

3.3. Specification Test

Due to limited number of observations (77) and to preserve the degrees of freedom lag orders of one and two are selected for the model[1]. Thus, there are two reduced-form VAR models to be devised. Since based on each reduced-form model recursive and non-recursive structural VAR models are attempted, four structural VAR models are to be estimated: SVAR(1) recursively structured, SVAR(1) non-recursively structured, SVAR(2) recursively structured, and SVAR(2) non-recursively structured.

As reported in table A3 in the appendix, SVAR(1) has two equations (*M2* and *RCWCRP*) with some serial correlation. But this autocorrelation problem disappears in SVAR(2), as reported in table A4. There are four equations in SVAR(1) and three equations in SVAR(2) that fail normality tests. This probably relates to the 1998 financial crisis which has created large movements in all the data series. This problem does not disappear although two shift dummies that represent the crisis are inserted. Adding extra shift dummies does not improve the result and instead makes the estimated impulse response functions hard to interpret[2]. However, the main features of the residual distribution may also roughly be obtained by plotting its estimated density. Figures A1 and A2 in the appendix depict the density

1-Fujiwara (2003) also sets the lag order of the VAR at one and two for 95 quarterly observations (1980Q1-2002Q3). Similarly, Angeloni *et al.* (2003) also estimate their VARs with 2 lags for the 1984Q1-2001Q4 sample. Further, setting lag order higher than two results in unstable systems with the presence of unit root as well as erratic and exploding impulse response functions.

2- This may be due to the fact that the emerging market economies, especially their financial markets, are far more volatile and subject to more frequent breaks than their industrialized counterpart, thereby producing data series with more outliers as well.

estimates, based on the Gaussian and Epanechnikov kernels, for all the nine equations' residuals of VAR with one and two lags respectively. Overall they do not provide strong evidence that the residuals are not from an underlying normal distribution.

Further, both systems are considered stable because, as reported in table A2 in the appendix, their characteristic polynomial produces no root that lies outside the unit circle. Thus, both systems have no unit root. This stability also characterises the impulse response functions which show no sign of explosion. They die down with time. Similarly, both systems show little sign of parameter instability as reflected in the CUSUM-of-squares tests depicted in figures A3 and A4 in the appendix. Therefore, overall the models fairly pass the specification tests.

4. Results and Interpretations

4.1. Impulse Responses to a Monetary Policy Tightening Shock

The estimated results of the non-recursive structure of both models are reported in tables 2 and 3, while those of the recursive structure are relegated in tables A5 and A6 in the appendix. Each table presents the estimated coefficients in matrix A_0 and matrix B, the associated standard errors, and the likelihood ratio of the over-identification restrictions. The over-identification restrictions cannot be rejected at standard significance levels as shown by the marginal significance level which is far above *10* per cent in all models. This suggests that there is evidence that the identifying restrictions imposed on the models are supported by the data.

Figures 1 through 4 show the impulse responses to a monetary policy tightening shock based on the estimated four SVAR models. The monetary tightening shock is measured by a positive innovation to the interbank call-money rate (*R1*). While some impulse responses are commonly shared by these four models, others differ between recursive and non-recursive structures. The responses of money supply and the GDP components are similar across models. A rise in the call-money rate by the central bank lowers the level of the money supply and together these combine to reduce investment and the remaining GDP components.

The notable differences between the recursive and non-recursive structures of both SVAR(1) and SVAR(2) pertain to the responses of the price level and exchange rate. The former entails an initial albeit temporary increase in the price level, which eventually declines after two quarters.

Hence, it contains a temporary initial price puzzle[1]. It also results in the exchange-rate puzzle, in that the exchange rate initially depreciates following the monetary tightening shock. In contrast, the latter produces no price puzzle and no exchange-rate puzzle. Hence, the non-recursive structure successfully resolves the price and exchange-rate puzzles in the models estimated on the quarterly data.

Table 2: Estimated Non-recursive Structure of SVAR(1)

Matrix A_0 of 9-Variable VAR with k = 1
Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.340 (0.189)	**1**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.711 (0.548)	**1.448** (0.326)	**1**	0.000	0.000	0.000	0.000	0.000	0.000
0.015 (0.034)	**0.002** (0.022)	0.000	**1**	0.000	0.000	0.000	0.000	**0.007** (0.058)
-0.181 (0.071)	**0.098** (0.043)	0.000	**0.569** (0.296)	**1**	0.000	**-0.002** (0.007)	0.000	0.000
0.074 (0.119)	**-0.114** (0.071)	0.000	0.000	0.000	**1**	**0.002** (0.008)	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	**1**	**-0.185** (0.032)	0.000
0.000	0.000	0.000	0.000	**13.048** (15.135)	0.000	0.000	**1**	**-26.180** (9.075)
0.221 (0.127)	**-0.242** (0.081)	**0.002** (0.021)	**-3.183** (0.767)	**-0.378** (0.201)	**-0.109** (0.114)	**0.055** (0.012)	**-0.008** (0.003)	**1**

Diagonal Matrix **B**

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
b_{11}	b_{22}	b_{33}	b_{44}	b_{55}	b_{66}	b_{77}	b_{88}	b_{99}
0.0590 (0.005)	**0.0972** (0.008)	**0.2760** (0.022)	**0.0161** (0.003)	**0.0353** (0.003)	**0.0598** (0.005)	**0.7241** (0.066)	**3.5566** (0.297)	**0.0565** (0.006)

LR Test: χ^2 (12) = 13.6113 (**0.3262**)

Note: Figures in parentheses are standard error. The calculation is with *JMulTi* version 3.11

1-Four empirical puzzles have been identified in the literature on the effects of monetary policy in closed and open economies (Kim and Roubini, 2000): (i) *the output puzzle* is associated with the increase in output level following a monetary tightening shock, (ii) *the liquidity puzzle* refers to increases in monetary aggregates (such as Total Reserves, M0, M1 and M2) in response to monetary policy shocks identified as positive innovations in nominal interest rates, (iii) *the price puzzle* relates to an increase (rather than decrease) in the price level associated with monetary policy shocks identified with innovations in interest rates representing a monetary tightening, and (iv) *the exchange rate puzzle* pertains to the depreciation (instead of appreciation) of domestic currency in response to a positive innovation in interest rate.

