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Essai empirique sur les conséquences de l'expansion de la liquidité globale dans les pays destinataires

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Essai empirique sur les conséquences de l'expansion de la liquidité globale dans les pays destinataires

Résumé

La liquidité globale est un concept multidimensionnel au cœur d'un important débat tant pour les chercheurs que pour les banques centrales et les autorités prudentielles à travers le monde. En effet, depuis l'article séminal de Baks et Kramer (1999), la liquidité globale est revenue au cœur de l'actualité durant la crise financière de 2008, car les facteurs de son développement ont été considérés comme ayant participé aux développements des déséquilibres précédents la période (Shin, 2011). De plus, avec l'évolution de ses déterminants au cours du temps, l'analyse de son évolution est devenue décisive tant pour les autorités monétaires des pays émetteurs et que celles des pays destinataires.

Face à l'importance des enjeux entourant la liquidité globale et à la nécessité du suivi de son évolution, la Banque des Règlements Internationaux (BIS, 2011) sous l'impulsion du Comité sur le système financier mondial (CGFS, 2011) a synthétisé ses différentes définitions. Ces travaux ont proposé, d'une part, la distinction fondamentale entre les composantes privée et publique de la liquidité globale et, d'autre part, la catégorisation des mesures de la liquidité globale en fonction, premièrement, de ses deux composantes et, secondement, de leur nature. Ainsi, la mise en place de ce cadre d'analyse a été une étape importante dans le débat sur la liquidité globale dans la mesure où il fournit un socle commun aux études ultérieures consacrées aux enjeux de son évolution permettant de comprendre les différentes approches théoriques et empiriques. Si les approches analytiques ont abordé la question de la liquidité globale sous différents angles, la littérature a mis l'accent sur la perspective de la stabilité financière. Celle-ci s'intéresseaux effets de l'expansion de la liquidité globale sur le prix des actifs (Baks et Kramer, 1999 ; Giese et Tuxen, 2007) ainsi que sur les variables domestiques dans les pays émetteurs (Ruffer et Stracca, 2006). La littérature a aussi accordé une attention particulière aux relations entre la dynamique de la liquidité globale et certaines évolutions majeures ayant touché l'économie mondiale, notamment les déséquilibres globaux (Bracke et Fidora, 2006; Forbes et al 2011; Djigbenou et al, 2015), le comportement d'accumulation des

réserves de change des pays émergents asiatiques (Park et al, 2015) et enfin la dynamique des prix des matières premières (Limbergen, 2010 ; Kang et al, 2015). Plusieurs études se sont concentrées sur l'exploration de la dynamique de la liquidité globale en fonction de ces différents cycles et de ses déterminants (Shin et al, 2012 ; Bruno et Shin, 2013 ; Shin et Azis, 2015). Ces études ont mis en évidence l'importance des gestionnaires de fonds et des banques internationales dans la transmission des conditions de la liquidité globale dans les pays émergents. La transmission de ces conditions est au cœur de la littérature récente sur la liquidité globale, notamment à travers la perspective des pays destinataires et tout particulièrement celui des pays émergents avec l'analyse des effets de reports de la liquidité globale sur la stabilité financière des pays destinataires (IMF, 2010 ; Brana et Prat, 2011).

Cette thèse propose une contribution à cette littérature récente, tournée vers la perspective des pays destinataires. Plus précisément, on analyse les conséquences de l'expansion de la liquidité globale dans les économies émergentes. Trois chapitres structurent cette recherche. Le premier chapitre se concentre sur la problématique de l'identification des effets de reports de l'expansion de la liquidité globale dans les pays émergents. Dans un premier temps, nous rappelons les définitions et les mesures de base de la liquidité globale retenue dans le cadre de notre analyse, puis, dans un second temps, les déterminants de la liquidité globale font l'objet d'une investigation. En troisième lieu, nous proposons un cadre théorique de la transmission de l'expansion de la liquidité globale dans les pays émergents à travers ses facteurs d'attractions et de répulsions. Quatrièmement enfin, nous adoptons une analyse économétrique basée sur une modélisation VAR en panel pour mettre en évidence les effets de l'expansion de la liquidité globale sur un échantillon de pays émergents et en voie de développement en hiérarchisant notre analyse en trois étapes : la première est l'analyse d'un modèle global, la deuxième l'étude de modèles régionaux et la dernière l'investigation des effets différenciés ou non de la liquidité globale selon les régimes de change.

Les principaux résultats que nous pouvons retenir de ce chapitre confirment le caractère déstabilisateur de l'expansion de la liquidité globale dans les pays destinataires mis en avant dans la littérature. Ainsi, l'expansion de la liquidité globale tend à exercer une pression à la baisse sur les taux d'intérêt et à la hausse sur les prix des actifs domestiques. De plus, notre approche régionale permet de mettre en évidence les effets différenciés de l'expansion de la liquidité globale avec l'importance des effets sur les pays historiquement destinataires des flux de capitaux tels que les pays émergents asiatiques, les pays sud-

américains et les pays de l'Europe de l'Est. Enfin, l'une des contributions originales du premier chapitre réside dans la distinction de l'échantillon de pays en fonction de leur régime de change. Notre résultat principal ici est de montrer que le choix d'un régime de change fixe ou d'un régime de change flexible par les autorités monétaires importe peu dans la mesure où les deux groupes de pays présentent des résultats similaires au regard de l'expansion de la liquidité globale. Un tel résultat se situe dans la lignée des travaux récents sur ce dilemme *versus* trilemme.

Le deuxième chapitre a comme objectif principal d'identifier les liens entre la tendance à l'accumulation des réserves dans les pays émergents et l'évolution des conditions de la liquidité globale dans les pays émetteurs, principalement dans le principal émetteur d'actif de réserves mondiales, à savoir les États-Unis. Cette démarche d'identification est divisée en trois points. Premièrement, le phénomène d'accumulation des réserves de change dans les pays asiatiques est analysé du point de vue de ses et des imperfections inhérentes au marché des actifs de réserves. Deuxièmement, le chapitre se concentre sur un cadre d'analyse rassemblant les phénomènes de la liquidité globale et l'accumulation de réserves des pays émergents. Troisièmement, en nous basant sur le cadre d'analyse développé précédemment, la dernière partie est consacrée à une étude empirique utilisant la méthodologie VAR structurelle pour analyser les effets de l'accumulation des réserves de changes sur le principal pays émetteur de réserves en adoptant une nouvelle mesure de l'accumulation de réserves et en nous concentrant sur le principal canal de transmission des conséquences de l'accumulation de réserves vers les pays émetteurs. Nous analysons ainsi les effets sur les taux d'intérêt de long terme du pays émetteur, principale mesure de l'évolution des conditions de la liquidité globale, l'évolution des prix de l'immobilier et du prix des actifs, ainsi que la consommation domestique et, enfin, l'évolution du solde courant.

Les principales contributions du chapitre peuvent être résumées en trois points. Il s'agit tout d'abord de l'élaboration d'un cadre d'analyse permettant d'étudier les liens entre la liquidité globale et le phénomène d'accumulation de réserves de change. Ensuite, le principal canal de transmission des effets de l'accumulation vers le pays émetteur de la liquidité globale et des actifs de réserves est identifié. Enfin, la modélisation économétrique adoptée nous permet de mettre en avant les effets déstabilisateurs d'une hausse de la demande en actifs de réserves sur le pays émetteur, en particulier sur le prix des actifs, le solde courant et l'évolution des taux d'intérêt à long terme.

Enfin, le dernier chapitre pose la problématique de l'efficacité des politiques monétaires des pays émergents durant les périodes d'excès de liquidité dans les pays émetteurs de la liquidité globale. Notre approche comprend trois étapes. La première analyse les grandes tendances des politiques monétaires adoptées dans les pays émergents depuis le début des années2000. La seconde étape se concentre sur le concept d'excès de liquidité globale. On cherche tout d'abord à identifier les épisodes d'excès de liquidité globale, puis on s'intéresse à leur influence sur les flux de capitaux vers les pays émergents durant les différentes phases du cycle de la liquidité globale. La troisième et dernière étape du chapitre est consacrée à une étude de cas basée sur l'approche empirique TVP-VAR (*Time-Varying Parameter* VAR) centrée sur l'analyse de l'efficacité des politiques monétaires de six pays émergents présentant des caractéristiques différentes, en termes de choix de politique monétaire par exemple, durant certains épisodes d'excès de liquidité globale durant la période 2000 — 2015.

Les principales contributions du troisième chapitre de la thèse résident dans l'identification des différents épisodes d'excès de liquidité globale. Il convient de souligner que leurs caractéristiques rejoignent les particularités des trois phases de la liquidité globale identifiées dans la littérature. De plus, les phases du cycle de la liquidité globale ont permis d'identifier la nature des flux de capitaux vers les pays émergents durant les périodes d'excès de liquidité et dont les implications ont motivé le choix de la création de plusieurs indicateurs dans notre analyse. Enfin, l'estimation empirique est consacrée à l'analyse de l'expansion de la liquidité globale sur l'efficacité de la politique monétaire dans les économies réceptrices. Cette analyse, conduite dans chaque pays pris individuellement, nous permet d'établir une hiérarchisation en fonction de cette efficacité à stériliser les flux de liquidités entrants. Une attention est accordée aux objectifs de politique monétaire adoptés et à leur évolution au cours de la période.

Mots-clés : Liquidité globale, Économies émergentes, Effets de débordements, VAR en panel, VAR bayésien, VAR structurels

Empirical essay on the global liquidity spillovers on receiving countries

Abstract

Global liquidity is a multidimensional concept at the center of an important debate for academics as well as for central banks and prudential authorities around the world. Indeed, since the seminal paper by Baks and Kramer (1999), global liquidity developments catch once again the attention during the financial crisis of 2008 because the factors of its expansion are considered in the literature as having contributed to the development of vulnerabilities prior to the pre-crisis period (Shin, 2011). Moreover, with the evolution of its determinants over time, monitoring the global liquidity evolution has become decisive for the monetary authorities of the issuing and receiving countries.

Given the importance of global liquidity issues and the need to monitor their evolution, the Bank for International Settlements (BIS, 2011) and the Committee on the Global Financial System (CGFS, 2011) synthesized the different existing definitions of global liquidity in the literature. The main contribution of the study was to propose the fundamental distinction between the private and public components of aggregate liquidity. They also introduced the classification of global liquidity's measures by distinguishing the various measures used in the literature in view of the two components of global liquidity according to their nature, quantity indicators or price indicators. While both theoretical and empirical approaches have addressed the issue of global liquidity's expansion from different viewpoints, the literature mainly focused on the financial stability perspective by focusing on the spillovers on interest rates and asset prices (Baks and Kramer 1999, Giese and Tuxen, 2007); and, in a lesser extent, domestic variables in the issuing countries (Ruffer and Stracca, 2006). The literature has also focused on the relationship between the dynamics of global liquidity and particular major developments affecting the global economy, including global imbalances (Bracke and Fidora, 2006, Forbes et al 2011, Djigbenou et al, 2015) and the hoarding reserves in Asian emerging countries (Park et al., 2015) and finally the dynamics of commodity prices (Limbergen, 2010, Kang et al., 2015). Several studies have focused on exploring the dynamics of global liquidity in relation to these different cycles and determinants (Shin et al., 2012, Bruno and Shin, 2013, Shin and

Azis, 2015). The latter studies have highlighted the importance of global fund managers and international banks in the transmission of global liquidity conditions in emerging countries. The transmission of these conditions is at the center of the recent literature on global liquidity, particularly from the perspective of the receiving countries and especially that of the emerging countries with the analysis of the spillovers of global liquidity considering the financial stability perspective of the receiving economies (IMF, 2010, Brana and Prat, 2011).

This Ph.D. thesis proposes a contribution to this strand of literature, turned towards the perspective of the receiving countries. More specifically, we analyze the consequences of the global liquidity's expansion in the emerging economies. Three chapters structure this research.

The first one focuses on the problem of identifying the spillovers of the global liquidity in the emerging countries. First, we recall the definitions and basic measures of the global liquidity, and then, we investigate the determinants of global liquidity. Third, we propose a theoretical framework for the transmission of the global liquidity in emerging countries through its factors "Push" or "Pull" channels. Fourth, we adopt an econometric analysis based on the Panel VAR (PVAR) methodology to highlight the spillovers on a sample of emerging and developing countries by adopting a three steps analysis. The first step relies on the benchmark global model analysis; the second steps of regional models and the last investigation of the differentiated or non-differentiated effects of global liquidity under exchange rate regimes. The main contributions we can learn from this chapter confirm the destabilizing consequences of the global liquidity in the receiving countries joining the main results of the literature. Thus, global liquidity's expansion tends to exert downward pressure on interest rates and upward pressure on domestic asset prices. In addition, our regional approach to highlight the existence of substantial differences between our groups of countries. Finally, one of the original contributions of the chapter relies on the distinction of our sample of countries regarding their exchange rate regime. Accordingly, our main finding shows that the choice of a fixed exchange rate regime or a flexible exchange rate regime does not matter as both groups of countries show similar results regarding the global liquidity's expansion. Such a result is in line with the recent literature on dilemma *versus* trilemma.

The main objective of the second chapter is to identify the links between the hoarding reserves behavior in the Asian emerging countries and changes in the conditions of global liquidity in the main issuing countries. This identification process is divided into three

points. First, the phenomenon of reserve accumulation in Asian countries is analyzed considering the existing imperfections on the reserve market. Secondly, the chapter focuses on an analytical framework combining the phenomena of global liquidity and the reserve accumulation behavior. Third, based on the analytical framework developed above, the last part is devoted to an empirical study using the Structural VAR (SVAR) methodology to analyze the effects of the accumulation of foreign exchange reserves on the main reserving country by adopting a new measure of reserves accumulation and focusing on the main channel of transmission of the consequences of the accumulation of reserves to the issuing countries. We analyze the effects on the long-term interest rates of the issuing country, the main measure of changes in global liquidity conditions, changes in real estate prices and asset prices, as well as consumption and finally the evolution of the current account.

The main contributions of the chapter can be summarized into three points. Firstly, we propose an analytical framework for examining the relations between global liquidity and the phenomenon of reserve accumulation. Then, the analysis identifies the main channel of transmission of the reserves accumulation behavior to the main issuing country of global liquidity and reserves asset. Finally, the econometric methodology allows us to highlight the destabilizing effects of the surge in the demand for reserves assets to the main issuing country, in particular on asset prices, the current account balance and the long-term interest rates.

Finally, the third chapter raises the question of the monetary policy's effectiveness in the emerging countries during periods of global excess liquidity. To answer our general problematic, the chapter is divided into three parts. The first part analyzes the main trends in monetary policies adopted in emerging countries since the early 2000s. The second part focuses on the concept of excess global liquidity, identifies the episodes of excess global liquidity and analyzes their influence on capital flows to emerging countries considering the global liquidity cycle. The third part of the chapter is devoted to a country case study based on the Time-Varying Parameter VAR (TVPVAR) empirical approach by focusing on analyzing the effectiveness of monetary policy in six emerging countries with different characteristics during selected episodes of excess global liquidity during the period 2000 - 2015.

The main contributions of this chapter lie in the identification of the episodes of global excess liquidity and their characteristics are in line with the characteristics of the three phases of global liquidity identified in the literature. In addition, the phases of the global liquidity cycle have made possible to identify the nature of capital flows to emerging

countries during periods of excess liquidity and whose implications have motivated the choice of the creation of several indicators in our analysis. Finally, the empirical methodology is dedicated to model the selected countries monetary policy's effectiveness during the period in view of the episodes of global excess liquidity. This analysis allows us to establish a hierarchy amongst the countries in our sample according to the global excess liquidity pass-through into their economies.

Keywords: Global liquidity, Emerging countries, Spillovers, Panel VARs, Structural VAR, TVP-VAR

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Introduction

La liquidité globale est un concept multidimensionnel au cœur d'un important débat académique tant pour les chercheurs que pour les banques centrales et les autorités prudentielles à travers le monde. En effet, depuis l'article séminal de Baks et Kramer (1999) concernant à la fois sa conceptualisation et les conséquences de son expansion, la liquidité globale est souvent revenue au cœur de l'actualité, particulièrement durant la crise financière mondiale de 2008. Plus précisément, les facteurs de son développement ont été considérés dans la littérature comme ayant participé aux développements des déséquilibres ayant conduit à la crise financière de 2008 (Shin, 2011). De plus, avec les changements de ses déterminants au cours du temps (Shin et Azis, 2015), l'analyse de son évolution s'avère décisive pour les autorités monétaires à la fois des pays émetteurs et des pays destinataires. Dans les deux cas, l'objectif est de contenir les effets domestiques liés aux conditions de la liquidité globale.

Face à l'importance des enjeux entourant la liquidité globale et à la nécessité du suivi de son évolution, la Banque des règlements internationaux (BIS, 2011), ainsi que le Comité sur le système financier mondial (CGFS, 2011) ont synthétisé les différentes définitions de la liquidité globale. L'apport important de ces travaux a été de proposer la distinction fondamentale entre les composantes privée et publique de la liquidité globale. Cette démarche d'uniformisation se retrouve aussi du point de vue de la catégorisation des mesures de la liquidité globale entreprise par la BRI en distinguant les différentes mesures employées dans la littérature en fonction, d'une part, des deux composantes de la liquidité globale, et, d'autre part, en fonction de leur nature dont des indicateurs de quantités et des indicateurs de prix. Ainsi, la mise en place de ce cadre d'analyse est une étape importante dans le débat sur la liquidité globale dans la mesure où il fournit un socle commun aux études ultérieures consacrées aux enjeux de l'évolution de la liquidité globale permettant de comprendre les différentes approches théoriques et empiriques sur le phénomène. Si les approches analytiques ont abordé la question de la liquidité globale sous différents angles, la littérature a mis l'accent sur la perspective de la stabilité financière. Celle-ci s'intéresse aux effets de l'expansion de la liquidité globale sur le prix des actifs (Baks et Kramer, 1999 ; Giese et Tuxen, 2007) ainsi que sur les variables domestiques dans les pays émetteurs (Ruffer et Stracca, 2006). La littérature a aussi accordé une attention particulière aux relations entre la

dynamique de la liquidité globale et certaines évolutions majeures ayant touché l'économie mondiale, notamment les déséquilibres globaux (Bracke et Fidora, 2006 ; Forbes et al 2011 ; Djigbenou et al, 2015), le comportement d'accumulation des réserves de change des pays émergents asiatiques (Park et al, 2015) et enfin la dynamique des prix des matières premières (Limbergen, 2010 ; Kang et al, 2015). Plusieurs études se sont concentrées sur l'exploration de la dynamique de la liquidité globale en fonction de ces différents cycles et de ses déterminants (Shin et al, 2012 ; Bruno et Shin, 2013 ; Shin et Azis, 2015). Ces études ont mis en évidence l'importance des gestionnaires de fonds et des banques internationales dans la transmission des conditions de la liquidité globale dans les pays émergents. La transmission de ces conditions est au cœur de la littérature récente sur la liquidité globale, notamment à travers la perspective des pays destinataires et tout particulièrement celui des pays émergents avec l'analyse des effets de reports de la liquidité globale sur la stabilité financière des pays destinataires (IMF, 2010 ; Brana et Prat, 2011).

