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EVALUATING MONETARY TRANSMISSION MECHANISM IN INDONESIA THROUGH EXCHANGE RATE CHANNEL

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Abstract: *This study aims to evaluate the role of exchange rate channel in transmitting monetary policy effects in Indonesia by addressing the following questions: (i) to what extent is the contribution of the exchange rate in inflation rate fluctuations in Indonesia? (ii) What are the effects of exchange rate channel in explaining the direct pass through effect in Indonesia; and (iii) can the exchange rate channel explain the trade competitiveness in Indonesia? The study utilizes monthly data spanning from January 1990 to April 2009 and is divided into four sub-periods, namely (i) pre-crisis period: January 1990-July 1997; (ii) crisis period: August 1997-December 2000; (iii) post-crisis period: January 2001-June 2005; and (iv) post-ITF period: July 2005-April 2009. By adopting the standard Vector Autoregression model, the study finds changing nature of the exchange rate channel during the various sub-periods of the study.*

Keywords: *exchange rate channel; trade balance; direct pass through; Indonesia*
JEL Classification: *E44, F15, G01*

Abstrak: *Studi ini bertujuan mengevaluasi peran saluran nilai tukar dalam mentransmisikan efek kebijakan moneter di Indonesia dengan mengatasi pertanyaan berikut: (i) sampai sejauh mana kontribusi dari nilai tukar fluktuasi tingkat inflasi di Indonesia? (ii) Apa efek dari saluran nilai tukar dalam menjelaskan lulus langsung melalui efek di Indonesia; dan (iii) Dapatkah saluran nilai tukar menjelaskan daya saing perdagangan di Indonesia? Studi ini menggunakan data bulanan mulai dari Januari 1990 sampai April 2009 dan dibagi menjadi empat sub-periode, yaitu (i) periode pra-krisis: Januari 1990-Juli 1997; (Ii) masa krisis: Agustus 1997-Desember 2000; (Iii) periode pasca-krisis: Januari 2001-Juni 2005; dan (iv) pasca-ITF periode: Juli 2005-April 2009. Dengan mengadopsi model Vector Autoregression standar, studi ini menemukan perubahan sifat saluran nilai tukar selama berbagai sub-periode studi.*

Kata kunci: *kurs channel; neraca perdagangan; direct pass through; Indonesia*
Klasifikasi JEL: *E44, F15, G01*

INTRODUCTION

The monetary transmission mechanism is a process through which monetary policy decisions are transmitted through the economy resulting in the intended changes in income and inflation (Taylor, 1995). Since there are various possible important transmission mechanisms in an economy, the task of identifying the relevant channels through which the impact of monetary policy is transmitted to the real economy has been one of the most challenging and crucial ones in the conduct of monetary policy. A clear understanding of the monetary transmission mechanism channel is highly important in ensuring effective and successful implementation of monetary policy. Domac (1999) highlights that understanding the transmission mechanism of monetary policy is highly important, particularly on the distributional consequences of the policy actions.

In small open economies, one of the candi-

dates for an important channel of monetary transmission is the exchange rate channel. Due to the high dependencies on the external sector, exchange rate movements might have major influences on the aggregate demand and aggregate supply, thus, output and prices in the small open economies. In the case of Indonesia, the conduct of monetary policy has been focusing on achieving output and price stability. Due to its open nature, the exchange rate channel is also an important channel of monetary transmission and becoming more pronounced in affecting the real economy and prices, particularly since the crisis in 1997/1998 (Bank Indonesia, 2000). Exchange rate stability becomes an important aspect in maintaining sustainability in the economy, in particular, when looking at its relationship with the other variables. Such stability, in the context of monetary policy, has been recorded as Bank Indonesia (BI) mandate, that is, to achieve stability in exchange rate (Rupiah) in efforts to control the level of domestic inflation.

In determining the role of the exchange rate in the transmission mechanism in the Indonesian economy, Siswanto *et al*. (2001) and Astiyah (2006) conduct empirical studies using a structural vector auto regression (SVAR) approach, by considering two sub-periods, pre-crisis and post-crisis. The first sub-period seeks to measure whether a monetary policy shock had a dominant influence on exchange rate movements compared to a risk factor, with the objective of determining whether the monetary policy could be transmitted to inflation through the exchange rate channel. Meanwhile, the second sub-period is aimed at detecting the transmission of exchange rate changes to the inflation rate both directly, through price (direct pass-through effect), and indirectly, through output (indirect pass-through effect). The findings reveal that during the pre-crisis period, monetary policy transmission through the exchange rate channel was very weak. In addition, during the pre-crisis, the study shows that the direct pass-through effect of the exchange rate to consumer prices is larger than the indirect pass through. These results lead to the conclusion that the magnitude of exchange rate channel in Indonesia is important to be put in place as a crucial mechanism of monetary policy to affect output, even though it indicates a weak form relationship.