Table 3: Estimated Non-recursive Structure of SVAR(2)

Matrix A_0 of 9-Variable VAR with $k = 2$
Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-0.0436	**1**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.208)								
1.4093	**1.1716**	**1**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.589)	(0.327)							
-0.0294	**0.0076**	0.0000	**1**	0.0000	0.0000	0.0000	0.0000	**-0.0463**
(0.026)	(0.015)							(0.026)
-0.1953	**0.1449**	0.0000	**0.8270**	**1**	0.0000	**-0.0203**	0.0000	0.0000
(0.080)	(0.054)		(0.455)			(0.012)		
0.2203	**-0.2061**	0.0000	0.0000	0.0000	**1**	**0.0226**	0.0000	0.0000
(0.133)	(0.084)					(0.016)		
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**1**	**-0.4200**	0.0000
							(0.130)	
0.0000	0.0000	0.0000	0.0000	**37.7212**	0.0000	0.0000	**1**	**-91.0187**
				(27.803)				(17.449)
0.0104	**-0.1985**	**-0.0299**	**-3.3547**	**0.4458**	**-0.8131**	**0.1310**	**-0.0144**	**1.0000**
(0.166)	(0.109)	(0.028)	(0.839)	(0.366)	(0.230)	(0.025)	(0.003)	

Diagonal Matrix **B**

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
b_{11}	b_{22}	b_{33}	b_{44}	b_{55}	b_{66}	b_{77}	b_{88}	b_{99}
0.0519	**0.0935**	**0.2650**	**0.0118**	**0.0328**	**0.0584**	**1.3302**	**5.0270**	**0.0638**
(0.004)	(0.008)	(0.022)	(0.001)	(0.004)	(0.007)	(0.461)	(0.925)	(0.011)

LR Test: χ^2 (12) = 12.332 (**0.4194**)

Note: Figures in parentheses are standard error. The calculation is with *JMulTi* version 3.11