Cette thèse propose une contribution à cette littérature récente, tournée vers la perspective des pays destinataires. Plus précisément, on analyse les conséquences de l'expansion de la liquidité globale dans les économies émergentes. Trois chapitres structurent cette recherche.

Le premier chapitre se concentre sur la problématique de l'identification des effets de reports de l'expansion de la liquidité globale dans les pays émergents. Dans un premier temps, nous rappelons les définitions et les mesures de base de la liquidité globale retenue dans le cadre de notre analyse, puis, dans un second temps, les déterminants de la liquidité globale font l'objet d'une investigation. En troisième lieu, nous proposons un cadre théorique de la transmission de l'expansion de la liquidité globale dans les pays émergents à travers ses facteurs d'attractions et de répulsions. Quatrièmement enfin, nous adoptons une analyse économétrique basée sur une modélisation VAR en panel pour mettre en évidence les effets de l'expansion de la liquidité globale sur un échantillon de pays émergents et en voie de développement en hiérarchisant notre analyse en trois étapes : la première est l'analyse d'un modèle global, la deuxième l'étude de modèles régionaux et la dernière l'investigation des effets différenciés ou non de la liquidité globale selon les régimes de change.

Les principaux résultats que nous pouvons retenir de ce chapitre confirment le caractère déstabilisateur de l'expansion de la liquidité globale dans les pays destinataires mis en avant dans la littérature. Ainsi, l'expansion de la liquidité globale tend à exercer une pression à la baisse sur les taux d'intérêt et à la hausse sur les prix des actifs domestiques. De plus, notre approche régionale permet de mettre en évidence les effets différenciés de l'expansion de la liquidité globale avec l'importance des effets sur les pays historiquement destinataires des

flux de capitaux tels que les pays émergents asiatiques, les pays sud-américains et les pays de l'Europe de l'Est. Enfin, l'une des contributions originales du premier chapitre réside dans la distinction de l'échantillon de pays en fonction de leur régime de change. Notre résultat principal ici est de montrer que le choix d'un régime de change fixe ou d'un régime de change flexible par les autorités monétaires importe peu dans la mesure où les deux groupes de pays présentent des résultats similaires au regard de l'expansion de la liquidité globale. Un tel résultat se situe dans la lignée des travaux récents sur le dilemme *versus* trilemme.

Le deuxième chapitre a comme objectif principal d'identifier les liens entre la tendance à l'accumulation des réserves dans les pays émergents et l'évolution des conditions de la liquidité globale dans les pays émetteurs, principalement dans le principal émetteur d'actif de réserves mondiale, à savoir les États-Unis. Cette démarche d'identification est divisée en trois points. Premièrement, le phénomène d'accumulation des réserves de change dans les pays asiatiques est analysé du point de vue de ses et des imperfections inhérentes au marché des actifs de réserves. Deuxièmement, le chapitre se concentre sur un cadre d'analyse rassemblant les phénomènes de la liquidité globale et l'accumulation de réserves des pays émergents. Troisièmement, en nous basant sur le cadre d'analyse développé précédemment, la dernière partie est consacrée à une étude empirique utilisant la méthodologie VAR structurelle pour analyser les effets de l'accumulation des réserves de changes sur le principal pays émetteur de réserves en adoptant une nouvelle mesure de l'accumulation de réserves et en nous concentrant sur le principal canal de transmission des conséquences de l'accumulation de réserves vers les pays émetteurs. Nous analysons ainsi les effets sur les taux d'intérêt de long terme du pays émetteur, principale mesure de l'évolution des conditions de la liquidité globale, l'évolution des prix de l'immobilier et du prix des actifs, ainsi que la consommation domestique et, enfin, l'évolution du solde courant.

Les principales contributions du chapitre peuvent être résumées en trois points. Il s'agit tout d'abord de l'élaboration d'un cadre d'analyse permettant d'étudier les liens entre la liquidité globale et le phénomène d'accumulation de réserves de change. Ensuite, le principal canal de transmission des effets de l'accumulation vers le pays émetteur de la liquidité globale et des actifs de réserves est identifié. Enfin, la modélisation économétrique adoptée nous permet de mettre en avant les effets déstabilisateurs d'une hausse de la demande en actifs de réserves sur le pays émetteur, en particulier sur le prix des actifs, le solde courant et l'évolution des taux d'intérêt à long terme.

Enfin, le dernier chapitre pose la problématique de l'efficacité des politiques monétaires des pays émergents durant les périodes d'excès de liquidité dans les pays émetteurs de la liquidité

globale. Notre approche comprend trois étapes. La première analyse les grandes tendances des politiques monétaires adoptées dans les pays émergents depuis le début des années 2000. La seconde étape se concentre sur le concept d'excès de liquidité globale. On cherche tout d'abord à identifier les épisodes d'excès de liquidité globale, puis on s'intéresse à leur influence sur les flux de capitaux vers les pays émergents durant les différentes phases du cycle de la liquidité globale. La troisième et dernière étape du chapitre est consacrée à une étude de cas basée sur l'approche empirique TVP-VAR (*Time VaryingParameter* VAR) centrée sur l'analyse de l'efficacité des politiques monétaires de six pays émergents présentant des caractéristiques différentes, en termes de choix de politique monétaire par exemple, durant chaque épisode d'excès de liquidité globale durant la période 2000 — 2015.
Les principales contributions du troisième chapitre de la thèse résident dans l'identification des différents épisodes d'excès de liquidité globale. Il convient de souligner que leurs caractéristiques rejoignent les particularités des trois phases de la liquidité globale identifiées dans la littérature. De plus, les phases du cycle de la liquidité globale ont permis d'identifier la nature des flux de capitaux vers les pays émergents durant les périodes d'excès de liquidité et dont les implications ont motivé le choix de la création de plusieurs indicateurs dans notre analyse. Enfin, l'estimation empirique est consacrée à l'analyse de l'expansion de la liquidité globale sur l'efficacité de la politique monétaire dans les économies réceptrices. Cette analyse, conduite dans chaque pays pris individuellement, nous permet d'établir une hiérarchisation en fonction de cette efficacité à stériliser les flux de liquidités entrants. Une attention est accordée aux objectifs de politique monétaire adoptes et à leur évolution au cours de la période.

Chapter 1
Global liquidity spillovers on emerging and developing countries

1.1. Introduction

Usually, *global liquidity* is a concept associated with the overall "ease of financing" in the major economies. However, despite its widespread usage, this hypothesis remains without a consensual definition. Specifically, the dramatic increase in global liquidity has been at the center of the debates between economists and policy-makers mainly because it has been proffered as a possible explanation for the financial developments in the last decade, especially those prior to the 2008 financial crisis. Global liquidity exerts an influence on international financial stability since its components are correlated to macroeconomic and financial developments such as strong increases in global monetary and credit aggregates, low bond yields, rising asset prices, commodity prices, and real estate booms (ECB, 2012). Especially during the pre-financial crisis period, monetary authorities further eased monetary conditions by drastically lowering the interest rates; some authors (Taylor, 2012, 2014; Hofman and Bilyana, 2012) argued that interest rates deviated from the Taylor rates, allowing the growth of global liquidity influence. This "great deviation" fueled the development of global liquidity conditions, leading to a major financial crisis that drove the global economy into a major recession. Furthermore, policies adopted by monetary authorities to mitigate the crisis have led to an additional increase in the global liquidity conditions. Indeed, major central banks decreased their policy rates to historic lows and as policy rates attained the zero bound level, central banks adopted unconventional monetary policies, particularly through quantitative easing, which allowed the global liquidity's question to be still relevant. Among economists and policy makers, the debate on the global liquidity focuses particularly on its transmission mechanisms from advanced countries to receiving economies (IMF, 2010; BIS, 2011) and their destabilizing effects on the receiving economies (Baks and Kramer, 1999). A specific strand of the literature, particularly important in the aftermath of the financial crisis, focuses on spillover effects on emerging countries (IMF, 2010; Brana and Prat, 2011) and this study is related to this topic. We contribute to the literature by using an innovative approach to the spillover effect issue, introducing new macroeconomic variables and advanced

econometric methodology to assess the consequences of the global liquidity expansion on the economy of these receiving countries.

The rest of this paper is structured as follows. Section 1 proposes a definition of global liquidity and explains its measure. In section 2, the determinants of global liquidity are investigated. Section 3 is dedicated to the channels by which global liquidity exerts an influence on other countries. In section 4, we investigate the spillover effects of global liquidity expansion by focusing on emerging economies. A last section concludes.

Specifically, in order to identify the consequences of global liquidity from the perspective of the emerging countries, section 1 to section 3 allow us to define an appropriate framework for our analysis, including a consensual definition for the concept of global liquidity; construction of global liquidity indicators specific to developed countries and their evolution throughout the chosen period; the evaluation of potential sources of global liquidity in both developed and emerging countries; and finally, the identification of transmission channels to receiving economies. In section 4, we investigate the related literature on the topic; then we examine the consequences of global liquidity in the emerging countries by applying a PVAR methodology. For this purpose, we implement 3 types of models: first, we construct a benchmark model using all the countries of our sample. Second, we analyze the effects on regional models. Third, we examine the effects of global liquidity according to the exchange rate regime. Finally, we use an alternative measure of global liquidity as robustness checks.

1.2. The global liquidity: definition and measure

The concept of global liquidity was defined for the first time by Baks and Kramer (1999). However, it remains a rather vague concept without consensual definition. The definition adopted in this work is based on BIS (2011) and ECB (2012) that provide a provisional definition summarizing the different approaches used in previous studies. We focus on the financial stability approach of global liquidity by distinguishing global liquidity into two components: official liquidity and private liquidity. However, a second approach of the global liquidity exists, which particularly focuses on its effects on consumer prices and inflation from a monetary policy perspective by considering two other components of global liquidity, via monetary liquidity and financial market liquidity.

1.2.1. Basic considerations

The official or public liquidity is defined, as the funding that is unconditionally available to settle claims through monetary authorities. Basically, it implies the monetary base including currency and reserved requirements of the banking sector at the central bank. This form of liquidity evolves only from the regular monetary operations and policy intervention of the monetary authorities in the money market.

Several tools are available to obtain the official liquidity in foreign currency; the most frequently used is the central bank reserve-accumulating policy. Secondly, the use of swap lines between banks has also turned out to be one of the methods used to obtain official liquidity. Finally, the last possibility is through monetary instruments such as the IMF's special drawing rights. It is important to note that using these monetary instruments is subject to certain conditions; for example, the use of SDR for an exchange against a certain amount of local currency is limited. Moreover, these instruments do not contribute to the process of money creation but are only means to use official liquidity.

It is important to note that there is a fundamental difference between official domestic liquidity and official "global" liquidity. From a domestic point of view, the official liquidity is endogenous because the central bank is the only institution that can provide this type of liquidity using monetary creation and it can be extended indefinitely according to the objectives of monetary authorities. At an international level, the creation of global official liquidity is exogenous for "non-reserve currency countries" since they rely on access to "major currencies" and their evolution depends on the monetary policies of these issuing countries.

The private liquidity is defined as the global liquidity component produced by the private sector, essentially by financial intermediaries.

At domestic level, financial intermediaries create private liquidity by issuing safe and redeemable liabilities against long-term risky assets using maturity transformation.As risks due to the transformation process are not fully internalized by banks, profits generated by this activity leads to built-in incentives to create excess private liquidity(Stein, 2011). In turn, this situation can generate liquidity mismatch (Brunnermeier et al., 2013) and lead to endogenous risk through the possibility of runs. The financial intermediaries' maturity transformation activities are unstable and their fragility can be compensated by financial regulation and supervision during stable periods and providing liquidity through the lender of last resort during a financial crisis.

At global level, with international financial integration, a similar transformation process is observed. The global private liquidity is mostly created through financial intermediaries' cross-border activities such as cross-border credit and foreign currency lending. According to BIS (2010) and the Committee on the global financial system (2011), private liquidity depends on the willingness of counterparties to extend credit or take risk against each other at the domestic or global level. Domestic and global private liquidity are subject to aggregate supply and demand shocks with sudden shift in risk aversion and liquidity preference, which are the results of leveraging and deleveraging by private sector.

Moreover, global private liquidity involves cross-border liquidity and maturity transformation that provides more complexity and creates more fragilities than pure domestic private liquidity because it needs currency transformation. It is also influenced by the multiplicity of decentralized monetary and regulatory decisions, which explains why cross-border liquidity can be more sensitive than domestic liquidity. In turn, this situation may generate powerful amplification mechanisms during a financial crisis, which might be difficult to predict.

Finally, private liquidity can be converted into official liquidity through foreign exchange interventions and exceptionally, such as during the last financial crisis, through dollar facilities implemented by foreign central banks via currency swaps. The substitution between private and official liquidity is essential for any financial system because in essence, private liquidity can expand indefinitely as long as financial intermediaries are willing to fund each other. The main problem arises during financial crises; when private liquidity is not available and the global liquidity is reduced to its official component, the question is whether official liquidity can compensate or substitute the scarcity of private liquidity.

1.2.2. Measurement

For the purposes of our analysis, we construct several indicators measuring global liquidity conditions. Numerous empirical indicators can be used as global liquidity indicators, especially those derived from money and credit aggregate, which are the fundamental methods used in previous studies. The indicators are essentially based on narrow monetary aggregates (typically banknotes and coins plus highly liquid bank deposits) or based on broad monetary aggregates that also include less liquid bank deposits and marketable instruments issued by monetary financial institutions). The narrow monetary aggregate has the advantage of homogenous components across economies, rendering the resulting measure is thus easier to interpret. On the other side, broad monetary aggregates provide a less volatile structure of

monetary growth in individual economies, as they internalize substitution among the different liquid assets. The main argument over choosing the broad monetary aggregates is its capacity to capture both public and private liquidity through the monetary and market liquidity conditions. So the broader the monetary aggregates are, the greater its capacity to measure the global liquidity conditions.

Two quantity-based indicators are used in this study using broad money and narrow monetary aggregates. Such indicators are in line with previous related literature.

The first indicator developed by Baks and Kramer (1999) is the sum of the broad money of the advanced countries in US dollar expressed as:

$$GL_1 = \sum_{i=1}^{4} \left(\frac{M^i}{S_i} \right)$$

Where M_i represents the monetary aggregates (narrow or broad money) and S_i is the exchange rates between the local currency and the dollar.

The second indicator is a GDP weighted global liquidity indicator that expresses the hypothesis of the existence of global excess liquidity. It is defined as the ratio between narrow or broad money aggregates and nominal aggregate GDP of advanced economies. This alternative indicator is used by Ruffer and Stracca (2006):

$$GL_2 = \sum_{i=1}^{4} \left(\frac{M^i}{GDP^i} \right) \cdot \frac{1}{S_i}$$

1.2.3. Overview of the 2000-2014 global liquidity expansion

In this sub-section, we undertake an historical analysis of global liquidity centered on the indicators we have previously developed and on Shin's framework **(**2012, 2013) regarding the identification of the two phases in the global liquidity cycle during the period 2000-2014.

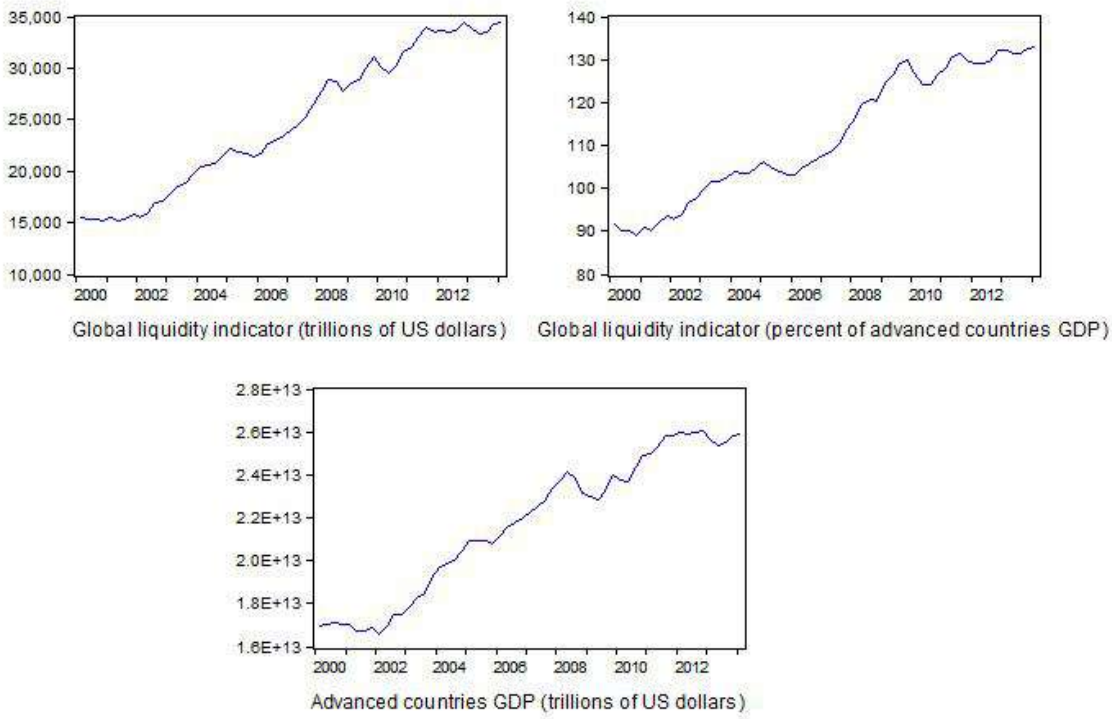
The first phase of global liquidity starts in early 2000 following the burst of the Internet bubble in developed countries and ends with the advent of the global financial crisis (GFC). Several factors could explain the surge of global liquidity during this period, mainly the determinants that affect the evolution of its components. With reference to the public component, this first phase is marked by the prevalence of Federal Reserve engagements upon the developments of global public liquidity component. This phase is characterized by a period of consecutive accommodative monetary policy, easing monetary conditions and decreasing key policies rates, especially after the burst of the dot.com bubble that pushed the

Fed and the Bank of Japan (BOJ) to adopt such policies to overcome the effects of the crisis. Consequently, between 2001 to 2003, the key policies rates decreased from 6,5% to 1% in the US and the BOJ decreased their interest rates to 0.15% until 2006. The European central Bank (ECB) and Bank of England (BOE) have also experienced some cycles of easing and tightening of their monetary conditions, especially between 2001 and 2005 when the ECB adopted an accommodative monetary policy following the introduction of the euro currency. These consecutive decreases of key policy rates and monetary easing by central banks have contributed to increase the influence of global public liquidity component. Concerning the private global liquidity's component, its main growth driver is the international banks leverage, involving the European banks intermediating US dollars credit developed by Shin (2012) under the "global banking glut" phenomenon. The amplification of these international banks activities, especially through the shadow banking system has contributed to the continuous rise of the global liquidity indicator during this phase, which led to the global financial crisis. Hence, during the first phase, the global liquidity indicator rose from 89%, following the burst of the dotcom bubble, to 114% of G4 GDP in 2007 4th quarter.