In terms of monetary policy framework, prior to the inflation targeting in July 2005, BI had initially adopted the base money as operational target for monetary policy. The notion of shifting to inflation as an anchor since 2000 was in line with the improvement in price condition and as complication in the banking system renders bank credit no longer compatible for monetary operation. Technically, under base money, it is difficult to trace its stability, and control and predict its behavior. More importantly, the monetary policy responses tend to be backward looking, thus it could be unreliable to be incorporated as a policy signal. Consequently, BI introduced a new policy framework which mainly focuses on inflation targeting as the operational target in monetary policy. In this regard, the basic principle of the monetary policy framework is to strike a balance between achieving the inflation target and optimal levels of other macroeconomic variables. Specific measures are implemented to curb inflationary pressure, guide inflation expectations, and deal more with the inflation shocks, as well as reduce output volatility over medium-term horizons. In short, the new monetary policy offered and adopted is based on the principle of flexibility in accommodating a temporary inflation shocks without deviating from the achievement of the medium-term target.

Amid the increasing need for more information on the effectiveness of the ITF following its recent adoption in the Indonesian economy, this study empirically deliberates on major issues pertaining to the role of exchange rate channel in Indonesia. In particular, this study aims to empirically determine whether the variability in the exchange rate triggers higher inflation rate and being harmful to the trade balance in case of Indonesia. In this regard, this paper attempts to address the following questions: (i) what is the extent of exchange rate channel contribution in the inflation rate fluctuation in Indonesia? (ii) What is the role of exchange rate channel in explaining the direct pass through effect in Indonesia, (iii) can exchange rate channel explain the trade competitiveness in Indonesia?

Exchange Rate Channel and Monetary Policy Framework in Indonesia

Exchange rate as a policy instrument used by central bank is affected by some changes in supply and demand aspects. This includes, *first*, changes in domestic real income; it implies that households and firms have more funds to spend (and save), increasing the demand for more domestic and foreign goods, services, and securities. The supply of domestic money, for instance, Indonesian Rupiah, will increase as increase in exports. *Second*, changes in domestic price of domestic goods relative to the domestic price of foreign goods. Residents will demand more foreign goods and therefore supply more domestic money in the foreign exchange market. *Third*, changes in foreign interest rates relative to domestic interest rates. As foreign interest rates raises relative to domestic rates, ceteris paribus, foreign securities become relatively more attractive. Accordingly, domestic residents will buy more foreign securities and supply more domestic money.

In Mundell-Fleming (1998) model for small open economies, an exchange rate appreciation would hurt exports and encourage imports. Further detailed explanation was provided by the Marshall-Lerner (1996) condition which states that the trade balance to improve following depreciation; export must increase enough and otherwise, import decreases to compensate in the increase of imports. During the exchange rate depreciation in 2008, the flows of Indonesia's exports were falling, and so did the imports volume. This indicates that under recession or global economic turmoil, the Marshall-Lerner condition needs to be re-examined in the specific context of a particular economy. In the context of Indonesia, an evaluation of the impact of changes in exchange rate on the economy is needed as the implementation of the ITF could result in a distinct economic condition.

Figure 1 shows the impact of the 2007/2008 global financial crisis in terms of export, import, and nominal exchange rate which seemed to be confirming on the above mentioned theory. In