Figure 1 : SVAR(1) Recursive

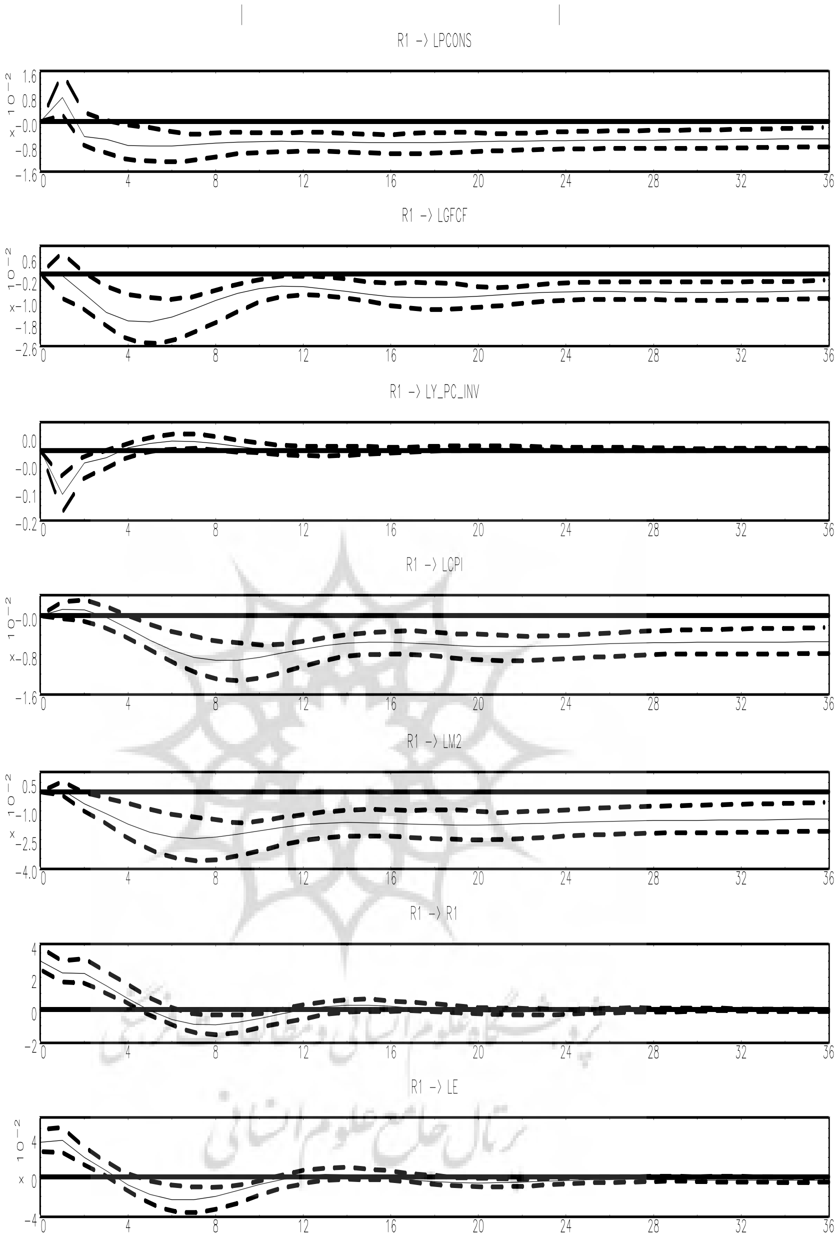


Figure 2 : SVAR(1) Non-Recursive

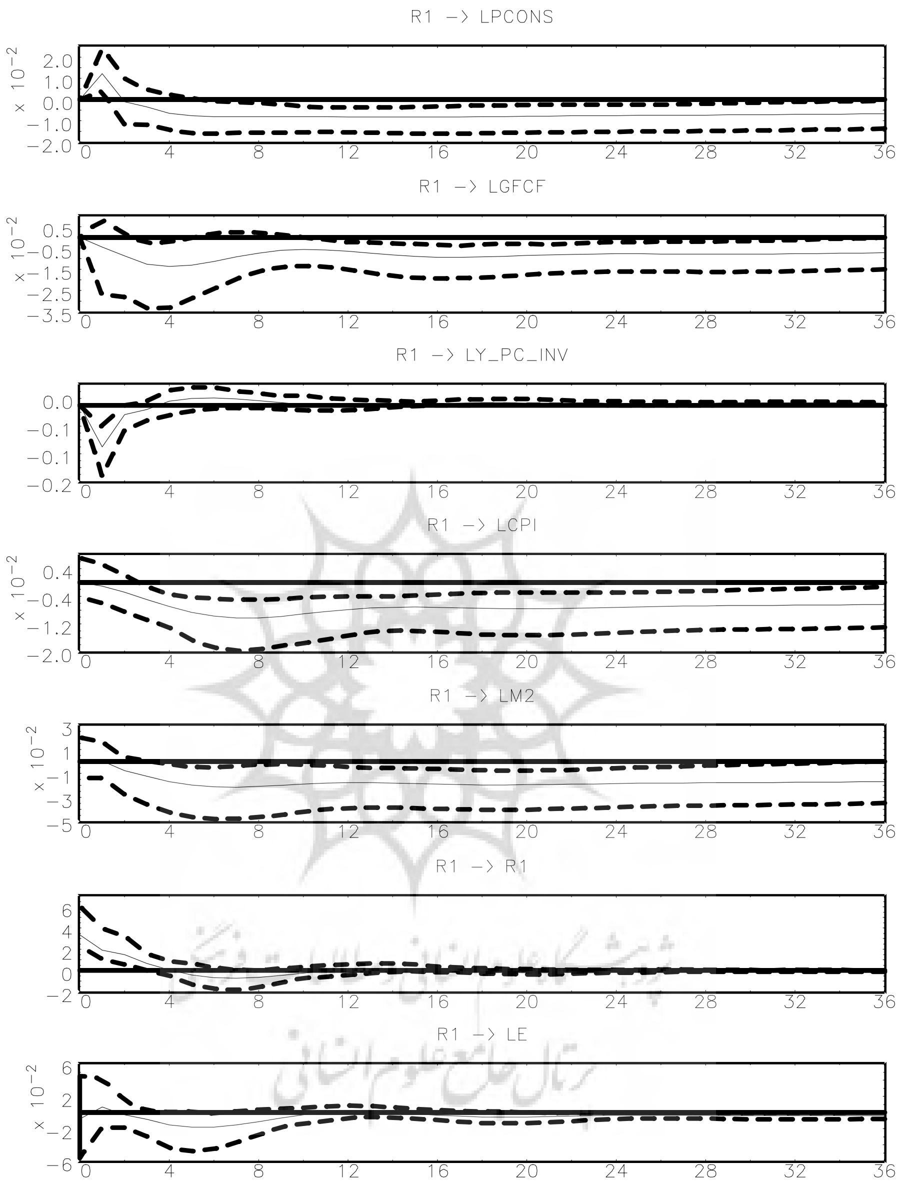


Figure 3 : SVAR(2) Recursive

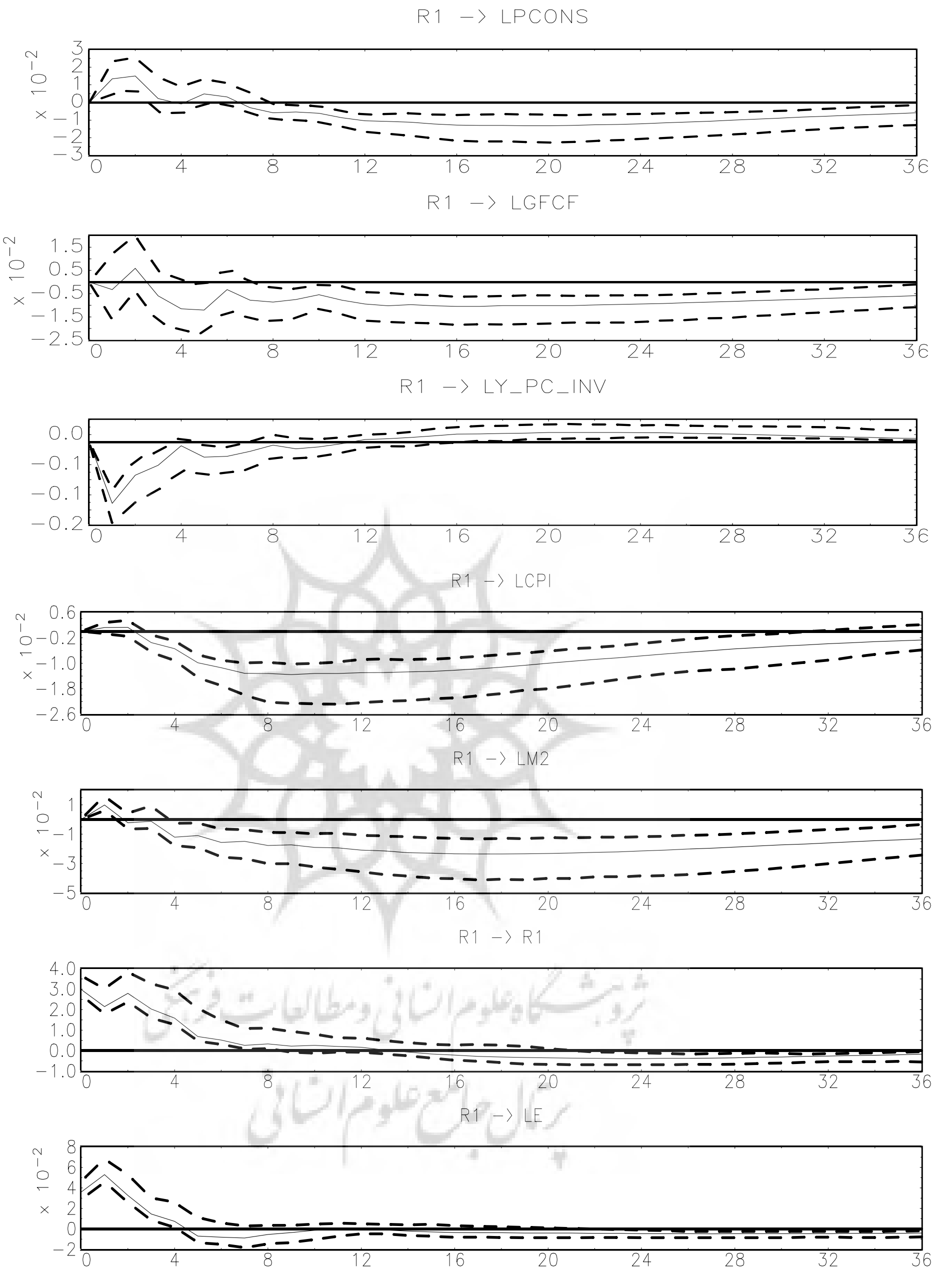


Figure 4 : SVAR(2) Non-Recursive

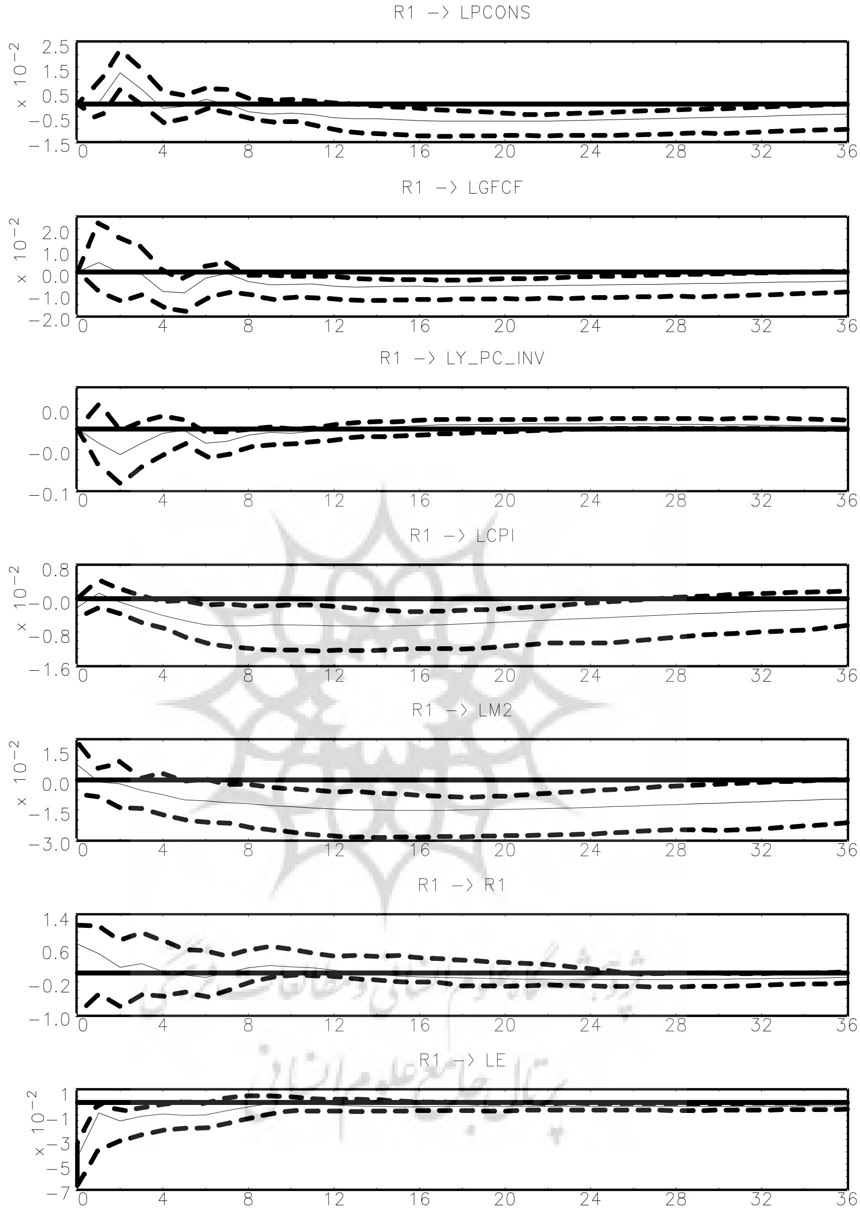


Table 4: Point Estimate of Impulse Responses of Output Components to a Monetary Tightening Shock , SVAR(1)

	RECURSIVE STRUCTURE			NON-RECURSIVE STRUCTURE		
Quarter	LPCONS	LINV	LY_PC_INV	LPCONS	LINV	LY_PC_INV
1	0.0077	-0.0007	-0.1272*	0.0122	-0.0045	-0.1198*
2	-0.0050	-0.0072	-0.0356	-0.0012	-0.0087	-0.0268
3	-0.0058	-0.0139	-0.0207	-0.0035	-0.0126	-0.0121
4	**-0.0078**	**-0.0171**	**0.0080**	**-0.0066**	**-0.0137***	**0.0118**
5	-0.0081*	-0.0175*	0.0209	-0.0075	-0.0130	0.0195
6	-0.0080	-0.0157	0.0272	-0.0080	-0.0112	0.0218
7	-0.0075	-0.0128	0.0258	-0.0080	-0.0091	0.0187
8	**-0.0071**	**-0.0097**	**0.0200**	**-0.0080**	**-0.0073**	**0.0133**
9	-0.0067	-0.0070	0.0121	-0.0080	-0.0061	0.0076
10	-0.0065	-0.0053	0.0044	-0.0080	-0.0056	0.0030
11	-0.0065	-0.0045	-0.0015	-0.0081	-0.0058	0.0002
12	**-0.0066**	**-0.0047**	**-0.0048**	**-0.0082**	**-0.0065**	**-0.0007**
13	-0.0067	-0.0054	-0.0056	-0.0083	-0.0073	0.0001
14	-0.0068	-0.0064	-0.0042	-0.0083	-0.0082	0.0018
15	-0.0069	-0.0074	-0.0016	-0.0083	-0.0089	0.0039
16	**-0.0070**	**-0.0082**	**0.0014**	**-0.0083***	**-0.0092**	**0.0059**
17	-0.0070	-0.0086	0.0041	-0.0082	-0.0094	0.0073
18	-0.0069	-0.0087	0.0060	-0.0081	-0.0092	0.0079
19	-0.0068	-0.0085	0.0069	-0.0080	-0.0089	0.0079
20	**-0.0066**	**-0.0080**	**0.0070**	**-0.0079**	**-0.0086**	**0.0073**
21	-0.0065	-0.0075	0.0064	-0.0077	-0.0082	0.0065
22	-0.0064	-0.0071	0.0054	-0.0076	-0.0080	0.0056
23	-0.0063	-0.0067	0.0043	-0.0076	-0.0078	0.0048
24	-0.0062	-0.0065	0.0034	-0.0075	-0.0077	0.0042

*The lowest point.

To further scrutinise the contribution of each GDP component, Tables 4 and 5 specifically report the point estimates of impulse responses of each GDP component to a monetary tightening shock, also based on the same four models. At least in the first three quarters, in all four cases, the biggest response comes from the rest of GDP component (*Y_PC_INV*). Based on the SVAR(2) both recursively and non-recursively structured, its predominance continues until the 10th quarter. However, based on the SVAR(1), the investment spending component (*GFCF*) quickly takes over the lead since the 4th quarter until the 9th quarter for recursive structure and the 7th quarter for non-recursive structure. Thereafter the consumption spending component (*PCONS*,) or investment alternately