In the third quarter of 2008, Lehman Brothers bankruptcy initiated the global financial crisis, which was characterized by a breakdown of the global private liquidity component. This situation has reduced global liquidity solely to its public component. At the peak of the crisis, the public component is essentially determined by the combined actions of the central banks in advanced economies to counter the effects of the financial crisis, particularly through the implementation of a zero interest rate policy and a general decrease in policy rates, the easing of the monetary conditions and finally an unconventional monetary policy through quantitative easing, adopted initially by the Fed (September 2008) and then by the BOE (march 2009). Consequently, these central banks interventions to support both financial and real economic spheres have led to a continuous increase of the global liquidity indicator during the crisis building up from 114% of GDP in the first quarter of 2008 to 130% of GDP in 2009 despite a lower contribution of private liquidity and a decline of economic activities in developed countries.

The second phase of global liquidity began roughly from early 2010, following monetary policy decisions of advanced economies to avoid recession**.** For this purpose**,** the Fed implemented the first quantitative easing (Q1) that consisted in acquiring 1.7 trillion dollars of toxic assets. During this phase, the global public liquidity component is influenced mainly by two factors including maintaining a zero rate policy over a long period (keeping the policy rates between 0% and 0.25% for the Fed, 1% for ECB, 0.5% for BOE and 0.1% for BOJ) with

the objective of reassuring the financial markets. The second factor influencing the evolution of the global public liquidity component is the launch of a quantitative easing program by monetary authorities in several advanced economies, especially in the United States (Q2 and Q3) and in the UK. Recourse to unconventional monetary policy was mostly conducted by the Fed, complemented by two more quantitative easing programs between 2010 and 2011 in order to self-finance US public debts (acquisition of 1 trillion public debts). By 2012, the Fed had engaged its third quantitative easing program (a purchase of 85 billion of assets per month) with the aim of keeping long-term interest rates at low level and promoting economic recovery. Regarding the private component of global liquidity; this component's main driver since early 2010 lies in the long-term investors' attitude in seeking for better yield prospects through bond market investments in emerging countries. In particular, Asian bond markets experienced large capital inflows that led to an increase in the share of foreign bondholders in local currency and in holdings of sovereign bond of international banks. These quantitative easing policies and global investors' behavior in the EME's bond markets contributed to the continuous rise of the global liquidity indicator during this second phase of the cycle. Hence global liquidity went from 130% to 133% of GDP G4 between the first quarter of 2010 and first quarter 2014, despite a decrease of 5% during 2010.



Sources: IMF, Macrobond and author's calculations

Figure1.1: Global liquidity indicators and advanced economies GDP

1.3. Determinants of global liquidity

The global liquidity is mainly grasped through international capital flows (in the form of international credits and foreign currency lending) resulting from economic behavior in both issuing and receiving countries (Landau, 2013). Specifically, the interactions between the actors of private and the public sector (ECB, 2011) exert also an influence on changes in global liquidity. According to literature, the conditions of global liquidity depend on the interaction of three major factors: macroeconomic factors (growth, monetary policy, exchange rate regime, current account, etc.), regulation policy, and financial factors influencing the behavior of financial intermediaries (financial innovation, risk appetite).

1.3.1. Macroeconomic factors

Regarding macroeconomic factors, the monetary policy adopted by central banks is an important determinant of credit and money growth at domestic and global levels. It determines short-term interest rates and influences risk-free yield curves through expectations about the future evolution of policy rates. The risk free yield curves will in turn influence the interbank interest rates and asset prices, including risk premiums reflecting market specific risks, counterparty risks and risk appetite. The level of interest rates also affects the growth rates of private liquidity and liquidity conditions in the economy. Lastly, low long-term interest rates influence private liquidity growth by encouraging search for yield behavior in financial markets through incentives for cross-country activities and cross currency investment strategies. This situation can lead to over-optimistic risk perceptions and high-risk tolerance, which can lead to mispricing of assets.

An additional significant macroeconomic factor is the choice of exchange rate regime, in so far as they explain the transmission of monetary stimuli across currency areas. However, monetary impacts tend to differ depending on the exchange rate regimes. On one hand, flexible exchange rates mitigate the transmission of policy spillovers and reduce capital flows through exchange rates variations. In other words, previous mechanisms suggest that floating regimes limit the effects of global liquidity on receiving countries. On the other hand, countries with fixed regimes encounter more difficulties to face foreign currency's monetary policy stance, particularly in the context of international financial integration. Indeed, the exchange rate rule implies that authorities must manage official exchange reserves in order to

contain appreciation or depreciation pressures on the domestic currency. The important point is that unless such interventions are sterilized, they exert an influence on domestic monetary aggregates. In addition, as suggested by the Asian crisis in 1997-98, from the private agents' point of view, fixed regimes play as an implicit insurance against exchange rate risks, leading to accumulate open positions in terms of an active lending and borrowing. This situation may be a source of systemic risk if the currency peg is abandoned (Chang and Velasco, 1998). However, as recently stressed by Rey (2013) flexible regime does not fully isolate the country from the spillover effects due to foreign macroeconomic and liquidity conditions since there are strong international asset market linkages among advanced countries with floating currencies. Besides, it affects both fixed and flexible exchange rate regimes by amplifying surge of capital inflows causing credit growth and asset prices appreciation. The exchange rate regime factor is important to the extent that it may trigger or exacerbate financial boom–bust cycles. Overall, the degree of exchange rate flexibility may affect the strength and propagation of global liquidity spillovers on credit and liquidity creation in the receiving economies.

One of the significant factors affecting global liquidity conditions is global imbalances. Until 2014, we observed that there was widening of the current account deficit of the advanced countries, particularly the United States. On the other side, many emerging economies are experiencing current account surplus and build up large foreign exchanges reserves to prevent the appreciation effect of capital inflows on their exchange rate. Their investments strategies are based on buying low-risks instruments, such as US treasury securities or dollar deposits, leading to downward pressure on long-term interest rates. In view of the strong linkages between bond markets of the advanced economies, the low levels of interest rates in the United States also have a spillover effect in other major markets. These two effects combined, the widening of global imbalances and the feedback loop on asset prices and interests rates affect global liquidity conditions.

1.3.2. Financial regulation policies

Before the subprime crisis, regulation policy in advanced countries focused mainly on micro prudential supervision, which was essentially focused on bank solvability (Basle ratio). However, financial intermediaries are not subject to the same prudential regulation and there are regulation hierarchies between them; banks are the most subject to regulation, particularly after the global financial crisis.

These differences in supervision between financial intermediaries induce more risk taking behavior from the intermediaries that are less regulated (hedge funds, for instance). This behavior affects the global liquidity conditions through surges in private liquidity, principally produced by portfolio investment on the financial markets. Moreover, regulations and supervision differences across countries may be a strong determinant of global private liquidity growth in the advanced countries through the channel of cross-border activities. Furthermore, with the diversification of bank's activities and the emergence of financial conglomerates, global banks have circumvented the regulations through the securitization activity, which has permits to overcome the solvability requirements. This situation led to a strong credit growth during the pre-crisis period and induced the development of global private liquidity. However, since the crisis, coordinated efforts to reduce the scope for regulatory arbitrage could help mitigate these risks.

1.3.3. Financial factors

There are well-funded reasons for the existence of common global financial factors that affect individual country's private liquidity trends. According to BIS committee there are three financial factors that drive the global private liquidity conditions, which in turn affect the evolution of global liquidity.

First of all, financial integration promotes greater cross-border financing flows and facilitates access to new financial products across jurisdictions and countries. In addition, the degree of financial integration has an impact on global liquidity through the spillover effects of domestic liquidity into other economies. Over the last decades, financial markets in advanced economies and EME's have become better integrated at the global level, which has reduced information asymmetries. In turn, it enhanced cross-border financial flows and more importantly, increased the diversity of investors. These combined effects had a positive impact on global private liquidity conditions. At the same time, there has been a positive feedback effect as the increase of private liquidity[1] itself attracted new participants since the endogenic hypothesis of liquidity.

Second, financial innovation has brought new financial instruments that create new means of payment or enhance market liquidity trends. A major example of this liquidity enhancing effect of financial innovation is the securitization process that involves the transformation of

[1] Particularly market liquidity.

illiquid assets into liquid assets via special purpose vehicle. So, the large cross border investments of global bank in securitized products illustrate how financial innovation may improve global liquidity conditions in a sense that it leads to an increase in risk sharing and hedging possibilities between the market participants, which in turn is a great incentive to increase transactions at a global level.

Third, market participants' risk appetite is the last financial factor that influences global liquidity conditions, especially its private liquidity components. The cyclic behavior of risk appetite is a well-known empirical regularity. Accordingly, sudden shifts in risk appetite or liquidity preference are associated with changes in leverage that can amplify liquidity cycles by intensifying liquidity surge during the upswing phase and liquidity shortage during downswing phase of the market cycle. The representative example of this fact is the expansion of international banking, which is closely correlated with fluctuations in attitudes towards risk. So, periods of rising risk appetite tend to be associated with swelling balance sheets, rising leverage and increasing dependence on short term funding, particularly wholesale funding, in the banking sector. When external shocks occur, it results in sudden withdrawal of the critical funding, and consequently concerns about liquidity rapidly become concerns about solvency. In this period of stress, market participants become more reluctant to transact with one another, it can be explained by their struggle to reduce their leverage in an environment of collapsing risk appetite, heightened counterparty risk and vanishing market liquidity which can amplify negative liquidity shocks. Moreover, this situation of market and funding liquidity shortages tends to correlate with surges in financial market volatility.

1.4. Global liquidity transmissions channels

In the previous sections, we argued that there are specific factors that explain the surges in global liquidity, but we did not investigate its consequences yet. From the financial stability perspective, the primary objective is to analyze the spillover effects of global liquidity from the perspective of receiving economies. Thus, it is important to clarify the theoretical framework behind the transmission channels for a better understanding of the global liquidity's impacts in the emerging economies, before implementing the empirical approach in the next section. There are two distinct transmissions channels that we are investigating in this analysis: the relation between global liquidity and asset price; then the relation between global liquidity and macroeconomic variables.

1.4.1. The impact on asset prices

The initial framework dedicated to spillover effects on receiving economies has been proposed by Baks and Kramer (1999). This paper focused on the case of advanced economies. They suggested the existence of two transmission channels: the "push" and "pull" channels considering the hypothesis of an accommodative monetary policy. This policy stance may open the way to liquidity spillovers at a global level.

First, the "push" channel would raise capital flows to foreign asset markets with better economic prospects through strong money and credit growth in the issuing country. This capital outflows would raise the demand for foreign assets and cause an upward pressure on asset prices and a downward pressure on interest rates in the receiving economies. Consequently, there would be a positive correlation between the money growth in the issuing country and the asset prices in the receiving economies and negative correlation between the money growth in the issuing country and interest rates in the receiving countries.

Second, the "pull" channel would depress foreign asset prices. The strong money growth and credit growth in the issuing country would raise the domestic asset prices and this evolution could attract foreign capital. If the foreign investors find the inflation in the asset prices in the domestic country as real and sustainable, it could attract reallocation of capital to the domestic country from abroad. These could trigger capital outflows from foreign countries and depress their asset prices. In this configuration, there would be a negative correlation between domestic money growth and foreign asset prices; then positive correlation between money growth and foreign interest rates.

Moreover, there are several factors affecting global liquidity conditions in the receiving economies such as exchange rate regimes, capital control policies and the main financial and trading partners of the receiving countries, all these factors contributing to the strength of the transmission channels.

1.4.2. The impact on macroeconomic variables

In this section, we investigate the effects of global liquidity on both financial variables, such as asset prices and interest rates, and macroeconomic variables particularly the effects on

receiving economies output[2]. There are various transmission channels through which monetary decisions and global liquidity conditions can be transmitted to domestic output. Since these transmission processes possibly yield an intermediary role for asset prices, it is interesting to explore the effects of global liquidity expansion on the output of the receiving economies.

The first assumption we need to remind for this analysis should be the "long run neutrality of money" which explains why a monetary shock will not have a significant effect on real output. However, there is a consensus regarding its significant impact on economic activity in the short and medium run. According to Ruffer and Stracca (2006) the relevant frameworks for excess liquidity spillovers are focused on the Mundell-Fleming framework and the New Open Economy models.

The Mundell-Flemming model[3] is the initial framework analyzing international monetary transmission. In case of flexible exchange rates and substitutable goods, an expansionary monetary shock in the country leads to a reduction of the interest rates; this leads to the depreciation of the currency through the capital outflows in the country. As a result, there is a rise in demand for domestic goods that increases the country output[4]. On the contrary, the impacts of the country A's monetary policy in the country B are negative in a way that it will contract their output and as the money is an exogenous variable, no direct quantity spillovers will occur. However, there might be cases where the monetary expansion in the issuing country A has positive impacts on the country B but through indirect transmissions mechanisms. In the country B, monetary authorities may react to the contraction of their output by injecting more money into the system to support their economy. It may create a positive correlation between countries A and B quantity of money and may have a positive correlation between country A's money and country B's output. The fixed exchange rates case is much simpler because the spillover operates directly through the monetary authority's reactions of the receiving country B, which is determined by their desire to keep the exchange rates fixed.

In the new open economy model[5], an expansionary monetary policy in the country A can affect the foreign country B output developments in a positive way. A positive liquidity shock in the issuing country will cause a depreciation of their exchange rate, which leads to demand

[2] In the financial stability hypothesis, we only focus on the effects of global liquidity on assets prices and in a lesser extent on economic activity. The monetary policy perspective gives a better framework to study the effects of global liquidity on price and inflation.

[3] We consider two countries: the domestic country A and the foreign country B.

[4] Expenditure switching effect.

[5] Obstfeld and Rogoff (1995), Kollmann (2001).

shift away from foreign goods. Since these models assume nominal rigidities and possibilities of intertemporal substitution, stronger inflation expectations arise in the domestic country A and the foreign country B. Furthermore, the real interest rates fall in both countries, which lead to a shift from future to present demand, (as the present goods are cheaper relative to future goods and assets). This situation leads to strong correlation between domestic money growth and output growth in both domestic and foreign countries. In other words, an expansionary monetary policy in the domestic country A affects positively the output developments of both countries. However, some effects can mitigate the correlation effects between domestic liquidity and foreign output. The foreign monetary authorities might undo the inter-temporal switching effects and the expenditure switching effects by endogenously reacting to domestic consumer prices, which are affected by exchange rates evolutions.

1.5. The spillover effects of global liquidity expansion: An empirical investigation on emerging economies

In this section, we investigate the spillover effects of global liquidity expansion on EME's. In order to assess the global liquidity effects on these countries, we adopt an empirical approach based on VAR methodology applied to Panel data (PVAR). Nevertheless, before implementing the empirical approach, we investigate the related literature regarding the global liquidity topic.

1.5.1. Literature review

Global liquidity is a recent research field pioneered by Baks and Kramer (1999) who introduced prices and quantity liquidity indicators to assess their impacts on economic variables - such as asset prices and equity returns - in receiving economies. Their results confirmed the effects obtained in the past studies working on the effects of liquidity expansion on asset prices at a country level initiated by Friedman (1968). Specifically, Baks and Kramer (1999) - by considering only the public component of the global liquidity - identified strong positive relationships between the expansion of global liquidity and the growth in asset prices and equity returns during the period.

This pioneering study started a new topic focusing exclusively on the effects of global liquidity in the issuing and receiving countries and the development of theoretical framework explaining its evolution. Initially, the early works on the subject were only interested if the

effects of this global liquidity in developed countries. Ruffer and Stracca's (2006) paper was the first to investigate spillover effects on receiving economies by using a Global VAR (GVAR) model. Their main results focused on the significant effects of global liquidity's expansion on financial variables in the euro area and on a lesser extent on Japan's financial variables. This study also showed that excess liquidity is an indicator of inflationary pressures in these economies. Bracke and Fidora (2006) test different hypotheses that may explain the current trend of global imbalances characterized by development of current account imbalances in developed countries, especially in the United States, the decline in long term interest rates and rising asset prices through the use of a structural VAR model (SVAR). The authors propose to test three hypotheses to explain these empirical observations: the global saving-glut, the global liquidity glut and investment strike. Their results exhibited positive evidences of the effects of global liquidity glut as possible explanation of the increase of current account imbalances in the developed countries. Sousa and Zaghini (2004) considered the impacts of global liquidity on macroeconomic variables by using the real GDP as an indicator of output level on the receiving economies, the exchange rates and domestic prices. They estimated a SVAR model to analyze how the euro area variables react to a foreign monetary expansion with liquidity indicator of the G5 countries as a proxy; they found significant effects of global liquidity expansion explaining fluctuations in prices and output in the euro area.

While, the consequences on developed countries have been largely investigated in the empirical literature, studies on emerging economies are scarcer and represent an interesting field of research. IMF (2010) have produced references papers on this topic. They examine the determinants of capital flows to emerging markets. These capital flows can be explained by economic opportunities offered by these countries or by the global excess liquidity inflow. Through a panel regression, the IMF highlights the role of global liquidity's expansion in the rises of asset prices and equity returns experienced by those countries. They also showed that changes in these financial variables are explained by developments in both global liquidity and changes in the local money supply in those emerging economies. Finally, their paper highlights the role of exchange rate regimes in the transmission of the global liquidity and the exchange rates regime may trigger the accumulation of foreign exchange reserves as an indirect effect of the liquidity inflows. Tao and Psalida (2011) study completes this first approach by introducing new financial variables such as bank lending and new global liquidity indicators. Their results are similar to the previous study and conclude on the existence of positive links between global liquidity's expansion and asset prices; and between

the evolution of global liquidity and the accumulation of foreign reserves in emerging countries. Their main findings conclude on the positive correlation between global liquidity expansion and credit growth in the receiving economies and between global liquidity expansion and equity returns in the receiving economies. Another significant paper on this topic was developed by Chudik and Fratzscher (2011), which include the traditional assumptions on global liquidity and introduce new kinds of shocks via liquidity shock and risk shock in the explanation of the global transfer during the global financial crisis. They test the impacts of these shocks by using a global VAR (GVAR) model on a set of developed and emerging countries. They conclude on the heterogeneous effects of these shocks as developed countries are highly vulnerable to liquidity shock while emerging countries are sensitive to shock risk and less vulnerable to a liquidity shock. Brana and Prat (2011) estimate a panel regression analysis by introducing a threshold effect to assess the evolution of asset prices in emerging countries and they use as threshold variable the investors risk aversion**.** Their results are consistent with the empirical literature, but they demonstrated the existence of a non-linear effect in the relationship between global liquidity and the evolution of asset prices depending on risk level. Specifically, when levels of risk aversion are low, the positive relationship between the evolution of global liquidity and asset prices is significant; this effect disappears when level of risk aversion increases especially during the period following the financial crisis. Djigbenou (2014) investigates the impacts of global liquidity on asset prices of emerging economies using the Panel VAR (PVAR) methodology. The contribution of the paper focuses on the inclusion of variable that models the evolution of house prices. The author concludes on the mixed effects of global liquidity expansion on asset prices, but she found that these effects are significant for the evolution of consumer prices and GDP growth.