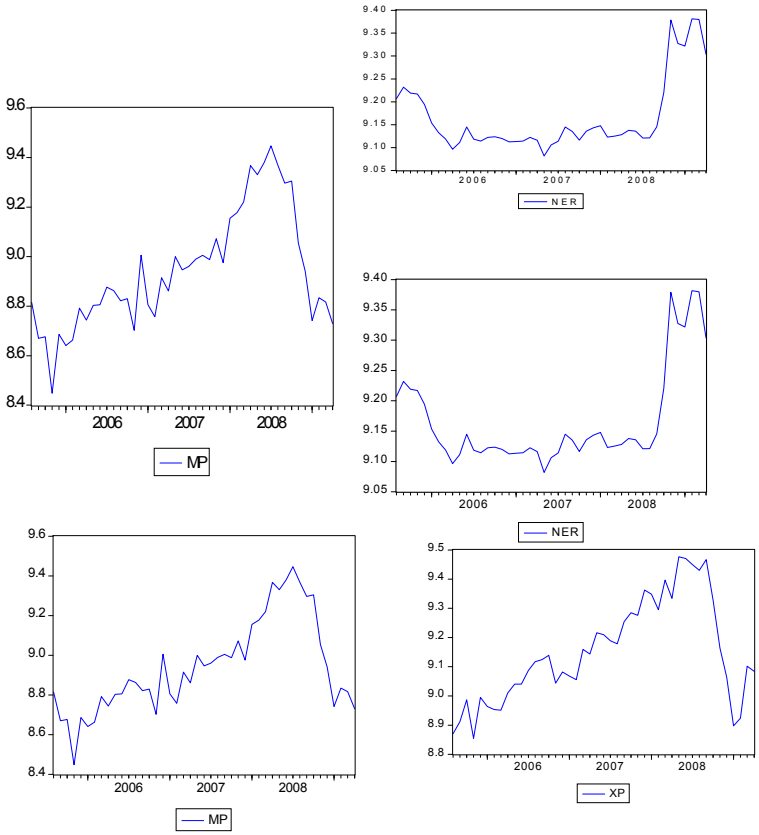

Figure 1. Fluctuations of Nominal Exchange Rate, Export, and Import during ITF Implementations

particular, due to the depreciation in 2008, the import value was slowing down, and export did so, which should be moving up. It may be guessed since the global markets were exaggerating so that it might decline the global demand, so finally tended to push down the Indonesia exports market. However, in the context of Marshall-Lerner condition on trade balance theory, the presence of nominal depreciation in domestic exchange rate against foreign exchange rate cause an increase in net exports.

In relation to the exchange rate and price level, the exchange rate pass-through (ERPT) refers to the extent in which exchange rate changes alter relative prices. The effects of exchange rate changes can be on: (1) import and export prices, (2) consumer prices, and (3) trade volumes. The ERPT can essentially be defined as "the percentage change in local currency import/export prices resulting from one percent change in the exchange rate" (Duasa, 2008). According to McFarlane (2002), the ERPT mechanism is comprised of two channels which is originally sourced by exchange rate depreciation, and affected the price level accordingly. A direct and indirect pass through effect is considered to be a channel through which current account imbalances can be adjusted. The direct pass through would contribute into inflation through imported inputs and imported of final goods which become more expensive. These conditions accordingly would raise production cost, and inflation in country. Meanwhile, indirect pass through effect is describing a depreciation on exchange rate is apparently channeled into inflation through (1) domestic demand for substitutes goods, and (2) demand for export. These two conditions would increase demand for labor and push up substitute and exports price, so definitely encourage inflation to crawl up. Given that Indonesia has been implementing the ITF in managing its monetary policy, for achieving inflation stabilization policy, it is important to understand if exchange rate channel contributes significantly to changes in the level of inflation in the country through the ERPT.

In view of the high possibility that the exchange rate channel would bring tremendous impact on the health and stability of the Indonesian economy, an empirical examination of the relationship between the exchange rate channel and price level in the context of the ITF is urgently needed. Several studies focusing on this area include that of Mohamed (2003), which empirically examines the roles of money and credit in the monetary policy during the pre- and post-liberalization period in Malaysia. The results indicate that money played important role post-liberalization compared with during pre-liberalization. Edwards (2006) analyzes the relationship between exchange rate and inflation in countries that have adopted inflation targeting. The study finds two important findings: first, these countries have experienced a decline in the pass-through from exchange rate to inflation since there is co-existence in the degree of effectiveness of the nominal exchange rate as a shock absorber. Second, the adoption of inflation targeting in the monetary policy procedures has not resulted in an increase in exchange rate volatility. The study by Rahmi *et al*. (2009) indicates that the Indonesian currency would be affected by the changes on the US, Singapore, and the UK exchange rates due to the interest rate differentials. Kara and Nelson (2002) explain the phenomena of "exchange rate disconnect" whereby exchange rate could not be co-existence with inflation in cases where imports are treated as the intermediate-goods specification rather than as a final consumer good. Jayanthy and Abdullah (2010) adopts the Granger causality test and finds that for Asia, there is a significant one way causal relationship between the nominal and real exchange rate and the rate of inflation. Ito and Sato (2007) argue that (i) the degree of exchange rate pass through to import prices was quite high in the crisis-hit economies, including in Indonesia, (ii) the pass through to CPI was generally low, with a notable exception of Indonesia. Concerning export competitiveness under appreciation of exchange rate, Abeysinghe and Yeok (1998) expose that in general, Singapore economy has a higher degree in imported input content, but exchange rate appreciation has the less the impact on its exports. This suggests that Singapore economy has successfully developed domestic value-added which calls for the critical leverage in maintaining export competitiveness and explains a concerted efforts to raise productivity across industries. *Finally*, Uddin