dominates the impulse responses. Thus, if the SVAR(2) is relied upon, in the first three years the responses of investment is clearly more dominant than those of consumption. In contrast, if the SVAR(1) is used, this is also the case only up to the first two years. However, it does not necessarily follow that investment plays a more important role in the monetary transmission mechanism than the consumption component. This is because each component does not account for an equal portion of the GDP. Instead, the average share of consumption in the GDP over the sample period is the largest, 0.61, followed by investment, 0.26, and the rest of GDP component accounts for the remaining 0.13. This difference is too large to ignore in assessing the relative importance of each GDP component in the monetary transmission mechanism. For this reason, Angeloni *et al.* (2003) propose a *contribution* analysis that takes account of the share of each component in the GDP as a weight in assessing the relative importance of each component in the monetary transmission mechanism.

Table 5: Point Estimate of Impulse Responses of Output Components to a Monetary Tightening Shock , SVAR(2)

	RECURSIVE STRUCTURE			NON-RECURSIVE STRUCTURE		
Quarter	LPCONS	LINV	LY_PC_INV	LPCONS	LINV	LY_PC_INV
1	0.0134	-0.0033	-0.1628*	0.0006	0.0044	-0.0282*
2	0.0150	0.0060	-0.0882	0.0128	-0.0005	-0.0506
3	0.0022	-0.0060	-0.0618	0.0060	-0.0010	-0.0278
4	**-0.0009**	**-0.0115**	**-0.0096**	**-0.0018**	**-0.0089**	**-0.0080**
5	0.0049	-0.0120*	-0.0401	-0.0009	-0.0096*	-0.0029
6	0.0032	-0.0033	-0.0380	0.0019	-0.0029	-0.0276
7	-0.0029	-0.0078	-0.0244	0.0000	-0.0007	-0.0239
8	**-0.0059**	**-0.0086**	**-0.0081**	**-0.0031**	**-0.0043**	**-0.0118**
9	-0.0053	-0.0075	-0.0175	-0.0040	-0.0058	-0.0069
10	-0.0061	-0.0054	-0.0128	-0.0036	-0.0056	-0.0087
11	-0.0086	-0.0078	-0.0038	-0.0043	-0.0054	-0.0050
12	**-0.0104**	**-0.0094**	**0.0071**	**-0.0055**	**-0.0065**	**0.0005**
13	-0.0107	-0.0102	0.0092	-0.0060	-0.0070	0.0037
14	-0.0112	-0.0097	0.0128	-0.0061	-0.0068	0.0038
15	-0.0122	-0.0102	0.0167	-0.0063	-0.0065	0.0049
16	**-0.0129**	**-0.0105**	**0.0209**	**-0.0067**	**-0.0066**	**0.0067**
17	-0.0130	-0.0105	0.0220	-0.0069	-0.0067	0.0080
18	-0.0131	-0.0101	0.0231	-0.0069	-0.0066	0.0084
19	-0.0132	-0.0101	0.0243	-0.0069	-0.0064	0.0090
20	**-0.0132***	**-0.0101**	**0.0256**	**-0.0070**	**-0.0064**	**0.0097**
21	-0.0130	-0.0101	0.0258	-0.0070*	-0.0064	0.0103
22	-0.0127	-0.0098	0.0257	-0.0069	-0.0063	0.0104
23	-0.0124	-0.0097	0.0255	-0.0067	-0.0062	0.0104
24	-0.0120	-0.0095	0.0252	-0.0066	-0.0060	0.0105

*The lowest point.