1.5.2. Data

For the purposes of this analysis, we built an unbalanced panel data composed of 30 countries divided into two groups, liquidity issuing economies represented by several advanced economies[6] and receiving economies mainly composed of emerging countries[7]. Those receiving countries are also decomposed into four country groups from Asia, Latin America, Eastern Europe and lastly Africa and the Middle East. This distinction will be important for

[6] Issuing economies: Euro area, Japan, United Kingdom, United States.
[7] Receiving economies: Australia, Argentina, Bulgaria, Chile, China, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Lithuania, Malaysia, Mexico, New Zealand, Peru, Philippines, Poland, Russia, Singapore, South Africa, South Korea, Taiwan, Thailand.

modeling the global liquidity spillovers at a regional level. To construct our database, we needed to collect:

- Official liquidity indicators, including broad money M2 and narrow money M1.
- Indicators of performance on financial markets with MSCI index. This indicator has the benefits to be harmonized and available for all the countries including emerging economies.
- Indicators of interest rates modeled by treasury bonds rates for long-term interest rates and interbank rates, discount rates and money market rates for short-term interest rates.
- An indicator modeling the domestic output with the industrial production index.
- Exchange rates between US dollars and local currencies in order to express all variables in the same currency.

These data are collected from January 2000 to May 2014 in monthly frequency from the IMF, Datastream and Macrobond database.

1.5.3. Data preliminary conversion

First, some data require preliminary treatment before estimating our models. Indeed, in addition to the necessary transformation in the same currency, a frequency transformation is also necessary. It turns out that Industrial production index data are available only in quarterly frequency in some of the countries of our panel. This situation requires the linear interpolation method to transform them into monthly data. This first step allows the creation of our six variables of interest namely GL global liquidity indicator, liquidity indicators in receiving countries $M2$ (or $M1$), IPI represent the short-term GDP, the indicator of assets prices $MSCI$, long term and short term interest rates with ILT and h IST. Then, we perform a logarithm transformation on our variables of interest.

Second, contrary to previous work on the subject, we choose to undertake a panel unit root test procedure. The results[8] of this methodology conclude on the presence of the unit root for all of our variables in level. This unit root is then removed using the first difference on all our variables. So, in order to perform the Panel VAR procedure we choose to use stationary variables.

[8] See appendice p.152.

1.5.4. Methodology

1.5.4.1. Panel VAR approach

To demonstrate the effects of global liquidity on our panel of emerging countries, we adopt the VAR methodology developed by Sims (1980) applied to panel data according to the empirical methodology developed by Love and Zicchino (2006). We choose this empirical methodology considering Canova's (2013) recommendations on the Panel VAR model. First, we rely on the PVAR methodology to highlights the transmission of idiosyncratic shock across countries and time; in our case, we rely on this methodology to investigate the effects of the global liquidity's expansion in the advanced economies and its impacts on a group of heterogeneous emerging economies. Second, this approach is also suited for investigating what channel of transmission may make responses to internationals shocks across heterogeneous group of countries, particularly we investigate which transmission's channels could explain the evolution of domestic variables in the receiving economies. Third, it is also suited for examining whether the shocks generated outside an area dominate the variability of domestic variables (Canova, 2005; Rebucci, 2010).

The theoretical reduced form of the PVAR model is defined by:

$$Y_{i,t} = \propto_i + \Gamma(L)Y_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where i $(i = 1, \dots, N)$ denotes the country, and t $(t = 1, \dots, T)$the time. $Y_{i,t}$ represents the vector of endogenous stationary variables, $\Gamma(L)$ the matrix polynomial in the lag operator L, $\propto_i$ denotes the vector of country-fixed effects and $\varepsilon_{i,t}$ is the vector of errors. The indicator of global liquidity and the variables of the receiving economies compose the vector of the endogenous variable: $Y_{i,t}$.

Concerning the empirical methodology, we follow the recommendations made by Love (2006) when implementing the PVAR procedure. This methodology requires imposing the same underlying structure for each cross-sectional unit (country) but this constraint may be violated in practice. The country-fixed effects introduced in the Equation (1) are the solutions to get around this restriction on the parameters so they can capture individual heterogeneity. However, theoretically the fixed-effects estimator in autoregressive panel data models is inconsistent because the fixed effects are correlated with the regressors due to lags of the

dependent variable (Nickell, 1981). To overcome this issue, we need to remove the fixed effects before estimating the coefficients by using generalized method of moments (GMM) or ordinary least squares (OLS) estimations. The GMM method needs the Helmert procedure recommended by Love to remove the fixed effects but we use an alternative method to resolve the fixed effects by differencing our variables as the first first-difference method removes the panel fixed effect. However, this choice creates a new issue, in practice, as the PVAR procedure needs the results of the Helmert procedure for the estimation. So, we perform OLS estimation for our PVAR models to overcome the previous technical issue as the OLS estimation use our variables in first difference as both regressors and instruments to estimate the panel VAR coefficients. Specifically, we use Pooled OLS VAR without fixed effects as these effects provide biased estimates of autoregressive coefficients (Juessen and Linneman, 2010).

1.5.4.2. Ordering the endogenous vector

Regarding the order of our endogenous variables, we use both Cholesky and results[9] from the panel non-causality tests. We specify the Cholesky ordering from the theoretical relationship between our variables and justify the order's choice by using the panel non-causality tests results.

First, we assume that the most exogenous variable of our model is the global liquidity indicator since it is created in the issuing countries. Second, a surge in global liquidity is first transmitted to money supply, which in turn affects the output of the receiving economies. At the same time the asset prices and the long-term interest rates are also affected by the evolution of the money supply, which indicate that the money supply is the most endogenous vector of our model. Furthermore, the evolution of interest rates affects theoretically the evolution of asset price so we conclude that the asset price is less endogenous than the interest rates. Lastly, the long-term interest rates affect the short-term interest rates.

From an empirical perspective, the main results from the panel non-causality tests confirm the important bi-directional causality link between all of our variables. Our results show that most of our variables interact with each other in a positive way. In other words, each variable homogeneously causes the developments of the other variables of the endogenous vector. However, only two non-significant results emerge from the causality test of production to the

[9]See appendice p. 150-151

money supply and the causality test of long-term interest rates to the asset price, which indicates that these variables are more exogenous compared to short-term interest rates, production, and asset prices. Nevertheless, these results are not strong enough to determine the order choice of our variables and since most of our variables face bidirectional causality, we cannot conclude on a stable order for our endogenous vector. So, we rely on the theoretical indications and define the vector of endogenous variables as:

$$Y_{i,t} = \left(\Delta GL_{i,t}; \Delta M1_{i,t}; \Delta OUTPUT_{i,t}; \Delta MSCI_{i,t}; \Delta i_{i,t}^{st}; \Delta i_{i,t}^{lt}\right) \quad (2)$$

1.5.5. Empirical analysis

To evaluate the effects of global liquidity expansion on emerging countries, we first focus on the analysis of a benchmark model that regroups all emerging economies in our database; second, we investigate the effects at a regional level and third, we investigate those effects depending on the exchange rate regime of the countries in our database. This main approach centers on the impacts of the first indicator of global liquidity we constructed before, which only measure the expansion of the global liquidity created by advanced economies throughout the given period. Additionally, we study the effects of global liquidity under the assumption of global excess liquidity implemented in the second indicator as a robustness analysis that we use this indicator only on the global model.

Since our variables are in first differences, our analysis is centered on the growth rate of those variables. For further analysis, we construct our reasoning on the impulse responses functions (IRFs), which allows examining the responses of a liquidity shock on the endogenous variables of the selected model, and the results of the variance decomposition through variation of each variable explained by the indicator of global liquidity. For every estimation, we use a 5% standard error bands generated with Monte-Carlo 1000 repetitions and we rely on a second order PVAR for our estimations considering the recommendations of empirical studies using monthly data and the Schwarz information criterion[10].

[10] See appendice p.139

1.5.5.1. Benchmark model

In the first model (figure 1.2 and table 1.1), we investigate the impacts of global liquidity expansion in the advanced economies on all receiving countries of our panel. We find that a positive shock of global liquidity has a positive significant effect on the evolution of money supply in emerging countries, especially during 3 months after the shock. Moreover, this transmission of global liquidity conditions in the receiving economy results in a relative increase in industrial production leading to a positive growth of the receiving economies output. These results are consistent with the effects of an expansionary monetary policy under the new open economy models theory, as the surge in global liquidity affects both monetary aggregates and output in receiving economies. However, as we cannot distinguish the individual effects of the liquidity expansion on each country, we cannot conclude on the monetary authority reactions. Their reactions could also explain the positive relation between global liquidity growth and foreign output growth if they increase their available money to reacts to the contraction of their output as explained in the M-F framework. These results are in line with the findings of Sousa and Zaghini (2004).

In addition, the global liquidity shock causes a decrease in interest rates only during a short period as the effect disappears quickly. This transitory effect on interest rates influences the appreciation of asset prices in the receiving countries with the transmission of the global liquidity flows to emerging financial markets. Furthermore, the results on short term interest rates are interesting since a decrease in short term interest rates could be explained by monetary authority's reactions by adjusting their key interest rates (central banks' policy rates), which in turn influence the short-term interest rates (money market interest rates and discount rates). These consequences on interest rates and assets prices are consistent with the "push" channel described by Baks and Kramer (1999) and the findings of Ruffer and Stracca (2006) and Bracke and Fidora (2006). In addition, these results are consistent with the findings of the numerous empirical studies, for instance the results of Djigbenou (2014) about the response of output in the receiving economies.

Finally, the variance decomposition analysis confirms the previous IRFs results and settles that only a small percentage of the global liquidity shock innovations explain the development of endogenous variables. The strongest effect concerns the money supply (7.1%) whose evolution is explained by expanding global liquidity.

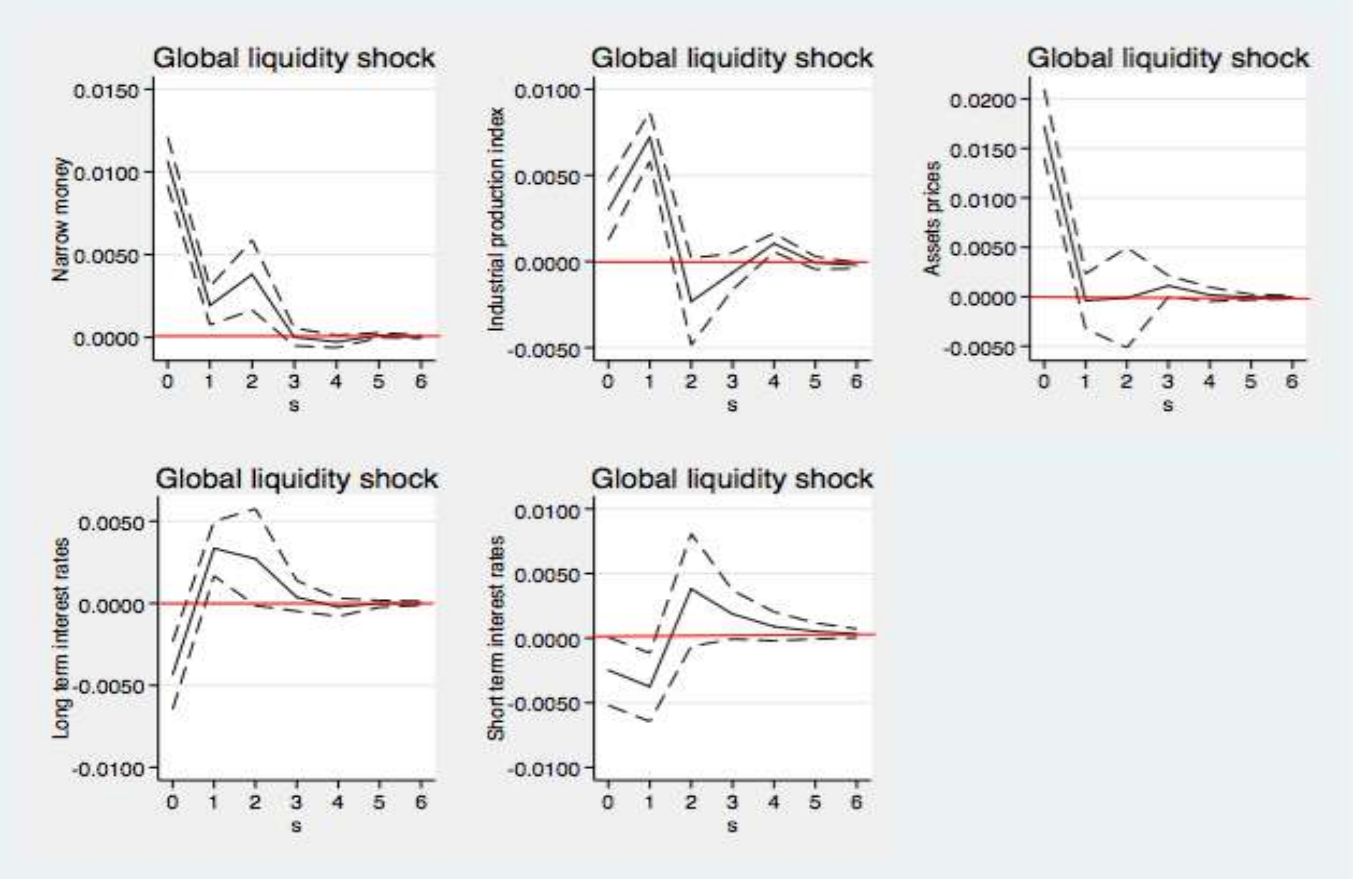


Figure 1.2: Benchmark model Impulse responses functions

	1 months	3 months	6 months
M1	6.0	7.1	7.1
IPI	0.2	0.9	1
MSCI	2.5	2.5	2.5
ILT	0.2	0.6	0.6
ICT	0.09	0.4	0.4

Table 1.1: Variance decomposition: percent of variation of the row variable explained by the indicator of global liquidity

1.5.5.2. Regional models

In this section, we study the effects of global liquidity at a regional level[11] to reveal the disparities between country groups according to their geographical origin or economic area that they belong.

1.5.5.2.1. Asia Pacific region

The impacts of global liquidity in Asia-Pacific countries[12] (figure 1.3) follow the results of the global model. However, small differences in the magnitude of these effects on the receiving countries are noticeable. Indeed, there are larger magnitudes on the evolution of interest rates and particularly the significant effect on output. These differences can be explained by region specificities, particularly regarding the Asian countries that are more responsive to changes in the evolution of global liquidity conditions. This significant effect could be explained by the fact that Asian emerging economies are countries that historically receive direct foreign investment and capital flows. The effects on receiving countries money supply could also be explained by their exchange rates management as most of the countries use intermediate or fixed exchange rate regimes. So a surge in global liquidity will be transmitted to the money supply of the receiving economies and increase the foreign exchange reserve in case intermediate flexible exchange rates or will be integrally transmitted to their foreign exchange reserve as they try to maintain the fixed exchange rates.

The variance decomposition results (table 1.2) are also interesting because contrary to the benchmark model, the global liquidity shock have a better explanatory power in the Asian-Pacific model. The global liquidity shock explains 3.6% of assets prices innovation while this share was roughly around 1% in the benchmark model.

1.5.5.2.2. Eastern Europe region

We find the same variables responses (figure 1.4) as the benchmark model on the countries[13] of the Eastern Europe region, especially larger amplitudes concerning the variables evolution after the global liquidity shock. Moreover, Eastern Europe money supply reacts strongly to a positive

[11] See appendice p.140-143 for the IRFs and variance decomposition results for the regional models

[12] Asia-Pacific countries: China, India, Indonesia, South Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Australia, Thailand.

[13] Eastern Europe countries: Bulgaria, Hungary, Lithuania, Poland, Czech Republic, Russia.

shock on global liquidity that can be explained by the "push" channel of global liquidity. Moreover, this strong money growth in the receiving countries put a weak relative downward pressure on long term interest rates as confirmed by the variance decomposition (table 1.3) (2%) and the upwards effects on the assets prices are relatively limited as exhibited by the variance decomposition (1.5%). However, this strong money growth affects strongly the output in the receiving economies as 10% of its evolution is explained by the global liquidity shock innovations. This result is consistent with the transmission channel of NOE models.

1.5.5.2.3. South America region

Relative to the benchmark model, Latin American countries[14] exhibit important differences in the consequences of the global liquidity expansion (figure 1.5). Despite similar effects on changes in asset prices and output, we notice that the money supply of these emerging countries is very sensitive to the global liquidity inflows. Specifically, the variance decomposition suggests that liquidity shock explains 10% of innovation in the money supply. This explanatory power (table 1.4) is also evident concerning the production with 21% of the innovation of this variable explained by the global liquidity shock. The significant effects on domestic monetary growth mostly drive the output improvement in the South America economies and spills to the asset prices. However, the effects on the interest rates are less significant as their innovations are only explained by less than 2% of the global liquidity shock.

1.5.5.2.4. Middle East and Africa region

As expected, results of this group[15] are mitigated (figure 1.6). Indeed, we do not notice any significant effect of global liquidity shock on the evolution money supply and interest rates, despite significant results concerning the evolution of output and asset prices according to the variance decomposition (table 1.5), respectively 21% and 2%. These results are not consistent with expected effects of global liquidity expansion and one possible explanation might be that their financial markets are less integrated than other emerging countries and regions.

[14] South American countries: Argentina, Chile, Colombia, Mexico, Peru.
[15] Middle East and African countries: Egypt, Israel, Jordan, South Africa.

1.5.5.3. Exchange rates regimes

We investigated in the previous theoretical framework that the effects on the receiving economies depend on several macroeconomic factors, including the exchange rate regime of these countries. The global liquidity's surge consequences may be different based on the nature of the exchange rates regimes of the receiving countries, especially depending on its degree of flexibility and the level of control over capital flows. These effects can be summarized through the opposing cases of the fixed exchange rates and floating exchange rates regime.