(2009) examines the co-integration between export and import in Bangladesh economy. He later suggests that Bangladesh economy is not in violation of its international budget constraints. It implies its trade balance is co-integrated and some policies on international trade are investigated to show long run equilibrium relationship between export and import.

RESEARCH METHOD

Type and Source of Data

The study utilizes monthly data series for the period from January 1990 to April 2009. For comparison purpose and more enriching discussion, the data sample period is further divided into four sub-periods, namely (i) pre-crisis period: January 1990 to July 1997; (ii) crisis period: August 1997 to December 2000; (iii) post-crisis period: January 2001 to June 2005; and (iv) post Inflation Targeting Framework (ITF): July 2005 until April 2009. Nominal exchange rate (NER), inflation rate (INF), imports (MP), and exports (XP) are further investigated and examined using the standard Vector Auto Regression analysis. All data are expressed in logarithmic forms, with the exception of inflation rate. Data are sourced from the International Monetary Fund's *International Financial Statistics* and Bank Indonesia database of various issues.

Data Analysis

Before we proceed, it is imperative to perform a priory analysis of the variables temporal properties. We subject each time series to the standard augmented Dickey Fuller (ADF) unit root test. The results indicate that almost all data series under consideration are integrated of order 1, or I (1). That is, they are stationary in their first differences. Accordingly, we implement the Philips-Perron (PP) test for all variables under consideration. The PP test confirms the stationary in I (1) process.

Subsequently, we proceed with a cointegration test, as suggested by Johansen (1992) and Johansen and Juselius (1990). Essentially, the test of a VAR- based test, treating all variables as essentially endogenous. In implementing the test, we place emphasis on the pre-condition that the error terms need to be serially uncorrelated.

Table 1. Unit Root Tests Results: ADF and PP Tests

Period	ADF Test		PP Test	
	Level	First Difference	Level	First Difference
Pre-Crisis				
NER	0.790	-5.612***	0.718	-5.611***
INF	-3.041**	-6.652***	-2.358	-6.445***
EXP	-1.017	-8.840***	-1.096	-18.242***
IMP	-1.349	-6.466***	-2.402	-19.536***
Crisis				
NER	-3.549**	-4.826***	-3.256**	-4.735***
INF	-2.071	-2.015***	-1.389	-1.961***
EXP	-2.161	-7.528***	-2.107	-7.847***
IMP	-2.933*	-7.404***	-2.838*	-7.421***
Post-Crisis				
NER	-1.788	-5.651***	-1.964	-5.610***
INF	-0.955	-5.897***	-1.148	-5.897***
EXP	-1.560	-10.458***	-1.313	-10.458***
IMP	0.366	-8.626***	-0.755	-12.063***
Post-ITF				
NER	-0.995	-5.321***	-1.115	-5.321***
INF	-1.457	-5.408***	-1.706	-5.408***
EXP	-1.891	-6.687***	-1.977	-6.687***
IMP	-1.566	-9.052***	-1.580	-8.660***

Note: *,**,*** denote significance at 10%, 5%, and 1%, respectively.