4.2. Contribution Measures

This subsection presents the *contribution* of each GDP component to measure the output composition of the monetary transmission mechanism in Indonesia. Angeloni *et al.* (2003) defines *contribution* as "the ratio of changes in the components of GDP to the overall movements in GDP." Based on the SVAR estimation results, its computation relies on the cumulative impulse responses of each component so as to eliminate the distortion from temporal noise (Fujiwara, 2003)[1]. Thus, the contribution is computed as follows: the cumulative response of each component, measured relative to its respective baseline, is weighted by its respective share in GDP; then, the weighted cumulative response of each component is stated as a ratio relative to the GDP response (which is the total responses of all components taken together). The weight for each GDP component is its average share in the GDP over the sample period (1984Q1-2003Q4), which is: consumption 0.61, investment 0.26, and the rest of GDP component 0.13. The calculation relies on SVAR(2) only since it is better specified than SVAR(1) in terms of no autocorrelation problem and more stable system. Following Angeloni *et al.* (2003) and Fujiwara (2003), the calculation covers the first twelve quarters (first three years). Tables 6 and 7 summarise the calculation results based on the recursively and non-recursively structured SVAR(2), respectively.

Table 6: Contribution of Output Components, VAR(2) Recursive

Quarter	Accumulated Impulse Responses			Contribution		
	PCONS	INV	Y_PC_INV	PCONS	INV	Y_PC_INV
4	-0.0009	-0.0115	-0.0096	0.114585	0.615648	0.269767
8	-0.0059	-0.0086	-0.0081	0.521942	0.319902	0.158156
12	-0.0104	-0.0094	0.0071	0.813424	0.309143	-0.122567
Three-Year Contribution Average				**0.483317**	**0.414898**	**0.101785**

Table 7: Contribution of Output Components, SVAR(2) Non-Recursive

Quarter	Accumulated Impulse Responses			Contribution		
	PCONS	INV	Y_PC_INV	PCONS	INV	Y_PC_INV
4	-0.0018	-0.0089	-0.0080	0.246305	0.512081	0.241614
8	-0.0031	-0.0043	-0.0118	0.412645	0.240675	0.346680
12	-0.0055	-0.0065	0.0005	0.677108	0.336478	-0.013586
Three-Year Contribution Average				**0.445353**	**0.363078**	**0.191569**

As reported in Tables 6 and 7, both models provide consistent albeit different figures for each GDP component's contribution. In the first four quarters the investment contribution is larger than that of consumption. The

[1]-Cumulating up to time *t* the responses to a one-off shock occurring in *t-k* can also be interpreted as observing, at time *t*, the response to a shock sustained from *t-k* to *t*. The noise can be present in the level responses, particularly in the initial periods. See Angeloni *et al.* (2003).

response of investment to a monetary tightening shock is quicker and more pronounced than that of consumption in the first four quarters. However, this is totally reversed in the second and third year. Thereafter the contribution of consumption far outstrips that of investment. On average, consumption contribution in the monetary transmission is larger than that of investment. These results stand contrast to the results of studies for Japan (Fujiwara, 2003) and the European area (Angeloni *et al.*, 2003), which found investment contribution larger than that of consumption. However, they are in line with what Angeloni *et al.* (2003) found for the US and the United Kingdom, in that the contribution of consumption is larger. For example, based on Fujiwara (2003), in Japan the average contribution of consumption is 0.25 at the end of the first year after the shock, and 0.33 and 0.32 at the end of the second and third years, respectively. On the other hand, the equivalent figures of investment are 0.37, 0.58 and 0.65.

4.3. Structural Factors

What makes the consumption contribution in the monetary transmission is larger than that of investment in Indonesia? Different relative importance of output composition across countries may help reveal underlying structural differences. Angeloni *et al.* (2003) and Fujiwara (2003) offer various possible explanations for the difference in consumption reactions to monetary contractions between the United States, European area, and Japan, of which the following may be applicable to Indonesian case: (*i*) the relative costs of investment (capital) and labour adjustments, (*ii*) the degree of provision of combined unemployment benefits, national health care systems, and pay-as-you-go pension schemes, and (*iii*) the relative risk aversion and the saving behaviour of consumers.

Arguably, the labour market in Indonesia is characterised by excess supply of labour. This is due to the fact that, as shown in table A7 in the appendix, in 2002 the labour market is still dominated by those who work in the informal sector (non-wage employees), 52.1 per cent of total employment. Further, there is a significant structural imbalance in which the agriculture sector that accounts for only 16.9 per cent of GDP absorbs 44.3 per cent of employment, while the manufacturing sector that contributes 43.6 per cent to GDP accommodates only 13.2 per cent of employment. This imbalance inevitably provides the latter sector with an almost unlimited supply of labour, since people find themselves more than happy to move from the former to the latter sector even at a wage rate lower than the existing rate provided it is still higher than the rate in the former sector[1]. The excess supply of labour naturally makes the labour market flexible and hence adjustment costs on labour are relatively cheaper than those on capital. Likewise in the face of contraction shocks adjustments are more likely made by reducing employment or wages than other elements of costs, thereby likely reducing consumers' purchasing power and spending.

The effect of the labour market structure is reinforced by the relative absence of social and employment security insurance. Angeloni *et al.* (2003) note that the Euro area residents are likely to be more insulated from economy wide shocks than their counterparts in the United States by a combination of more generous unemployment benefits, national health care systems, and generous pay-as-you-go pension schemes. Arguably far worse than the US, Indonesia hardly has any social protection programs to assist individuals, households, and communities in dealing with negative shocks, including labour market shocks (Suryahadi, 2001). Like those in most developing economies, Indonesians have largely relied on informal arrangements for their social protection[2]. Further, in Indonesia most workers, except for public servants, were not covered by more comprehensive labour union and employment security Acts, which did not come out until 2000, let alone guaranteed with lifetime employment[3]. Therefore, economy wide shocks are likely translated into, at least partly, a lower employment or wages and in turn lower consumption spending.