To highlight the influence of the exchange rate regime, the countries in our sample are divided into two subsamples, countries with fixed exchange rates regime and countries with floating exchange rates regime. To this end, we use the de facto monthly coarse classification developed by Reinhart and Rogoff. This classification covers only a part of our period, yet we apply the average and the median[16] to distinguish the countries exchange rates regime from January 2000 to December 2010. Consequently, when the median during the period is between 1 and 2 or the average is between 1 and 2.5, the country is placed in the fixed exchange rate regime group[17], which consists of 13 countries. Finally, countries with a median between 3 and 6 or an average of between 2.51 and 6 during the period are included in the floating exchange rate regime group[18], which is composed of 13 countries.

1.5.5.3.1. Empirical results

The main results[19] of this empirical approach considering the exchange rates regime join the results of the benchmark model but dividing our countries in two groups allows us to interpret the results differently. First of all, a global liquidity shock on the monetary conditions indicator produce similar effects on both countries groups when we use narrow money as proxy for monetary conditions. However, taking into account the exchange rate regime can complete the previous analysis.

Firstly, we find that countries with fixed exchange rates regime are particularly sensitive to monetary policies of the issuing countries (figure 1.7) as we notice significant effects of the

[16] See appendice p.154.
[17] Countries with fixed exchange rates: Argentina, Bulgaria, China, Egypt, Hungary, India, Jordan, Lithuania, Malaysia, Peru, Philippines, Russia, Taiwan.
[18] Countries with floating exchange rates: Australia, Chile, Colombia, Czech Republic, Indonesia, Israel, Mexico, New Zealand, Poland, Singapore, South Africa, South Korea, Thailand.
[19] See appendice p. 144-147 for IRFs and variance decomposition results.

global liquidity shock on the monetary conditions in the receiving economies. This result is consistent with theoretical assumptions according to which fixed exchange rate regime does not isolate the receiving countries from evolutions in monetary policies of issuing countries. Furthermore, contrary to the benchmark model, we also find significant effects on the evolution of monetary conditions with the model using broad money (figure 1.8); it highlights the fact that the global liquidity affects not only the public components of the monetary conditions, but it affects also the behaviors of the private sector, by stimulating the credit creation for instance. However, we cannot distinguish properly the effects on the private liquidity of the receiving economies in this model, as we cannot differentiate between the public and private liquidity in the monetary conditions indicator.

Secondly, results concerning countries with floating regimes show that the exchange rate does not protect those countries from the expansion of the global liquidity. This result is in line with Rey (2013). Indeed, regarding the first model using narrow money as monetary indicator (figure 1.9), we note that the evolutions of the variables of this group of receiving economies are significant to the global liquidity shock. In addition, no significant mitigating effect related to the fluctuation of exchange rates is observed. Finally, although variables of the second model using broad money (figure 1.10) are sensitive to changes in global liquidity, the indicator of monetary conditions is not affected by the global liquidity shock. This result moderate our analysis about the behavior of the private sector, as the private liquidity is not stimulated by the developments of the global liquidity conditions. In other words, it means that the global liquidity effects do not affect the behavior of the financial intermediaries and the credit creation in this group of countries.

Thirdly, the interpretation of these results is reinforced by the corroboration of Rey (2013) hypothesis, which states under hypothesis of perfect capital mobility that the exchange rate regime is not important considering the global financial cycles. The appreciation effects of asset prices and private liquidity creation, which we showed in the case of the fixed exchange rates regime, are representative of Rey's assumptions and are the effects of the developments of the global liquidity conditions.

1.5.5.4. Robustness check

In this section, we investigate the spillovers effects of global liquidity on the emerging economies under the assumption of global excess liquidity in the issuing countries. We rely

on the GDP weighted global liquidity indicator[20] developed by Ruffer and Stracca (2006) to assess the results obtained with the first global liquidity indicator. The hypothesis of global excess liquidity in the advanced countries implies that only the excess liquidity affects the receiving economies and developments of global liquidity conditions may only affect the receiving economies at a limited degree.

We adopt the same underlying methodology than in the previous section; the only difference being the nature of the global liquidity indicator implemented in the panel VAR. We focus on the spillover effects of the excess global liquidity on the global model to analyze the differences between the effects of the global liquidity indicators.

The excess global liquidity shock pushes the same mechanisms[21] (figure 1.11) obtained in the first global model. We notice that the global liquidity shock causes strong money growth, asset prices appreciation and downward pressure on interest rates. The only differences rely on the magnitude of the global liquidity effects as we notice a weak effect on the output and a strong significant effect on the short-term interest rates. The transmission mechanisms are similar to those of the first global model, strong money growth and fall of interest rates, especially long term interest rates, influences the increase of the asset prices through the "push" channel. In turn, the receiving economies output is affected by the money growth, which could be provoked by monetary authority's reaction to the surge of global liquidity or the effect of global liquidity in the NOE framework.

The analysis is confirmed by variance decomposition (table 1.10) results, with a relatively strong effect of the global excess liquidity shock on the innovations of the money growth (6.1%), the asset prices (3.7%) and the short-term interest rate (3.9%). Except, the strong result on short-term interest rates, which normally is influenced by the evolution of the long-term interest rates though these results agreed with the findings of the first global model.

1.6. Conclusion

Since the late 90's, the global liquidity development and its issues on both issuing and receiving countries have captured the attention of economists and the financial macroeconomic literature over the recent years. The debates have been mainly focused on the destabilizing effects of the global liquidity since its components evolutions, official and

[20] Ruffer and Stracca (2006) use two indicators to express the hypothesis of global excess liquidity: $\log \frac{M3_t}{PIB_t}$ the monetary aggregate M3 weighted by the GDP and $\Delta \log \frac{M3_t}{PIB_t}$ the growth rate of the monetary aggregate M3.

[21] See appendice p.148 for IRFs and variance decomposition results.

private liquidity, could had led to the 2008 financial crisis. Moreover, the policies responses to mitigate the crisis effects are also in the center of this topic since the quantitative easing and accommodative monetary policy fueled the evolution of the global liquidity. So, in order to investigate the consequences of global liquidity, one strand of the literature focused exclusively on the spillovers effects to the receiving economies, mostly advanced countries. The studies investigating the effects on emerging countries are scarcer mainly because of data availability reason. In this context, the primary objective of this chapter is to examine the theoretical transmission channels and the consequences of the evolution of the global liquidity conditions on the emerging countries. We focus on the effects on specific emerging countries variables such as money supply, asset prices, interest rates and more importantly output. For this purpose, we estimate a panel VAR model on a sample of 30 countries over the period from January 2000 to May 2014.

Our main results are consistent with the hypothesis of destabilizing effects of the global liquidity to the emerging countries. From a financial stability perspective, a surge in global liquidity triggers the emerging economies money growth, drives downwards pressures on the interest rates and upward pressures on asset prices. These findings are in line with Baks and Kramer (1999) and studies focused on emerging countries, especially FMI (2011) and Djigbenou (2014). However, contrary to the papers working on spillover effects of global liquidity, we showed that there are different effects between the emerging countries groups. Some groups are more affected by the global liquidity conditions than others, Asian countries and European countries for instance. Moreover, we find a significant positive correlation between the global liquidity and the output of emerging countries, which is line with the previous results on the topic (Souza and Zaghini, 2004). This result confirms that a surge in global liquidity improves the output development in the receiving economies and we demonstrate the existence of disparity among the countries groups. Finally, distinguishing the emerging countries based on the exchange rate regime revealed that according to Rey (2013) hypothesis, the choice of the exchange rate regime does not matter as the emerging countries are all affected by the global liquidity expansion.

Our contributions to the debate are mainly centered on the financial stability perspective. But in order to measure all the different characteristics of global liquidity, we need to examine the impacts of global liquidity conditions on prices (consumer prices and commodities prices) and inflation under a new approach, the monetary policy perspective.

Chapter 2
Hoarding international reserves and global liquidity expansion

2.1. Introduction

Although *Global liquidity spillover effects* on receiving economies have been greatly explored in the literature since Baks and Kramer's (1999), those consequences have not fully been developed yet, especially the effects of global liquidity expansion on emerging economies (EMEs). Recent studies suggest that global liquidity developments drive the same mechanisms in both emerging and advanced countries, namely strong money and credit growth, asset prices appreciation, and more importantly, downward pressure on the long-term interest rates (ECB, 2011). While those consequences in the advanced countries have been largely reported in the literature, changes in global liquidity conditions induce slightly different consequences on the emerging markets. Specifically, EMEs are subjected to different concerns that may have important consequences on their economies, in particular, greater financial vulnerabilities and dependence to exports relative to advanced economies. While the topic of reserve accumulation behavior in EMEs is quite well developed, the links between global liquidity expansion, mostly the official liquidity, and reserve accumulation lack consensus in the literature. Previous studies (Baduel, 2012; Djigbenou et al, 2015) have analyzed the link between global liquidity expansion and its consequences on the reserves progression in EMEs. However, the feedback outcomes of reserves accumulation behavior in the EMEs to the reserves issuing countries are not fully detailed yet. Our main objectives are to review theoretical relations between global liquidity expansion in the advanced countries and its implications on the reserve accumulation behavior in the EMEs, in particular in the Asian EMEs. We also investigate the feedback effects of the reserve accumulation trend on major reserve currency issuers and how this behavior affects the global liquidity conditions.

In order to investigate those feedback effects, the chapter is structured as follows: in the first section we present the recent evolutions of reserve accumulation in the emerging countries and we analyze its drivers; in the second section, we undertake an analysis of the hoarding reserve behavior through the lens of demand and supply for reserve assets distortions; in the third section, we investigate the links between reserve accumulation and the global liquidity; the last section is dedicated to an empirical analysis of the macroeconomic consequences of

the hoarding reserve trend in the Asian EMEs on the reserve issuer countries and on global liquidity conditions.

2.2. Understanding the reserve accumulation trend in the Emerging countries

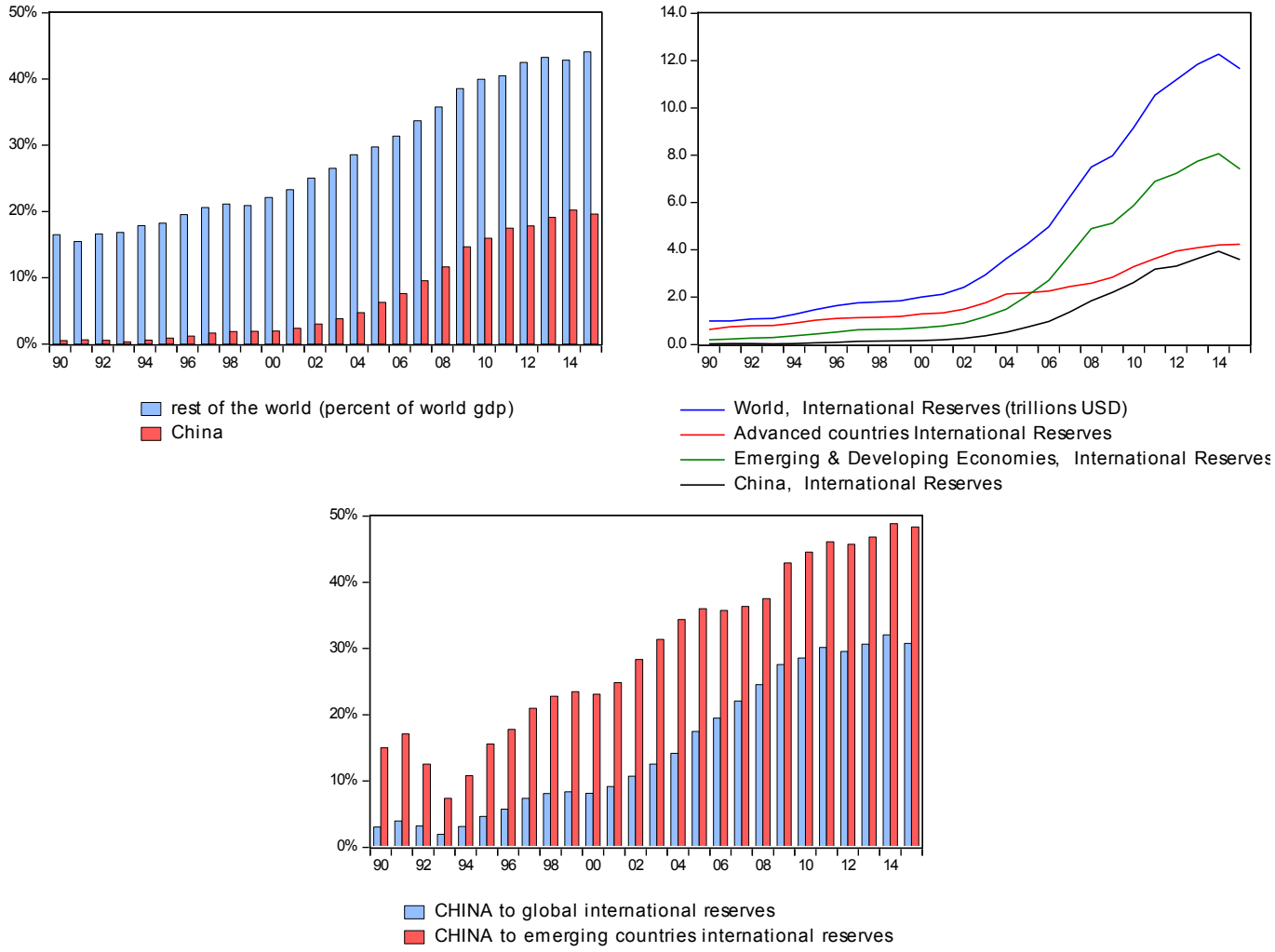
Since Heller (1966), the question of the optimal level of foreign exchange level has been widely investigated in the literature, especially concerning their theoretical considerations. Nevertheless, the theme has gained new importance, as the reserve accumulation and their outcomes have become a new trend in the emerging Asian countries since the late 1990s.

2.2.1. Recent trends concerning the global reserve accumulation

Since the late 1990s, the global reserve accumulation has increased abruptly, with an average annual growth of 31% during the period of 1996-2015 (approximately 800 billion USD per year). This strong growth is essentially led by two groups of countries (figure 1): the emerging market, in particularChina, and the oil-exporting countries. The reserve accumulation pace in the advanced countries, in turn, has slowed since the early 2000s and was surpassed by the emerging countries[22] in late 2005. Moreover, the global financial crisis (GFC) only slowed the reserve accumulation for a short period, since the trend recovered its pre-crisis pace by 2009 and reached its historical peak during mid-2014 at 12.78 trillion USD. By the end of the year, the global reserve accumulation growth had begun to slow as the Federal Reserve began to curtail their quantitative easing program ("taper tantrums") and this decision had affected the emerging countries' reserve accumulation strategy as some Asian countries experienced capital flight and depreciation of their currencies. To fully understand how fast the pace of global reserve accumulation was during this period, it must be mentioned that the global reserve was 11.8 times their 1990 level; in comparison, the world GDP was only multiplied by 3.1 times during the same period. This strong pace led to a maximum record at 23% of the ratio of global international reserve to world GDP in late 2014 before slowing down at the beginning of 2015 after the FED's decision. At a regional level, this trend has not been uniform since emerging and developing countries behaviors insofar as emerging countries are the main drivers of the global reserve accumulation trend since the late 1990s with an annual growth of 57.3% until 2015. The advanced economies, in turn, have had

[22] Despite the growing importance of the Asian emerging countries, Japan remains the second largest reserve accumulator country during the period.

a steady reserve accumulation annual growth of 13.7%, which significantly equals the annual growth rate of the period 1980-1995 (17.9% per year). Finally, on a national level, China has displaced Japan as the largest international reserve holder as its assets represented 32% and 49% of the global international reserves and the emerging countries reserves respectively by the end of 2014.



Sources: IMF, authors' calculations

Figure 2.1: Reserve accumulation in Emerging and developing countries

2.2.2. Why do emerging countries accumulate reserve?

Considering the literature on the topic, two main causes have been put forth to explain the reserve accumulation trend in emerging countries: the precautionary motive and the mercantilist motive.

2.2.2.1. Precautionary motive

First, the precautionary driver for international reserve is closely related to crisis-insurance and "self-assurance" motives in the aftermath of the Asian crisis in the late 90s. As the pegged exchange rate has been the predominant exchange rate regime adopted in the region during the pre-crisis period, the lessons learned from the rapid depletion of foreign exchange reserves during the crisis led regional policy makers to change their behavior concerning the international reserve optimal level. They started to rebuild their foreign assets in the early 2000s to insure themselves against future macroeconomic or financial shocks on their economies since they wanted to protect themselves from the dreadful macroeconomic consequences of the crisis they had just experienced. Furthermore, they started this policy of building large international reserves to overcome the dependence on the international community during times of macroeconomic and financial stress. Also, because most of the emerging Asian countries experienced persistent current account surpluses, this situation has resulted in an unparalleled accumulation of international reserve and has also affected the countries that were not directly affected by the crisis (China, for instance). Moreover, the literature (Noyer, 2007) suggests that building large international reserves, not only tends to reduce the probability of speculative attack but also allows lessening macroeconomic damages due to the Global Financial Crisis. Such results constitute an important incentive for Asian economies to continue their accumulation policy. They only slowed their reserve accumulation during the crisis to support their economies, as the growth rate of the reserve accumulation in the Asian countries slowed to 14.5% during the year following the crisis while it was 40.6% in 2007.

Second, from theoretical and empirical perspectives, the precautionary driver for holding reserve was originally underlined by Heller (1966) in his pioneering works using a cost-benefit approach. The author stressed that this driver is preeminent than the transaction driver usually used in the previous studies and showed that the precautionary driver for reserve holding is determined by three parameters; the cost of adjusting to an external imbalance; the opportunity cost of holding reserves and the likelihood of a situation where the need for reserves would occur. Heller determined that holding international reserves helps funding transitory deficits from external trade shocks and lessen the costs adjustments in terms of welfare. More recent works on the optimal demand for reserves tend to focus on the financial openness than trade openness by introducing new vulnerabilities (capital account openness, foreign liabilities, external debt, etc.) and their consequences on the domestic financial

systems (currency mismatches and probability of capital flight) by using extended buffer-stock models introduced by Frenkel and Jovanovic (1981) since this framework offers a broader perspective on the optimal level of reserve issue. For instance, latest studies show that the importance of financial variables is increasing at the expense of the trade openness variables, especially the variables of modeling external financing whose influence has been growing since the last decade (Cheung and Ito, 2009). Additional determinants are introduced in recent studies such as financial stability underlined by Obstfeld et al. (2010) in which they show that the probabilities of sudden stops and capital flight episodes could explain the reserve accumulation over the recent years. These results are confirmed by Mendoza (2010) who shows that the explanatory power of the driver is growing in the Asian countries after the crisis period since those countries had experienced financial stability concerns. He finds that these countries tend to build large reserves for self-insurance since they do not have access to other forms of contingency measures and instruments.