1. Concerning the effect of exchange rate Channel to Inflation

To observe whether exchange rate can effect inflation during various period of time, the co-integration test is utilized and the results suggest that in all period observed, it indicates exchange rate does not carry out the long run relationship with the existed inflation in Indonesia. Such condition is exposed by the forecast error variance shown by Variance decomposition function. Interestingly, during the post implementation of ITF, the innovation of inflation is very low compared with post crisis period, even crisis period. VDC function illustrate that the innovation of inflation was contributed by exchange rate shock just around 3% during pre-crisis, but tending to increase to more less 10% on 30 horizons. In addition, during crisis period it was accounted for around more less 20% on 30 horizons, and during post crisis the VCD shows an outstanding outcome which contributes roughly 75% in inflation rate variation. Meanwhile, during ITF implementation, conversely its contribution is weak and low, just around 1%, (see table 2), also see table 3 in appendix.

According to above estimated results, the present study finds out that we reject the statement states "during the pre-crisis, exchange rate channel does not become an important channel in transmitting monetary policy, meanwhile during the crisis, post crisis, and post-ITF implementation, it is considered as a crux channel, given under the floating exchange rate regime". In particular, in the post crisis period after the implementation of the ITF, the exchange rate channel tends to affect inflation but in a negligible portion, and relatively weak. Therefore, in a nutshell, after implementation of ITF, transmission channel through exchange rate becomes a less powerful to trace and explain the behavior of inflation rate in Indonesia.

2. Concerning the effect of exchange rate channel in explaining existed the direct pass through

Theoretically, the direct pass through is occurred in the form of an exchange rate depreciation which is transmitted through production cost process and accordingly into inflation. Hence, in that context, by examining the integration process, we may ensure on how strong the inflation would arise in the case of depreciation taken place. According to co-integration results, during the crisis as well as post ITF empirically shows significant result. It is meant that depreciation is reported as a threat policy which should be put into account in formulating monetary policy stance. In addition, those effect is obviously corrected by tracing out the VDC table which was during post ITF the innovation of inflation through import variables is quite large and signed with significant portion, namely around 47% in 30 horizons period. Meanwhile, during post, crisis, and pre-crisis, the portion is considered weak, (see table 4) and also see table 5 in appendix.

According to above results, we sum up that (1) the process of direct pass through is higher and considered higher during the post crisis, in particular, post ITF implementation, (2) the exchange rate channel can empirically explain the significant role of direct effect pass through only during post crisis, particularly, post ITF implementation. Therefore, in a nutshell, transmission mechanism through exchange rate channel yet stands as a good signal to expound the process of direct pass through effect in Indonesia.

3. Concerning The Role of Exchange Rate in explaining the Trade Balance Competitiveness

Given a condition in which exchange rate channel is considered very important during pre and post crisis, particularly, transmitting monetary policy under various exchange rate

Table 2. Co-Integration Tests – Trace and Maximum Eigenvalue Tests (NER and INF)

Ho	Trace test				Maximum Eigenvalue test			
	Pre Crisis	Crisis	Post Crisis	Post ITF	Pre Crisis	Crisis	Post Crisis	Post ITF
r=0	14.646	18.328	15.773	6.525	12.368	14.687	13.176	5.545
r<1	2.277	3.641	2.596	0.979	2.277	3.641	2.596	0.979

*,**,*** denote significance at better that 10%, 5%, and 1%

Table 4. Co-Integration Tests – Trace and Maximum Eigenvalue Tests (NER and IMP)

Ho	Trace test				Maximum Eigenvalue test			
	Pre Crisis	Crisis	Post Crisis	Post ITF	Pre Crisis	Crisis	Post Crisis	Post ITF
r=0	15.875	14.851*	14.052	27.274**	12.358	14.848*	12.302	21.596**
r<1	3.516	0.002	1.749	5.678	3.516	0.002	1.749	5.678

Note: *,**,*** denote significance at better that 10%, 5%, and 1%

regime and directed to achieve a desired level of inflation. Looking at trade balance equilibrium, we might have known that export and import would be also affected by some shocks occurred in exchange rate. However, some economists expect that between export and import is co-integrated by econometric point of view so that a country (Indonesia) is not in violation of her international budget constraints, (see table 6), and also table 5 in appendix.

According to above results, they suggest that during various period, between export and import is co-integrated so that we accept above mention condition which states Indonesian economy is not in violation of her international budget constraint and structurally immune from shock, for instance, through exchange rate channel. In a nutshell, exchange rate channel does not give an extra harmful situation to trade balance, during pre as well as post period. In other words, exchange rate channel cannot be used as a good channel to explain trade competitiveness in Indonesia.