5. Concluding Remarks and Policy Recommendations

This paper has investigated the role of each aggregate spending component in the monetary policy transmission in Indonesia. It has assessed

1 -The wage gap between sectors may be proxied by the gap in productivity of each worker between different sectors. In real terms (1995 price) during 2002 each worker produced Rp 2.1 million in agriculture, as opposed to Rp 11.2 million and Rp 7.3 million in the manufacturing and other sectors, respectively. See Manning (2004)

2-Exceptions to this are social security schemes mandated for employees in the medium and large enterprises (*Jamsostek*), public servants (*Taspen*), military (*Asabri*), and health insurance for public servants (*Askes*). See Suryahadi (2001).

3-These new acts are yet to be consistently implemented since there is negative precedence in the past. Before the crisis in 1998, governments had legislated for a quite comprehensive set of labour standards covering both survival and Security Rights, most of which had been introduced through Basic Laws (Acts) in the 1950s and 1960s before Soeharto came to power. However, there were problems in ensuring that these were guaranteed even in the small modern sector, owing to shortcomings in the political, bureaucratic and institutional framework for implementation and supervision. See Manning (2004).

the relative strength of the role of each spending component in the monetary policy transmission. It finds that on average consumption spending plays predominant role in the monetary policy transmission. This result is more in line with the findings for the United States than those for the European Area and Japan. For the latter countries investment spending is predominant in the monetary transmission.

The following might explain the dominance of consumption in the monetary policy transmission in Indonesia. First, the adjustment cost on labour is lower than on capital in Indonesia due to the flexible labour market characterised by excess supply of labour. Second, this is reinforced by the fact that Indonesia has a comparatively lower degree of provision of combined unemployment benefits, national health care systems, pay-as-you-go pension schemes, and guaranteed job security. Finally, most Indonesian people are not covered by insurance because they are not yet insurance-minded and importantly do not have enough saving. Therefore, a monetary-induced economic shock might directly translate into lower consumption spending. Looking ahead, once the labour market structure improves, labour positions are strengthened, and people accumulate more income and hence a higher level of saving, the aggregate spending composition of monetary transmission also likely shifts toward the dominance of investment spending.

The paper offers the following policy recommendations. In deciding whether the current stance of monetary policy is appropriate or needs a change, it is necessary for Bank Indonesia to look at structural factors such as institutional and legal factors in the labour market, the structure of the labour market itself and the degree of social security insurance. The fact that consumption spending plays a predominant role in the monetary policy transmission necessitates Bank Indonesia to also monitor its movements in determining the monetary policy stance. However, any shift in those structural factors may make consumption no longer play predominant role. For example, changes in legal and institutional environments where labours become freer, employment security and minimum wage regulations are put in place and more people are covered by insurance will likely result in a declining role played by consumption spending in the monetary transmission mechanism. Thus, any failure on the part of Bank Indonesia to notice these changes would make monetary policy miss the target because its stance is based on monitoring the same and wrong variable, which no longer plays important role.

REFERENCES

1-Amisano, G.G. and C. Giannini (1997), *Topics in Structural VAR Econometrics*, 2nd Edition, Springer-Verlag, Berlin.

2- Angeloni, I., A.K. Kashyap, B. Mojon and D. Terlizzese (2003), "The Output Composition Puzzle: A Difference in the Monetary Transmission Mechanism in the Euro Area and US," *NBER Working Paper* No. 9985, Cambridge, Massachusetts, National Bureau of Economic Research, September.

3- Breitung, J., R. Brüggemann and H. Lütkepohl (2004), "Structural Vector Autoregressive Modeling and Impulse Responses", in Helmut Lütkepohl and Markus Krätzig (Eds.), *Applied Time Series Econometrics*, Cambridge, Cambridge University Press.

4- Christiano, L. J., M. Eichenbaum and C. L. Evans (1998), "Monetary policy Shocks: What We Learned and To What End?" *NBER Working Paper* No. 6400, Cambridge, Massachusetts, National Bureau of Economic Research, February.

5- ______ (2001), "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy", *NBER Working Paper* No. 8403, Cambridge, Massachusetts, National Bureau of Economic Research.

6- Disyatat, P. and P. Vongsinsirikul (2003), "Monetary Policy and Transmission Mechanism in Thailand", *Journal of Asian Economics*, 14, pp. 389–418

7- Erceg, C. J. and A. Levin (2002), "Optimal Monetary Policy with Durable and Non-Durable Goods", *ECB Working Paper* No. 179.

8- Fujiwara, I. (2003), "Output Composition of the Monetary Policy Transmission Mechanism in Japan," *Bank of Japan Working Paper Series*, No.03-E-9, November.

9- Gordon, D.B. and E. Leeper (1994), "The Dynamic Impacts of Monetary Policy: An Exercise in Tentative Identification", *Journal of Political Economy*, 102(6), pp. 1228-1247.

10- Kim, S. and N. Roubini (2000), "Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach," *Journal of Monetary Economics* 45, pp. 561-586.

11- Leeper, E. M., C.A. Sims, and T. Zha (1996), "What Does Monetary Policy Do?" *Brookings Papers on Economic Activity*, 2, pp. 1-78.

12- Manning, C. (2004), "Legislating for Labour Protection: Betting on the Weak or Strong?" *Working Paper* No. 2004/08, Division of Economics, Research School of Pacific and Asian Studies, ANU, December.

13- Morsink, J. and T. Bayoumi (2001), "A Peek Inside the Black Box: The Monetary Transmission Mechanism in Japan", *IMF Staff Papers*, 48(1), pp. 22–57.

14- Suryahadi, A. (2001), "International Economic Integration and Labor Markets: The Case of Indonesia," East-West Centers *Working Papers Economic Series* No.22, May.

15- Taylor, J.B. (1995), "The Monetary Transmission Mechanism: An Empirical Framework." *Journal of Economic Perspective*, 9(4), pp. 11-26.

APPENDIX

Table A1: 9-Variable VAR Lag Order Selection Criteria

Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-101.9028	NA	2.76E-10	3.531582	4.378739	3.869189
1	497.4827	1003.384	1.88E-16	-10.69816	-7.309532*	-9.347732
2	640.5460	202.3916	3.98E-17	-12.37112	-6.441031	-10.00788
3	744.8829	122.9174	2.88E-17	-13.01049	-4.538929	-9.634427
4	880.7526	126.5635	1.22E-17*	-14.51377*	-3.500739	-10.12489*

Note: * indicates lag order selected by the criterion; LR is sequential modified LR test statistic (each test at 5% level); FPE is Final prediction error; AIC is Akaike information criterion; SC is Schwarz information criterion; and HQ: Hannan-Quinn information criterion (they are calculated using *E-Views* version 4.1)

Table A2: Root of Characteristic Polynomial of 9-variable VAR System

Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

VAR with $k = 1$		VAR with $k = 2$	
Root	Modulus	Root	Modulus
0.990788	0.990788	0.974483	0.974483
0.877632	0.877632	0.929862 + 0.100601i	0.935288
0.766380 + 0.386897i	0.858503	0.929862 - 0.100601i	0.935288
0.766380 - 0.386897i	0.858503	0.609161 - 0.440213i	0.751575
0.732510	0.732510	0.609161 + 0.440213i	0.751575
0.597108	0.597108	0.035091 + 0.742692i	0.743520
-0.311502	0.311502	0.035091 - 0.742692i	0.743520
0.214965	0.214965	-0.741592	0.741592
0.115271	0.115271	0.710848 - 0.098147i	0.717591
		0.710848 + 0.098147i	0.717591
		0.290169 + 0.523095i	0.598186
		0.290169 - 0.523095i	0.598186
		-0.594291	0.594291
		-0.349694 - 0.444428i	0.565510
		-0.349694 + 0.444428i	0.565510
		0.412811	0.412811
		0.017473 - 0.233335i	0.233988
		0.017473 + 0.233335i	0.233988
No root lies outside the unit circle. VAR satisfies the stability condition.		No root lies outside the unit circle. VAR satisfies the stability condition.	