2.2.2.2. The mercantilist/transaction motive

According to Dooley et al. (2003, 2007) and Noyer (2007), the mercantilist approach explaining the foreign reserve accumulation in Asian countries is justified by the export-led growthstrategies adopted in those countries. Asian emerging economies are intentionally pursuing these policies by maintaining undervalued exchange rate in order to promote their exports. As a corollary, they affect the US current account deficit, since the US is the main outlet of their products. In addition, Asian emerging economies are historically on the receiving end of direct foreign investment, the authors underlined that excessive reserve accumulation behavior may act as "collateral" guaranteeing that foreign investment. This link between the US consumption (and saving) patterns and the emerging Asian countries economic growth is at the heart of the discussion on the global imbalances topic.

From a theoretical standpoint, the attention regarding the mercantilist motive has been growing over recent years because the precautionary motive failed to fully explain the recent trend regarding the reserve accumulation in the emerging countries since the early 2000s (Aizenman and Lee, 2007). This approach explains the accumulation behavior observed in the emerging Asian countries as a consequence of their current account surpluses specifically the export-led strategies explained previously. As a result, the hoarding reserves behavior observed in China and the other emerging Asian countries (Aizenman, 2009), is explained by the trade competitions between those countries instead of the self-insurance motive from the

late 90s to 2006 before the GFC (Aizenman, Cheung, and Ito, 2014). According to the mercantilist motive, the optimal level of reserve is associated to the degree of reserves that maintains external competitiveness and preserves the exchange rate at undervalued levels. However, this motive has also its flaws since it cannot fully explain the excessive trend in reserve accumulation despite it has more explanatory power than the precautionary motive.

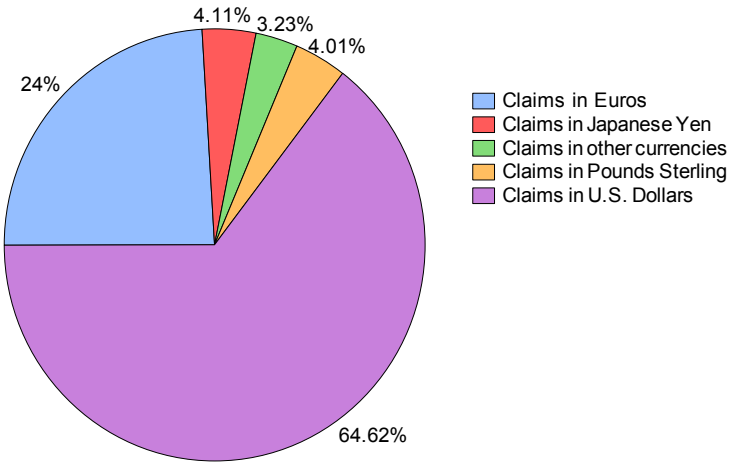
2.2.3. Remarks on the determinants of international reserves

As there is no consensus in the literature explaining the surge of hoarding reserves in the Asian countries during the last decade, it is important to take into account the outcomes of the GFC on the hoarding international reserve (IR) behavior as its determinants may evolve over time. According to Aizenman, Cheung, and Ito (2014), the GFC and the underlying structural changes experienced by China and Korea, for instance, are associated with new patterns of hoarding international reserves. They showed that during the pre-GFC period, the hoarding international reserves pattern in emerging Asian countries is related to the hoarding rivalry motive and especially the precautionary buffer motive as those countries experience commodity price volatility; this results stand in line with IMF (2010). In other words, the pre-crisis IR determinants are closely related to the precautionary motive. During the 2007-2009 GFC, neither of the two main determinants could explain the international reserve patterns, as the factors associated with those determinants could not be measured because of the market turmoil preventing the normal economic relationships from holding. Finally, during the 2008-2012 post-GFC period, the previous determinants explained the IR accumulation pattern despite the lower explanatory power of the precautionary motive. In addition to these determinants, several factors may explain the current trend such as the macro-prudential policy factor, which is found to complement the international reserve accumulation.

2.3. The hoarding reserves, what are the consequences?

Since the repeal of the Bretton Woods system, the US dollar is currently the major reserve currency and represents approximately 70% of the world allocated reserves before the creation of the euro and falls to 63.9% in 2015; in comparison, the reserves in euro represent only 19.8% of the allocated reserves during the same year. Despite the growing importance of the euro, the dollar's central role is even more significant considering the fact that the total reserves grew by 393% during the period 1999-2015. As seen in the previous section, this

growth is essentially explained by the hoarding of international reserve consisting essentially of US dollars initiated by the emerging Asian countries. By the end of 2015, China's reserves alone represent 48% of the emerging countries' reserves and 31% of the world's total reserves. According to Farhi, Gourinchas, and Rey (2012), the dollar hegemony and especially the importance of US Treasury bill as the main reserve asset is due to its fundamental characteristics: first, the liquidity of US T-bill provides several benefits for various reasons, especially during crisis period as this asset acts as a safe haven asset, and second, the fiscal capacity and integrity of the issuer which is closely related to the solvability of the US economy. To fully understand the challenges raised by the international reserve accumulation and the central role of the US dollar as a reserve currency, we develop in the following sections the consequences of the IR accumulation on the supply side and demand side for safe assets. We also explore the outcomes of this behavior in the safe assets issuing countries and in the applicant countries. Finally, we examine the short term and long term consequences of the IR accumulation behavior.



Sources: IMF, IFS, author's calculations

Figure 2.2: Total allocated reserves by currency in 2014

2.3.1. US dollar's hegemony: indications from the reserve asset market

2.3.1.1. The "great convergence" and the reserve assets demand

From a historical standpoint, there is a continuous increase in both public and private components of demand for assets reserves during the last decades. This increase is explained at first by the catching-up process of the emerging countries since their economic development is approaching to that of the developed countries. While economic development

frequently precedes financial development, convergence affects the demand for assets in two different ways. First, there is an increase in the private component of the demand for assets reserves in emerging countries. The rise in demand from households is driven by an insufficient supply of domestic reserve assets because of the inability of their domestic financial systems of these states to provide reliable reserve assets. The private sector demand has its origin in the household retirement concerns, as they want to transfer their purchasing power over time and meet their long-term need, it is important to stress that this demand for safe assets is structural insofar as many emerging countries have weak social welfare systems. Second, there is also an increase in the public demand for reserve assets explained by the inter-temporal approach of the commodity exporting countries for instance, oil producing countries seek to recycle their petrodollars and build a "war chest" to protect themselves against long-term effects of the depletion of their natural resources. In both cases, the rise of reserve asset demand in the emerging countries is the result of public institutions 'failure in the issuance of domestic reserve assets.

2.3.1.2. Reserve accumulation policy and reserve assets demand

The second factor affecting the reserve assets demand is related to the reserve accumulation behavior in the emerging countries insofar as this strategy affects directly the demand's public component. As seen in the previous section, this behavior is partially driven by the precautionary motive, particularly the "self-assurance" motive to cope with the international financial instability. Although this behavior is a source of concerns at a global level, principally affecting the evolution of long-term interest rates and global imbalances, recent empirical studies, the IMF (2010) for example, suggests that these countries were less affected by the crisis' outcomes in comparison of the developed economies. During the period, they only slowed their reserve accumulation at the peak of the crisis to support their economy and resumed the international reserve hoarding once again in 2009.

2.3.1.3. Reserve asset supply and the emergence of alternative safe reserve assets

On the public side, US dollar's hegemony as the quintessential reserve currency is explained by the lack of alternative reserve currencies. Indeed, the euro is the only currency whose the size of its issuer is comparable relative to the US dollar but unlike the latter, it suffers from various structural weaknesses that limit its attractiveness. One of its flaws stems in the fiscal

independence of the euro area countries which results in limited integration of its fiscal structure although individually, some countries have the financial depth necessary to produce safe and reliable reserve assets. This fiscal independence and the different situations of public debt in the eurozone are the main limits of the euro as reserve currency. During the crisis, there has been a repositioning of the reserve assets demand from central banks to dollar to the detriment of euro, which saw a significant drop in demand and resale of existing reserves to the dollar. At the intra-European level, due to the disparities of budget situations and the quality the public debt that differs across countries, there has also been a repositioning of the flow from peripheral countries to the core countries that offer more satisfactory guarantees. Finally, although the Chinese authorities are actively working on the Yuan's internationalization, it still has a very limited role as a reserve currency. This state of affairs regarding the public supply of reserve currency shows a lack of diversification of the supply of reserve currency, thereby putting the dollar at the center of challenges of the reserve assets market

2.3.2. Consequences of the evolutions of demand and supply for reserve assets

On the demand side, there is an increasing demand for reserve assets on a global level, mainly explained by strong demand from the emerging Asian countries and commodity exporting countries. As seen previously, this important growth in emerging countries is explained by several factors, including the lack of a domestic reserve asset, absence or weak development of financial markets, structural weaknesses that limit the creation safe assets, and the households' concerns about their future in countries where these guarantees are lacking.

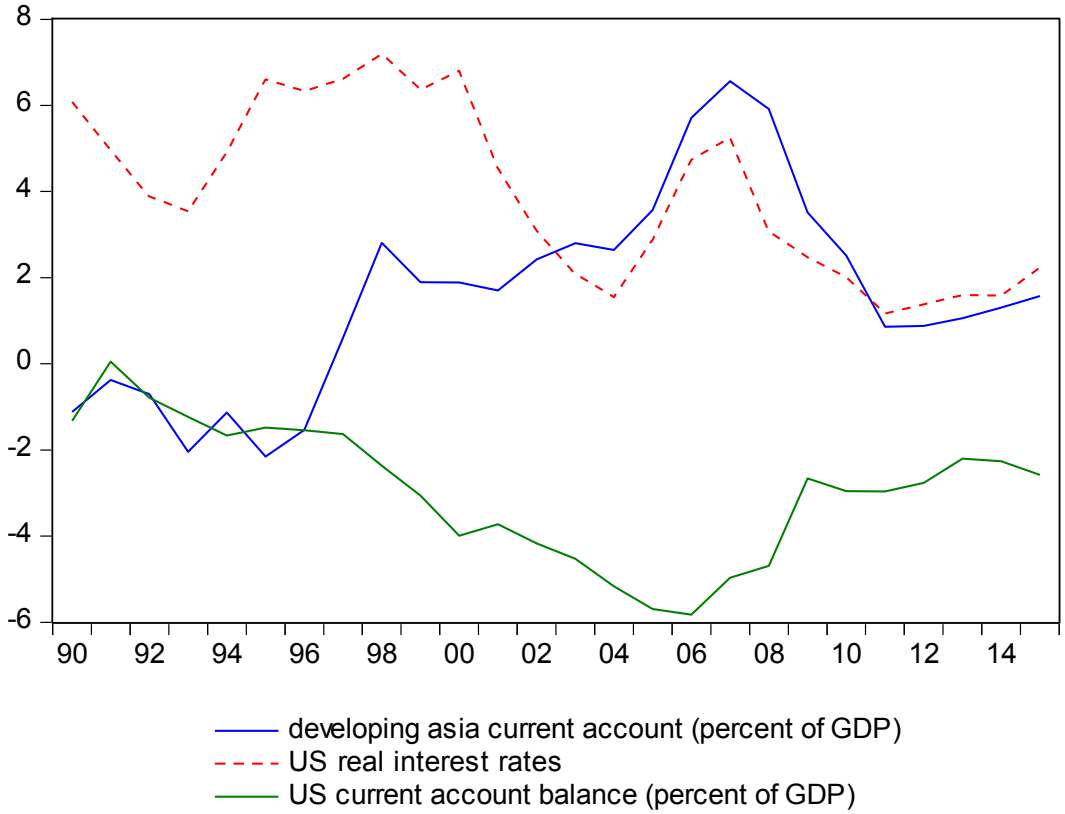
On the supply side, the dollar and US T-bill hegemony against other reserve assets is reflected in the reserves structure of central banks in emerging countries where the dollar is predominant as main asset reserves. This leading role of the US dollar is explained by a lack of diversification in terms of supply of reserve assets with the structural weaknesses of the euro that limit its expansion, a bond market not integrated into the euro area and the minor internationalization of Chinese Yuan. Nevertheless, the dollar's role could reduce in the medium term with implications for the reserve assets supply. These limits will come from the internal development of the US economy.

In sum, these developments concerning supply and demand for reserve assets will affect both the issuing and the holding countries' reserve assets in different ways. These consequences

could be summarized into four points: the short and medium term consequences; and the implications of the demand and supply distortions.

2.3.2.1. Short term consequences

The continuous growth of the public demand for reserve assets has consequences for the amplifications of imbalances mechanisms involved during the pre-GFC period, in particular the effects of low, long-term interest rates. Indeed, the excessive demand for safe assets in emerging countries greatly contributes to lowering the global interest rates and exerts influence on the liquidity cost. In turn, these extremely low-interest rates will lead to a "search for yield" race by financial markets' participants. Such behavior may lead to financial assets and house prices bubbles that have strong macroeconomic destabilizing implications. These developments that led to the GFC and are still relevant today as the combination of quantitative easing outcomes and the continuing demand for safe assets still contribute for the financial instability. Furthermore, high demand for reserve assets from emerging countries and commodity exporting countries which are associated with a high level of gross saving influences the patterns of the current account in the reserve issuing countries, particularly the United States. The hypothesis of high level of gross saving in the emerging countries affecting the US current account was previously developed by Bernanke (2006, 2011) under the hypothesis of "global saving glut", which included the main short-term consequences of the hoarding reserves with the persistence of the "global imbalances" and their consequences on the global economy.



Sources: IMF, World Bank

Figure 2.3: Evolutions of current account and US real interest rates

2.3.2.2. Medium term consequences

The continuous growth for safe and reliable reserve assets may contribute to the emergence of a modern version of the Triffin's dilemma in the medium run as the US economy cannot sustain indefinitely the reserve asset supply to meet the increasing demand from the rest of the world. However, are those assumptions still relevant? According to Farhi et al (2012) and especially Smaghi (2011), there are several reasons explaining the presence of a modern version of Triffin's dilemma.

The first factor is related to the reserve accumulation of the emerging countries, which causes distortions in the reserve asset market since those countries add their own public demand in addition to the private demand for US safe reserve assets. As a result, this situation leads to the "Lucas paradox" where the EMEs become net exporters of capital at the expense of the developed countries that become net importers of capital even though according to the theory, the emerging countries are still the historical destination of capital flows. This situation increases vulnerabilities in the US financial markets by driving down real interest rates and risk premiums, which uplift financial innovation and develop the destabilizing effects that led

to the GFC. Furthermore, as in the Triffin's Dilemma, the high demand for US reserve asset induces the same mechanisms since that privilege contributes to a loosening of US economic policy as they tend to rely on the easy credit through the capital flows received from the reserve holding countries during the normal periods. On the other side, during a period of crisis, they tend to rely on expensive macroeconomic policies that lead to excessive US indebtedness.

The second reason is related to the observed lack of a credible anchor for international monetary and financial stability as in Triffin's Bretton Woods days. The independent macroeconomic objectives of the key issuers and holders of reserve assets have destabilizing effects on the International monetary system and would not serve those countries' interests in the long term. Particularly, those policies would not take account of the negative externalities for other countries and especially for the global financial stability, as they tend to produce unsustainable imbalances and produce vulnerabilities in the global financial system. The credible factors contributing to these imbalances have been largely developed in the literature, especially under the hypothesis of global liquidity glut and global saving glut. Moreover, according to Farhi et al (2012), contrary to the gold standard during the BW era, we must consider the fiscal position of the safe assets issuing countries, especially the US, as a reliable anchor for the global monetary system to understand the new Triffin's dilemma. In the medium term, US cannot sustain the strong growth of the world economy; especially through the supply for safe assets as the US dollar monopoly as currency reserve will tend to a multipolar reserve currency perspective.

In sum, there is still no credible mechanism for symmetric adjustment of imbalances nowadays despite several differences from Triffin's times, such as the wide usage of exchange rates, higher capital mobility due to more financial integration, and higher private international liquidity.

2.3.2.3. Distortions in the demand for reserve assets and consequences

As we have seen above, the excessive demand in the reserve assets market is largely explained by the hoarding reserves by emerging Asian countries following the painful episode of the Asian crisis. This policy has allowed these countries to protect themselves from the whims of the global economy but this behavior is a source of negative externalities. Indeed, one can understand this precautionary behavior of Asian countries by the analogy of the consumer precautionary savings behavior at microeconomic level (Leland, 1968 and Sandmo,

1970). For lack of alternative, this policy is the only solution used by these countries to stabilize their economies and allow them to be isolated from external developments. This behavior is entitled as a self-insurance behavior by accumulation of precautionary savings. At a macroeconomic level, although this behavior is rational from the consumer's standpoint; self-insurance leads to an aggregate of excess savings situation whose principal consequences are clearly stated by Bernanke (2006, 2011) as maintaining real interest rates extremely low over a long period and the persistence of global imbalances as this situation reflects the market imperfections in the presence of incomplete markets. This analysis from the consumer behavior and its effects at macroeconomic level can also be transposed in the study of hoarding reserves from the EMEs. In this context, these countries want to protect their economies against macroeconomic shocks by performing an accumulation of assets by analogy to precautionary savings. Reserve accumulation is the only option of insurance possible to deal with various potential macroeconomic shocks. Consequently, there is a situation of an over-accumulation of reserves that causes a downward pressure on the long-term interest rates at global level. This prolonged decline in long-term interest rates enhances the possibility that the global economy is in a liquidity trap situation with consequences undermining the stability of the global economy.

2.3.2.4. Distortions in the supply of reserve assets and consequences

This excessive strength on the demand side is coupled with imperfections in the supply of safe assets. Indeed, the very low-interest rates that followed the excess demand will cause several consequences, the most important of which will be the weakening of the financial system. Thus, maintaining low-interest rates over a long period will cause several distortions, including the emergence of "search for yields" behavior. This will also contribute to the emergence of speculative bubbles whose appearance and disappearance are sources of instabilities and macroeconomic volatilities. Then, the principal distortion resides on the supply side of reserve assets due to the high demand in this market. Indeed, we witness the increase of national indebtedness in developed countries, primarily in the US, and the creation of "virtually safe" assets through securitization that can be summed as an attempt from the private sector to create safe assets. However, this attempt has shown its limits during the GFC, because it is precisely the wrong assessment of those assets that triggered the financial crisis. Finally, this situation has also conducted a change of the behavior of financial intermediaries that led to the weakening of their balance sheets along with the excessive uses of short-term

financing that are inherently fragile to financial shocks and can lead during periods of stress to fire asset sales.

This approach gives us a complete overview of the consequences of the hoarding reserves from EMEs on supply and demand for reserve assets, and this behavior's influence on the real and financial sphere, especially in the US that almost has a monopoly of the supply of reserve assets.