CONCLUSION

In general, the study shows that monetary transmission through exchange rate channel has been responded differently. In the post-crisis, notably during post ITP implementation, transmission channel through exchange rate becomes a less powerful tool to trace and guide inflation rate in Indonesia. Transmission mechanism through exchange rate channel yet stands a good signal to explain the process of direct pass through effect in Indonesia. Exchange rate channel does not give an extra harmful situation to trade balance, during pre and post crisis period. In other words, exchange rate channel cannot be used as a good channel to explain trade competitiveness in Indonesia. An appreciation of the exchange rate is more favorable for the Indonesian economy to boost economic growth and to lessen inflationary pressure.

Based on the findings of the study, it can be implied that as direct pass through has a higher magnitude over time, a depreciation of the exchange rate will slow down the economy. The relative high direct pass through, however does not affect the trade balance due to the existence of co-integration between export and import with exchange rate channel. After ITF implementation, exchange rate channel is less powerful to achieve the policy target. Therefore, an appreciation of the exchange rate is more favorable for the Indonesian economy to boost economy growth and to lessen inflationary pressure. Exchange rate appreciation will bring inflation down through its direct pass through effect on production cost. Indeed. At a certain level, it would also support export of manufacturing products with high import content.

Direct pass through is higher in crisis period as well as ITF according to VDC results. It may reflect that Indonesian economy is more

Table 6. Co-Integration Tests – Trace and Maximum Eigenvalue Tests (XP and MP)

Ho	Trace test				Maximum Eigenvalue test			
	Pre Crisis	Crisis	Post Crisis	Post ITF	Pre Crisis	Crisis	Post Crisis	Post ITF
r=0	15.875	14.851*	14.052	27.274**	12.358	14.848*	12.302	21.596**
r<1	3.516	0.002	1.749	5.678	3.516	0.002	1.749	5.678

Note: *,**,*** denote significance at better that 10%, 5%, and 1%.

opened and liberalized over global markets. Therefore, we may view that frankly, the rise of inflation post ITF and later being transmitted into domestic economy through exchange rate channel, which then generates the higher degree of direct pass through effect, is not caused by solely exchange rate role and contribution. However, it has been contributed by state bank as well as private banks which increasingly are expanding their share of the lending market.

Given rigidities in nominal wages, the Mundell-Fleeming postulates that for small open economies, an exchange rate appreciation would hurt exports and encourage imports. In varying degrees, exporters maintain competitiveness in world markets by reducing their profit mark-up in the face of an appreciating currency. However, input-output economies argue that such theory might be irrelevant since exports perhaps depend in also varying degree in imported raw materials and imported intermediate inputs. Therefore, in the case of Indonesia which empirically conveys mostly in all period under observations, in particular, between export and import is serially co-integrated. Hence, we summarize that: (1) In general, the higher the imported input content, the less the impact of exchange rate changes on export. At one extreme, we may suggest that exchange rate changes had no effect on re-exports, (2) Indonesian government has been successfully intertwining between trade policies and exchange rate policies, (3) There is an absence of productivity gap in the economy which means domestic value-added increases. On that reason, we may conclude that exchange rate channel might have not been a powerful channel to gauge the degree of competitiveness in Indonesia economy, notably post-ITF implementation.

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APPENDIX

Table 3. Variance decomposition function between NER and INF

Horizon	Explained by Innovation in NER to INF			
	Pre-Crisis	Crisis	Post-Crisis	Post ITF
2	2.539	15.023	20.647	0.016
4	5.121	22.900	47.042	0.0164
8	7.019	22.633	68.159	0.288
12	7.747	20.521	72.795	0.672
16	8.226	19.783	74.189	0.909
20	8.654	19.854	74.692	1.017
24	9.082	19.972	74.888	1.058
28	9.526	19.988	74.966	1.072
30	9.755	19.982	74.986	1.075

Table 5. Variance decomposition function between NER and MP

Horizon	Explained by Innovation in NER to MP			
	Pre-Crisis	Crisis	Post-Crisis	Post ITF
2	0.141	1.073	0.016	4.558
4	0.220	1.316	0.629	14.105
8	0.228	1.353	4.278	33.574
12	0.227	1.351	7.489	44.379
16	0.227	1.351	9.499	47.316
20	0.227	1.351	10.701	46.661
24	0.227	1.351	11.431	46.183
28	0.227	1.351	11.884	46.569
30	0.227	1.351	12.044	46.822