Note: The roots and modulus are calculated using *E-Views* version 4.1.

Table A3: Diagnostic Test for 9-Variable VAR with k = 1

Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

	PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
L&B(1)[a] p-val	0.050 (0.82)	0.329 (0.57)	0.195 (0.64)	0.220 (0.64)	13.444 (**0.000**)	7.698 (**0.01**)	0.288 (0.59)	0.018 (0.89)	2.952 (0.09)
Normality[b] $\chi^2(2)$	1.535 (0.46)	63.400 (**0.00**)	3.265 (0.19)	1.743 (0.42)	1.455 (0.48)	31.736 (**0.00**)	22.669 (**0.00**)	14.047 (**0.00**)	4.321 (0.12)
$\overline{R}^2$	0.98	0.92	0.47	0.999	0.999	0.98	0.95	0.91	0.99

[a] Based on the Portmanteau test by Ljung and Box (1978) with one lag calculated with *JMulTi* software version 3.11.
[b] Obtained from calculating the Jarque and Bera (1987) test of nonnormality based on the skewness and kurtosis of a distribution, using *E-Views* version 4.1.

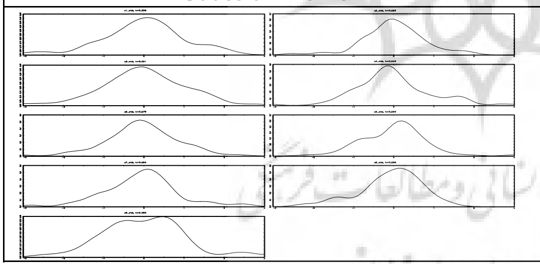
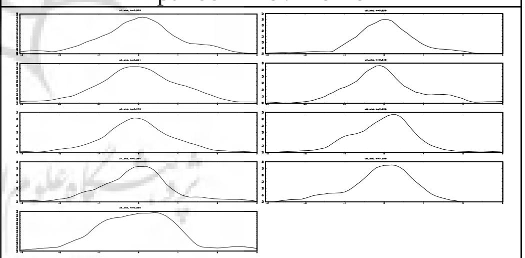
Table A4: Diagnostic Test for 9-Variable VAR with k = 2

Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

	PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
L&B(1)[a] p-val	2.839 (0.24)	0.047 (0.98)	0.351 (0.84)	1.408 (0.49)	0.617 (0.73)	1.951 (0.38)	1.048 (0.59)	0.331 (0.85)	0.996 (0.61)
Normality[b] $\chi^2(2)$	7.522 (**0.02**)	37.268 (**0.00**)	5.674 (0.06)	4.322 (0.12)	4.226 (0.12)	0.591 (0.74)	5.8981 (**0.05**)	0.944 (0.63)	5.244 (0.07)
$\overline{R}^2$	0.98	0.92	0.595	0.999	0.999	0.98	0.97	0.91	0.99

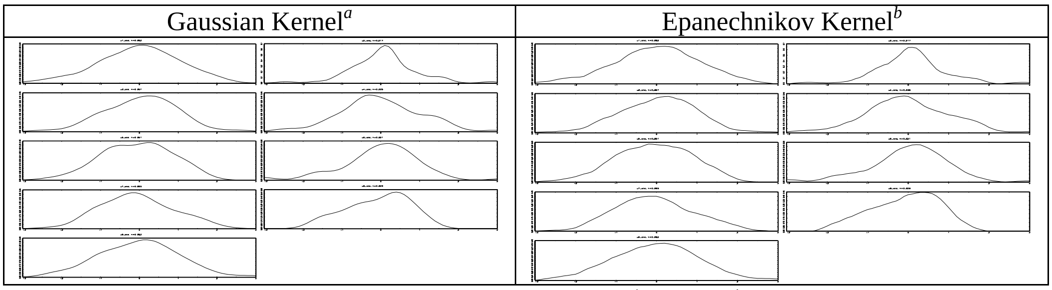
[a] Based on the Portmanteau test by Ljung and Box (1978) with two lags calculated with *JMulTi* software version 3.11.
[b] Obtained from calculating the Jarque and Bera (1987) test of nonnormality based on the skewness and kurtosis of a distribution, using *E-Views* version 4.1.

Figure A1: Kernel Density Estimates for 9-Variable VAR with k = 1

Gaussian Kernel[a]	Epanechnikov Kernel[b]
	

[a] Its density is estimated by a Kernel function $K(u) = (2\pi)^{-1/2} \exp(-u^2/2)$ where u is the equation residual.
[b] Its density is estimated a Kernel function $K(u) = \frac{3}{4}(1 - 1/5\ u^2)/\sqrt{5}$ for $|u|<\sqrt{5}$ and *0* otherwise.

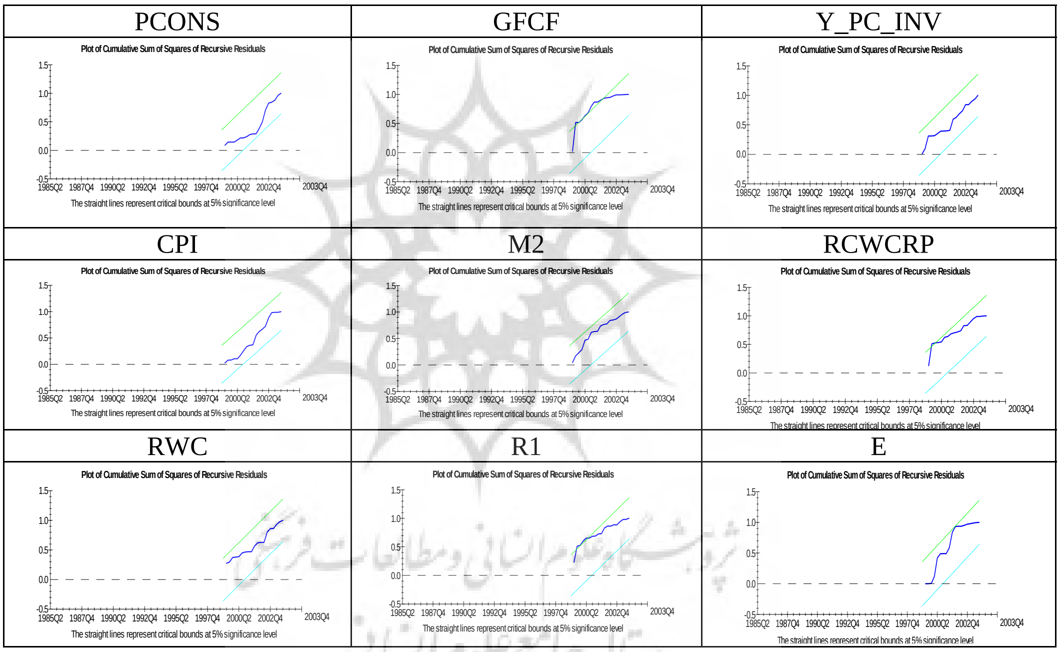
Figure A2: Kernel Density Estimates for 9-Variable VAR with k = 2



[a] Its density is estimated by a Kernel function $K(u) = (2\pi)^{-1/2} \exp(-u^2/2)$ where u is the equation residual.