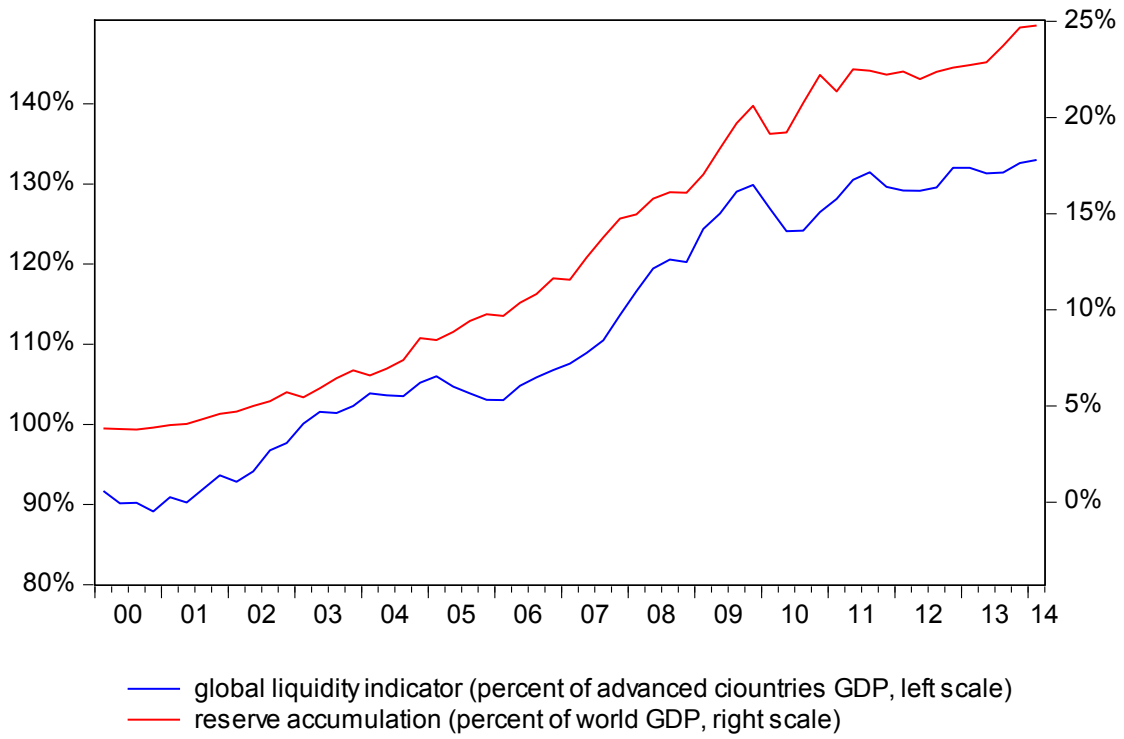
2.4. Global reserves accumulation and global liquidity

2.4.1. Global liquidity and reserve accumulation's literature overview

Since early 2000, the world has experienced unparalleled expansions of both global liquidity and reserve accumulation. Concerning the global liquidity, the growth was fueled before the crisis by accommodative monetary policies that enhanced the public liquidity available in the advanced countries and affected in turn the financial market by enhancing the creation of private liquidity through financial innovation. After the crisis, the growth was led by the accommodative policies (QE) implemented by central banks in the advanced countries to sustain their economies from the GFC negative externalities. These developments are related to macroeconomic and financial concerns in the global liquidity's receiving economies such as asset prices appreciations (Baks and Kramer, 1999; Ruffer and Stracca, 2006; Brana and Prat, 2011), increase in house prices (Djigbenou, 2014) and commodity prices (IMF, 2010), a change in monetary conditions in the receiving economies and their output level (Souza and Zaghini, 2004). Another strand of the literature investigates the relations between the global liquidity dynamics and global imbalances (Brake and Fidora, 2006; Park, Fourel and Djigbenou, 2015) which introduced concerns relating the growing global liquidity observed nowadays and the evolution of the reserve accumulation in the emerging countries. On the reserve accumulation side, the growing reserves in the EMEs are explained by the surge of capital inflows into these countries as spillover effects of global liquidity expansion (Psalida and Sun, 2011). Several studies are also investigating the feedback link between the global liquidity and global imbalances with the reserve accumulation as primitive concern (Choi and Lee, 2010) as global liquidity expansion account partially to the large current account surplus in the EMEs and the evolutions of sterilized interventions in the foreign exchanges market have consequences on the domestic reserves asset and domestic level investment level. The authors showed that an increase of sterilized interventions conducts the capital inflows to be

reallocated into reserve accumulation in place of ending in the domestic investment and in turn, the reserve accumulation lowers the US interest rates diminishing the shrinking process of the global imbalances. A new approach on the global liquidity and global imbalances topic have been developed under the hypothesis of "global liquidity imbalances" (Gourinchas, 2012), in which the author supports that the traditional approach using the net imbalances and current account does not work anymore. Instead, the approach that does work involves gross imbalances, particularly regarding the liquidity component of those imbalances. He underlined that the gross external position is a better indicator of external position than the standard current account indicator.

This short overview on the global liquidity and reserve accumulation concerns present the actual challenges between these phenomena. The next section is dedicated to determining the possible links and consequences of the combined evolutions of the global liquidity and hoarding reserves on advanced countries and emerging countries.



Sources: IMF, COFER, author's calculations

Figure 2.4: Reserve accumulation in Asian EMEs and Global liquidity evolutions

2.4.2. Global liquidity and reserve accumulation framework

For the purpose of our analysis, only the public component of global liquidity is considered in this section. We define the official public component of global liquidity as the monetary

aggregates issued by monetary authorities and used by domestic agents inside and outside their own monetary areas for transactions purposes. This public component of global liquidity is essentially fueled by the policies implemented by the central banks in the advanced countries. Those monetary policies are defined individually by each central bank according to their macroeconomic objectives and conditions. In turn, these actions contribute to the growth and declines of global liquidity conditions, particularly since the GFC and the beginning of the quantitative easing programs in the United States and the other advanced countries, which reveal accurately the effects of the independent decisions for monetary authorities over the evolutions of global liquidity. Since the crisis, one of the main drivers of global liquidity expansion is the quantitative easing in the advanced countries and reintroduction of excessive global liquidity concerns. Additionally, these domestic developments leading to the increase of the global monetary liquidity affects the emerging countries' monetary conditions as the advanced countries' official liquidity are also transferred to other receiving economies by affecting their economies and markets through different channels, particularly the foreign exchange reserves, if the capital flows into these countries are not correctly sterilized.

According to previous studies on the global liquidity topic, it is important to consider the Mundell-Flemming framework, particularly the Mundell trilemma to understand the global liquidity and reserve accumulations dynamics between the core issuing countries and the receiving countries of the global liquidity. The Mundell trilemma or the "impossible trinity" shows that a country cannot simultaneously achieve financial openness, monetary policy independence, and exchange rate stability; the monetary authorities have to choose only two of these objectives. In this context, conventional and non-conventional monetary policies are labeled as "push" factors as they induce the same mechanism in a two-country framework (Park, Djigbenou, Fourel, 2015; ECB, 2011). Firstly, an accommodative monetary policy in the first country, especially in the US as the leading country, drives upward the interest rates' differences between the two countries and redirects the capital flows to the second country with the attraction of local financial assets. Moreover, those capital flows induce currency appreciations in the second country and also affects the competitiveness of their local product. To cope with their asset and currency appreciations and to prevent capital outflows, the monetary authorities in the second countries may have to reduce their key interest rates to rebalance the interest rates differences between both countries. Secondly, when quantitative easing and other non-conventional policies are implemented in the core country, it impacts essentially investor's portfolios through assets prices evolutions. So, to protect themselves from these external developments, investors redefine the allocation of domestic and foreign

assets in their portfolio to maintain their risk and return expectations because of the asset prices appreciation in the second country. This measure affects the global liquidity conditions as well since the monetary authorities in the second country will have the choice between letting the markets self-correct and choosing to implement an accommodative policy to counter the effects of the policy conducted in the core country. As a result, the combined actions of the monetary authorities in both countries enhance the official component of global liquidity.

Since the global liquidity expansion and strong capital flows into the receiving economies result in several concerns for financial stability, the most important of which are strong upward pressures on asset prices, undesired exchange rates appreciations that could undermine the competitiveness of the economy. As seen in the previous sections, the reserve accumulation in the receiving economies may act partially as buffer against future crises for precautionary purposes and as a tool for maintaining export competitiveness by controlling the domestic currency path for mercantilist purposes. These motives are important as it introduces the feedback effect of reserve accumulation behavior on global liquidity. So according to ECB (2011), the accumulation of reserves can contribute to global liquidity through its effects on the global liquidity conditions, as it affects the global bond yield configurations, as capital flows are channeled from emerging markets to advanced countries. The effects are particularly relevant concerning the US economy, as the US Treasury bonds are the main reserve assets globally. As a result, the strong demand for safe and reliable asset from emerging countries exerts downward pressures on yields and hence has an impact on the global liquidity.

2.5. Global reserves accumulation Effects on the global liquidity conditions in the core country.

In this section, we undertake an empirical analysis about the outcomes of the global reserve accumulation in the emerging Asian countries on the main reserves issuer country, the United States. For this purpose, we implement a Structural Vector autoregressive (SVAR) model to determine the effects on the US economy, especially their contemporaneous effects on the path of the US current account and the global liquidity conditions.

2.5.1. Data and preliminary transformation

2.5.1.1. Data

For the purpose of our analysis, we collect series in quarterly frequency from the first quarter of 2000 to the third quarter of 2015. Two groups of countries are considered in this investigation: on the one hand, the United States as the main issuer of international reserves, and, on the other hand, the Asian EMEs and Japan as the main region accumulating foreign reserves. The database contains the following US domestic variables:

- The current account balance to represent the effect of reserve accumulation on US current account.
- The US 10 year Treasury bond yields as the benchmark for the long-term interest rates.
- An indicator of performance in the US financial market to represent the US asset prices from the OECD share prices NYSE composite index.
- The real estate prices in the US using OECD house prices index.
- Indicators for US consumption, saving and investment.
- The US consumer price index (CPI).

Additionally, as a proxy of reserve accumulation in US dollars, we use the holdings of US Treasury bills by EMEs, particularly Asian Emerging countries. We choose this indicator contrary to the traditional metrics[23] (Short time Debts, Imports cover…) of reserve accumulation, as our main objective is to review the destabilizing effects of the hoarding reserves in the issuing countries, it is important to distinguish claims in dollars from claims in

[23] The traditional metrics to measure the reserve adequacy, which is largely used and cited in the academic literature, are summarized into the simple following rules of thumb. Despite their simple definition and relevance, these metrics are difficult to interpret.
The ratio of reserves to imports is defined as a measure of the number of month's imports that should be sustained by the foreign exchange reserves during a crisis, in particular when export revenue and external financing cease. This rule is especially relevant for low incomes countries (LICs). Indeed, such countries are relatively immune to international financial shocks -as their level of international financial integration is still low- but very sensitive to trade shocks due to their dependence on commodity exports. According to this measure, the traditional benchmark is three months of imports covered by international reserves.
Short-term debt (STD) or the thumb rule of "Greenspan-Guidotti" is the indicator of reserve adequacy usually used by EMEs with open financial account. This indicator has the advantage to be a measure of crisis risk for market access countries and its common measure proposes to cover 100% of STD for one year. The 12 months coverage is essentially arbitrary and depends on the definition of "short term" but it is important that the country should able to "be out of the market for one year" (IMF, 2010) because of the uncertainty of the crisis duration.
Broad money (M2) or the ratio reserve to M2 (20 percent level is the consensus amongst policymakers) is an indicator that captures the risk of capital flight during financial crises. This indicator rests in the fact that such crises tend to be linked to bank runs. In this context, the monetary aggregate M2 gives a proxy to estimate the amount of liquid domestic assets that domestic and foreign agents can easily concert in foreign reserves.

other currency. Moreover, we focus exclusively on US reserve asset because of the main importance of the US safe assets in the safe reserve market.
Finally, such data are available from the Treasury securities (TIC) database, the IMF, BEA and Macrobond databases.

2.5.1.2. Data issues and preliminary treatment

Before implementing the SVAR procedure, some data requires being treated afore beginning the estimation.
Firstly, it turns out that several series as TIC securities or the consumer price index are only available in monthly frequency, so the quarterly transformation is applied to these data. Then, we choose to transform the data into constant term by using the consumer price index for the consumption, saving and investment series; then we use the inflation in the US to determinate the real long-term interest rates using the 10-year treasury yield. The series modeling the house price index and asset price are extracted directly in constant prices so they do not need any further treatment. Also, before proceeding to the next treatment, we express some of our variables in logarithm (share and house prices, reserve accumulation variables) and the other variables are expressed in percent of US GDP (consumption, current account balance).
Secondly, we choose to detrend our series by using the Hodrick-Prescott filter (1980), despite the voices arguing against the use of the HP filter in a VAR framework (VAR-in-level models). Particularly, considering the Ashley and Verbrugge (2009) comments which indicate that the model using this kind of data has a less explanatory power than the Lag augmented VAR models suggested by Toda and Yamamoto (1995), and the first difference VAR models when it comes to identifying the Granger causality relationships and estimating confidence levels. However, according to Bernanke et al. (1997), the VAR-in-level models using HP filtered data is relevant in a business cycles framework and more broadly in a dynamic general equilibrium model. Furthermore, the choice of the HP filtered data is also motivated by the fact that we do not test for Granger relationship in the SVAR framework as we aim to discuss the transmission channels of the reserve accumulation behavior into the reserves issuer country by identifying the short-term consequences of this accumulation behavior. In other words, we do not seek to demonstrate the medium consequences through a cointegration analysis between our variables.

Thirdly, we check every variable for the existence of multiple breakpoint tests by using the Bai-Perron (1998) methodology. The results[24] suggest the existence of structural breakpoints on the intercept of each series that may lead to non-significant results for our estimations. We deal with this particular issue by introducing dummy variables during the dates of break and we are careful to not fall into the "dummy trap" by not treating at least one of our variables with this method, particularly the reserve variables.

Fourthly, despite the fact that we decide to perform a SVAR in level, we undertake unit root tests[25] to verify that all of our variables are currently I(0) after the HP filter is conducted.

Finally, the previous transformations allow us to create the following endogenous vector for our analysis. The following endogenous vector gathers all the variables useful for our approach. However, as we aim to test different models, the endogenous vector may differ across specifications.

$$y_t = \left(reserve_t; i_t^{lt}; house_t; asset_t; consumption_t; saving_t; Investment_t; CA_t\right) \qquad (1)$$

2.5.2. Methodology

2.5.2.1. Structural VAR model

Our modeling strategy is based on the Structural VARs models developed by Amisano and Giannini (1997), under the *AB model* approach. The main purpose of this method is to obtain a non-recursive orthogonalization of the error terms for impulse response analysis. This methodology is an alternative to the recursive Cholesky orthogonalization that requires that we impose enough restrictions to identify the orthogonal (or structural) components of the error terms.

We consider y_t a k-element of the vector of endogenous variables and $\Sigma = E[e_t e_t']$ the residual correlation matrix. Considering the recommendations on the SVAR topic, the AB model that we consider may be written as follow:

$$Au_t = B\varepsilon_t \qquad (2)$$

[24]See appendice p.160.
[25]See appendice p.159.

Where u_t and ε_t are vectors of length k; ε_t is considered as observed (or in reduced form) residuals while u_t is the unobserved structural innovations. A and B are $k \times k$ matrices to be estimated. The structural innovations u_t are assumed to be orthonormal as its covariance is an identity matrix $E[u_t u_t'] = I$. The assumption of orthonormal innovations u_t imposes the following identifying restrictions on A and B as follow:

$$A\Sigma A' = BB' \tag{3}$$

Considering that the expressions on both sides are symmetric, we can follow the setting for linear restrictions on the A and B matrices explained formally by Breitung et al (2004). As there are altogether $2K^2$ elements in the structural matrices and the maximum number of identifiable parameters in these matrices is $K(K+1)/2$, we need $2K^2 - K(K+1)/2$ further restrictions for exact identification. The identifying process of the restrictions is discussed in the next section.

2.5.2.2. Specifying the identifying restrictions

The benchmark model of our analysis includes five US domestic variables and one external endogenous variable:

$$y_t = \left(reserve_t; i_t^{lt}; house_t; asset_t; consumption_t; CA_t\right) \tag{4}$$

The previous vector yields to the reduced form for disturbances: $u_t^r, u_t^i, u_t^h, u_t^a, u_t^c, u_t^{CA}$. The model for innovations $Au_t = B\varepsilon_t$ is specified as:

$$\begin{pmatrix} 1 & a_{12} & 0 & a_{14} & 0 & 0 \\ 0 & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\ 0 & 0 & 1 & a_{34} & a_{35} & 0 \\ 0 & 0 & a_{43} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & a_{56} \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} u_t^r \\ u_t^i \\ u_t^h \\ u_t^a \\ u_t^c \\ u_t^{CA} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{pmatrix} \begin{pmatrix} \varepsilon_t^r \\ \varepsilon_t^i \\ \varepsilon_t^h \\ \varepsilon_t^a \\ \varepsilon_t^c \\ \varepsilon_t^{CA} \end{pmatrix} \tag{5}$$

In the expression (5), the structural shocks represent respectively the reserve accumulation in the Asian countries shockε_t^r; long-term interest shock ε_t^i; house price shock ε_t^h; financial

assets prices shock ε_t^a; US consumption shock ε_t^c and finally the current account shock ε_t^{CA}. Our identification scheme of A matrix follows the hypothesis below:

- The first row represents the reserve hoarding process in the Asian countries. As we only consider the accumulation of US reserve assets, we assume that the hoarding process contemporaneously affects the interest rates in the US markets through the liquidity feedback into US economy hypothesis developed in the previous sections. Also, considering the fact that the US financial markets are highly integrated, the evolution in the US bond markets may have consequences in the other segments of the financial markets. We assume that the asset prices are responding to the high demand in the reserve asset market.
- The second row represents the global liquidity conditions[26], which affect the US domestic variables in the short term through its impacts on long-term interest rates. Consequently, consumption, asset prices, house prices and the US current account react to the US interest rates. For instance, the push factors (Baks and Kramer, 1999) induced by the global liquidity expansion may heighten the reserve accumulation in the receiving countries and in turn, they affect the path of interest rates in the issuing countries which also influence the evolutions of the asset prices and the house prices. Furthermore, this situation also intensifies the US current account deficit (Park, Djigbenou and Fourel, 2015) and affects the consumption, saving and investment patterns (Bernanke, 2006, 2011).
- The third and fourth rows express the links between the real estate markets and the financial markets in the US as their evolutions are closely related during normal times. So the house prices contemporaneously affect the asset prices and reversely. Additionally, the third row expresses the housing wealth effect (Carrol and Zhou, 2010) as the evolution of the housing prices and the stock prices affect the consumption of the US households. Particularly, as stressed by Aciovello (2011), there is a causal link between the consumption and the housing wealth as they tend to move together empirically despite the fact that theoretically, an increase in housing health should have negative consequences on non-housing consumption.
- The fifth row represents the relation between US consumption and the current account patterns. This row underlines that the US current account may also react in the short

[26] We consider only the effect of the evolution of long-term interest rates as main transmission channel.

run to US consumption as a growth in level of consumption in the US may intensify the imports of foreign goods that deepen the current account deficit.