[b] Its density is estimated a Kernel function $K(u) = \frac{3}{4}(1 - 1/5\, u^2)/\sqrt{5}$ for $|u| < \sqrt{5}$ and 0 otherwise.

Figure A3: CUSUM-of-squares tests of 9-Variables VAR with k = 2



Note: The border straight lines represent critical bounds at 5% significant level (calculated with *Microfit*).

Table A5: Estimated Matrix A_0 and Diagonal Matrix B (Recursive Structure)

Matrix A_0 of 9-Variable VAR with $k = 2$
Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-0.0436	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.208)								
1.4093	**1.1716**	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.589)	(0.327)							
-0.0390	**-0.0010**	**-0.0014**	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000
(0.029)	(0.017)	(0.005)						
-0.1398	**0.1109**	**0.0060**	**0.2441**	**1.0000**	0.0000	0.0000	0.0000	0.0000
(0.074)	(0.043)	(0.014)	(0.296)					
0.2695	**-0.1893**	**0.0189**	**0.4740**	**-0.4924**	**1.0000**	0.0000	0.0000	0.0000
(0.120)	(0.070)	(0.022)	(0.469)	(0.182)				
1.5011	**-1.9758**	**-0.2546**	**-26.8150**	**-1.3685**	**-3.0209**	**1.0000**	0.0000	0.0000
(1.545)	(0.915)	(0.275)	(5.895)	(2.381)	(1.440)			
-11.7900	**-1.8398**	**-0.8202**	**-35.8514**	**-6.2411**	**5.0716**	**-2.8923**	**1.0000**	0.0000
(7.427)	(4.506)	(1.319)	(1.807)	(11.396)	(7.079)	(0.552)		
0.0514	**-0.1874**	**-0.0109**	**-1.8523**	**-0.1514**	**-0.2629**	**0.0559**	**-0.0120**	**1.0000**
(0.102)	(0.061)	(0.018)	(0.435)	(0.155)	(0.096)	(0.009)	(0.002)	

Diagonal Matrix *B*

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
b_{11}	b_{22}	b_{33}	b_{44}	b_{55}	b_{66}	$C7_7$	b_{88}	b_{99}
0.0519	**0.0935**	**0.2650**	**0.0124**	**0.0318**	**0.0502**	**0.6258**	**2.9894**	**0.0405**
(0.004)	(0.008)	(0.022)	(0.001)	(0.003)	(0.004)	(0.051)	(0.244)	(0.0063

Just Identified

Note: the calculation is with *JMulTi* version 3.11

Table A6: Estimated Matrix A_0 and Diagonal Matrix B (Recursive Structure)

Matrix A_0 of 9-Variable VAR with k = 1
Endogenous variables: *LPCONS LGFCF LY_PC_INV LCPI LM2 LRCWCRP RWC R1 LE*
Exogenous variables: C SD98 SD99; Sample: 1984Q4 2003Q4 (Observations: 73)

PCONS	GFCF	Y_PC_I	CPI	M2	RCWCRP	RWC	R1	E
1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-0.3395	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.189)								
1.7113	**1.4477**	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(0.548)	(0.326)							
0.0066	**-0.0038**	**-0.0044**	**1.0000**	0.0000	0.0000	0.0000	0.0000	0.0000
(0.033)	(0.021)	(0.007)						
-0.1809	**0.0888**	**-0.0024**	**0.5497**	**1.0000**	0.0000	0.0000	0.0000	0.0000
(0.075)	(0.047)	(0.015)	(0.257)					
0.1122	**-0.1621**	**-0.0140**	**-0.0506**	**-0.3656**	**1.0000**	0.0000	0.0000	0.0000
(0.127)	(0.079)	(0.024)	(0.435)	(0.189)				
2.5246	**-1.7499**	**0.3798**	**-15.7007**	**-0.7716**	**-0.1656**	**1.0000**	0.0000	0.0000
(1.814)	(1.149)	(0.345)	(6.171)	(2.740)	(1.626)			
-10.1727	**1.7583**	**-0.7241**	**-34.7255**	**3.4653**	**3.1957**	**-2.6987**	**1.0000**	0.0000
(6.654)	(4.225)	(1.258)	(3.288)	(9.931)	(5.890)	(0.416)		
0.2189	**-0.2180**	**-0.0033**	**-2.6355**	**-0.4094**	**-0.1054**	**0.0457**	**-0.0120**	**1.0000**
(0.118)	(0.074)	(0.022)	(0.412)	(0.173)	(0.103)	(0.009)	(0.002)	
Diagonal Matrix *B*								
PCONS	***GFCF***	***Y_PC_I***	***CPI***	***M2***	***RCWCRP***	***RWC***	***R1***	***E***
b_{11}	b_{22}	b_{33}	b_{44}	b_{55}	b_{66}	$C7_7$	b_{88}	b_{99}
0.0590	**0.0972**	**0.2760**	**0.0158**	**0.0354**	**0.0582**	**0.8243**	**2.9862**	**0.0521**
(0.005)	(0.008)	(0.022)	(0.001)	(0.003)	(0.005)	(0.067)	(0.242)	(0.004)
Just Idenitified								

Note: the calculation is with *JMulTi* version 3.11

Table A7: The Structure of Indonesian GDP and Employment and Output per Workers, 1986-2002

	1986	1996	1998	2000	2002
Share of GDP					
Agriculture	24.6	16.5	18.0	17.7	16.9
Industry	35.5	43.0	42.7	43.6	43.6
Manufacturing	17.9	25.0	25.6	26.7	27.0
Services	40.0	40.6	39.3	38.7	39.4
	100.0	100.0	100.0	100.0	100.0
Share of Employment					
Agriculture	55.1	44.0	45.1	44.3	44.3
Manufacturing	8.2	12.6	13.0	13.2	13.2
Services	36.7	43.4	41.9	42.4	42.4
	100.0	100.0	100.0	100.0	100.0
Wage employees	45.8	50.0	48.9	49.2	47.9
Non-wage employees	54.2	50.0	51.1	50.8	52.1
Output per worker (Rp-Million) •					
Agriculture	1.5	2.1	2.0	2.1	2.1
Manufacturing	7.5	11.3	11.5	10.8	11.2
Other••	5.4	7.7	6.6	7.0	7.3
Total••	3.4	5.7	5.1	5.2	5.5

• At constant 1995 prices Includes services and other industry

•• Includes all services , mining , utilities and construction

Source : Manning (2004) .