- The sixth row represents the current account innovations. We assume that it does not have any contemporaneous effect on other endogenous variables.

2.5.2.3. SVAR estimation strategy

As our final objective is to investigate the consequences of the hoarding reserve on the US domestic variables through impulses function responses and variance decomposition analysis, we use the following estimation strategy:

First, we have to estimate the underlying VAR model before applying the SVAR framework. For this purpose, we need to define the optimal lag length by computing the information criterion. We follow Ivanov and Killian (2005) recommendations by giving in priority the choice to Akaike information criterion (AIC) and the Hannan-Quinn information criterion (HQC) since those information criteria tend to produce accurate quarterly VAR for a sample size fewer than 120 quarters.

Second, we introduce subset restrictions for our underlying VAR model by using a sequential elimination of regressors strategy developed by Lütkephol and Brüggemann (2001) that sequentially delete the regressors which lead to the largest reduction of the AIC criterion until no further reduction is possible. The procedure eliminates only a single regressor in each step and new t-ratios are computed for the reduced VAR model at each step. This procedure improves the accuracy of the underlying VAR estimation and improves the impulse response functions.

Third, we estimate the structural VAR model from the underlying VAR by using maximum likelihood from scoring algorithm (Amisano and Giannini, 1997; Breitung et al., 2004). The SVAR estimation uses the variance-covariance matrix of the reduced VAR model and the restrictions imposed for the structural form. We then check if the system is overidentified by implementing a likelihood ratio test. For example, the benchmark model is overidentified by five restrictions, as our AB model requires 51 restrictions for exact identification.

Fourth, the Impulse Responses functions are calculated from the coefficient of the newly estimated SVAR model. We then construct confidence intervals (CIs) by bootstrap computing method. For the purposes of our analysis, we consider two CIs: the standard percentile interval by Efron and Tibshirani (1993) and Hall's studentized interval by Hall (1992) to check for the robustness of our IRFs results.

Fifth, we compute the Forecast error variance decomposition (FEVD) based on the structural innovations. But unlike the standard VAR FEVD, it may not be possible to associate the structural innovations uniquely with the variables of the system (Lütkepohl, 2004). The SVAR FEVD is not decomposed into contributions of the different variables but into the contributions of the structural innovations, so we center our analysis on the contributions of these structural innovations.

2.5.3. Empirical results

2.5.3.1. Asian hoarding reserves behavior: Benchmark model

2.5.3.1.1. Preliminary results

As underlined in the previous section, the restrictions for the benchmark model are represented by equation (5). We consider in this first model that the $reserve_t$ endogenous variable represent the total US Treasury securities (TIC securities) held by foreign emerging Asian countries[27]. Furthermore, according to the preliminary steps of the SVAR procedure, the optimal lag length minimizing to the information criterion (AIC, HQ) is one lag. We implement a VAR (1) model whose estimation results for the VAR coefficient are below:

$$y_t = \begin{bmatrix} 0.877 & 0 & 0 & -0.124 & 0 & 0 \\ 0 & 0.663 & 3.755 & 0 & 0 & 0.124 \\ 0.030 & -0.007 & 1.059 & -0.034 & 0 & -0.005 \\ 0.361 & 0 & 0.877 & 0.768 & 0.105 & 0.042 \\ 0 & -0.055 & 1.465 & 0 & 0.477 & 0 \\ -1.224 & 0.312 & -3.036 & -1.094 & 0 & 0.434 \end{bmatrix} y_{t-1}$$
$$+ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.422 & -0.367 & 0 \\ 0 & -0.008 & -0.007 & 0 & 0 & 0.002 \\ 0 & 0.035 & 0.037 & -0.047 & -0.056 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.313 & 0 \end{bmatrix} Dum_t + u_t$$

Where $y_t$represents the endogenous vector (3). The SER strategy allows rejecting 39 not significant regressors. The current VAR model is the model minimizing the AIC information criterion used in the SER procedure.

[27] We take also into account the contributions of Japan, as they are the second TIC securities holder amongst Asian countries behind China.

From the VAR (1) model, we estimate the SVAR (1) associated with the restrictions described in (4) and the estimated structural parameters of the AB model is described by the following results:

$$\tilde{A} = \begin{bmatrix} 1 & -0.0174 & 0 & 0.1647 & 0 & 0 \\ 0 & 1 & 1.7078 & 0.9664 & 0.2782 & 0.0073 \\ 0 & 0 & 1 & 0.2811 & -0.0353 & 0 \\ 0 & 0 & -18.9187 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & -0.1298 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \text{ and } \tilde{B} = \begin{bmatrix} 0.0247 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.2117 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.0113 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.1683 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.0126 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.2628 \end{bmatrix}$$

Since the structural parameters are not informative compared to the impulse functions analysis, we also display the estimated contemporaneous impact matrix obtained from the Maximum Likelihood estimates of the structural parameters before performing the IRFs analysis:

$$\tilde{A}^{-1}\tilde{B} = \begin{bmatrix} 0.0247 & 0.0037 & -0.0062 & -0.0042 & -0.0034 & -0.0009 \\ 0 & 0.2117 & -0.0359 & -0.0118 & -0.0543 & -0.0152 \\ 0 & 0 & 0.0018 & -0.0068 & 0.0008 & 0.0002 \\ 0 & 0 & 0.0339 & 0.0243 & 0.0147 & 0.0036 \\ 0 & 0 & 0 & 0 & 0.01392 & 0.0341 \\ 0 & 0 & 0 & 0 & 0 & 0.2628 \end{bmatrix} \times 10^{-2}$$

Furthermore, we note that according to the LR test for 5 overidentifying restrictions, the null hypothesis of overidentified model at $\propto = 5\%$ cannot be rejected. However, the restrictions are weakly rejected at $\propto = 10\%$.

LR	P-value
9.3222	0.0969*

Table 2.1: Test for overidentifying restrictions

2.5.3.1.2. IRFs and FEVD analysis

In this first model, we investigate the effects of the reserve asset accumulation by Asian economies in the main issuer country of reserve asset, the United States. We find that a transitory positive shock (figure 2.5) in the reserve accumulation, which corresponds to a temporary increase in demand for reserve asset, has a mitigated effect on long-term interest rates and the housing price despite an appreciation effect of the real estate price. However, the

shock has significant effects on the US consumption, the asset prices and the current account. Indeed, the shock induces significant appreciation effect on the US asset prices during the 8 first quarter of the model validating the push factors effects of the liquidity inflowing to the US economy. We note also a delayed relative significant effect – considering the Studentized CI- of the shock on US consumption during the second quarter. We cannot fully comment on the housing wealth effect on consumption since the evolution of house prices is not significant. Nevertheless, we conclude that house prices and domestic consumption follows the same movement, corroborating previous empirical results on this topic, particularly Aciovello (2011). Furthermore, we observe that an increase in the reserve hoarding process affects negatively the path of US current account and the effects persist for 8 quarters after the initial shock. This last result highlights the relationship between the hoarding process – which is an indication of high gross saving and current account surpluses in the EMEs – and the current account deficit in the US as the hoarding reserve contribute to the persistence of the global imbalances.

The previous results from the transitory shock are confirmed by the accumulated responses of our endogenous variables after a permanent structural shock of reserves (figure 2.6). We confirm – considering our restrictions- that the long-term interest rates, the house prices and consumption do not have any significant effects to an accumulated reserve structural shock. In this configuration, a continuous increase in demand for US reserve assets from the emerging Asian countries does not have effect on the interest rates in the reserve-issuing countries. In other words considering this particular configuration, a surge in demand does not influence the global liquidity conditions despite the fact that reserve accumulation triggers excessive liquidity flow into the US economy, enhances the available liquidity in the US economy and finally, increases global liquidity. However, significant effects are observed and they are in line with the theoretical hypothesis. Indeed, we note that a permanent structural shock of reserve induces a permanent change in asset prices and the current account path. So, the hoarding of reserves has an effect on the current account deficit in the reserve country issuer. The last results are in line with previous empirical studies as Bracke and Fidora (2008) and Park, Djigbenou, Fourel, (2015) that showed the persistence of the global imbalances after a positive liquidity flow, particularly a positive shock of reserve, into the advanced countries.

The FEVD (table 2.2) of the benchmark model shows that the reserves structural shock has limited effects on the variance decomposition of the other variables. The main results indicate that it is essentially each endogenous variable's structural innovations that explain their variance decomposition. The most notable effect is represented by the variance decomposition

of asset prices and the current account balance in which the shock's structural innovations has relative important parts in the explanation of the variance decomposition of these two variables, respectively 11% for asset prices and 16% for current account

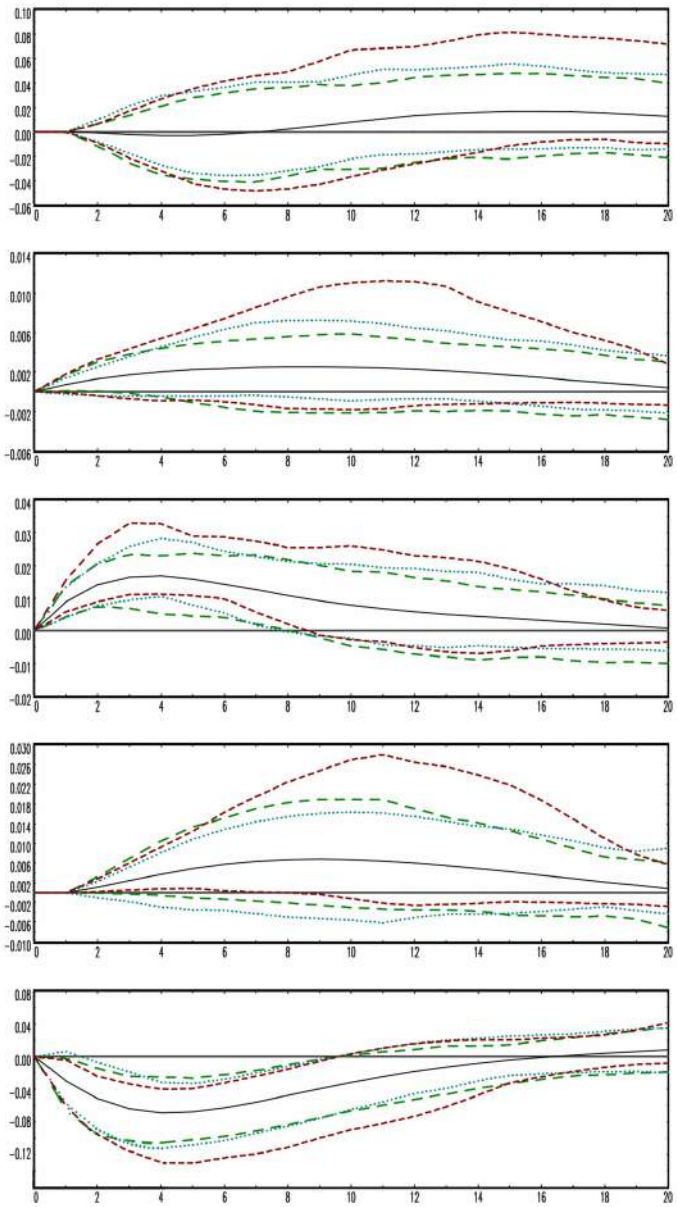


Figure 2.5: Responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a transitory shock of international reserve with standard percentile (green) and studentized hall percentile (red) 95% bootstrap confidence intervals based on 1000 bootstrap replications

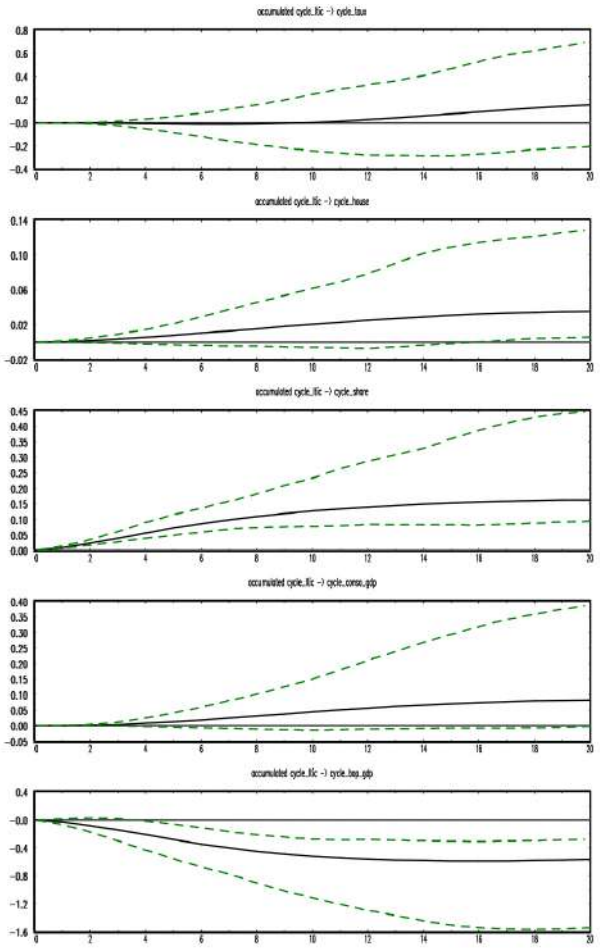


Figure 2.6: Accumulated responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a permanent shock of international reserve with studentized hall percentile 95% bootstrap confidence intervals based on 1000 bootstrap replications

	1 quarter	5 quarter	10 quarter	15 quarter	20 quarter
Interest rates	0	0	0	1	1
House prices	0	2	3	5	5
Asset prices	0	12	13	11	11
Consumption	0	0	1	1	1
Current account	0	10	17	16	16

Table 2.2 percent of FEVD explained by the Reserve accumulation shock's structural innovations

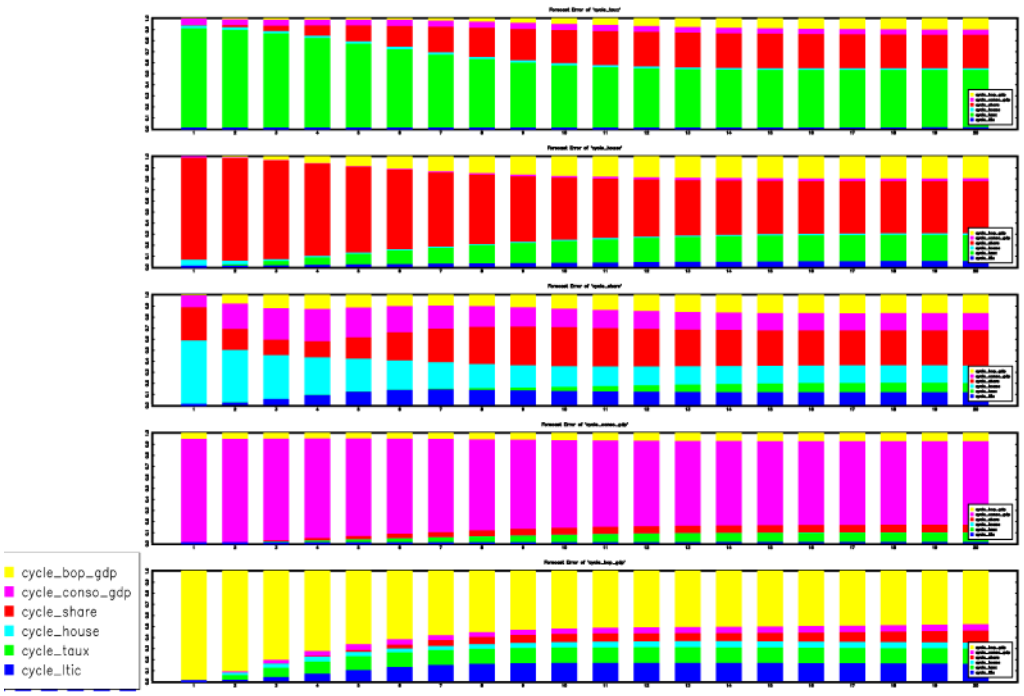


Figure 2.7: Forecast error variance decomposition (top to bottom) of interest rates, house, assets price, consumption, US current account variables

2.5.3.2. Alternative model IRFs and FEVD

To strengthen our results, the second model considers an alternative hypothesis concerning the reserve endogenous variable as we choose a GDP-weighted variable[28] to measure the evolution of the reserve asset accumulation in the emerging countries and contrary to the previous variable, this particular version of the reserve variable follows Ruffer and Stracca (2006) methodology to express the excess accumulation of reserve by EMEs. We implement the same estimation strategy and use the same underlying restrictions developed in (4) for our second SVAR estimation to verify the robustness of our previous results. The main results from the preliminary estimation procedure show that our model is overidentified after the LR overidentification test[29].

We conduct the same analysis procedure than in the benchmark model and we focus on the transitory shock first. The results[30] (figure 2.8, figure 2.9 and table 2.3) show that a transitory structural shock of reserve in the emerging countries drives the same mechanisms as we highlighted in the previous model with slight differences. We notice the relative significant

[28] The new variable is constructed as follow: $reserve_t = \frac{TIC_t}{GDP} \times 100$ .The new variable is also treated with the HP filter before the SVAR estimation.
[29] The LR test shows that the null hypothesis cannot be rejected since P-value $= 0.2 > \propto = 0.05$.
[30] Alternative model IRFs and FEVD results appendice p. 155-156.

effects of the structural shocks on the house prices according to the Efron standard CI and consumption according to the Hall studentized CI but we cannot completely conclude on the housing wealth effect on consumption. Nevertheless, we confirm the same reactions of the other endogenous variables, particularly the weak response of the long-term interest rates. As a result, hoarding reserves do not exert an influence on US long-term interest rates and its later effects on the global liquidity conditions.

The previous benchmark results are also confirmed in the accumulated responses and the FEVD of our second model. We confirm that the only variables that were durably affected by the structural shock of demand of reserve in the EMEs are the current account and asset prices. So the liquidity inflows provided by the reserve accumulating countries can trigger a speculative bubble in the reserve currency issuer, especially in the United States. Finally, the reserve accumulation dynamics perpetuate the US current account deficit giving de facto credit to the perpetuation of the global imbalances.

2.5.3.3. China's accumulation behavior

In this section, we analyze China's accumulation behavior[31] and its consequences on the US economy. This distinction from the previous model is particularly relevant since China is the main holder and buyer of US reserves assets worldwide. We undertake the same estimation strategy as in the previous models, consider a quantity based variable[32] for measuring China's accumulation behavior and use the same restrictions developed in (4) for our SVAR model. The main results from the preliminary estimation procedure show that our model is overidentified after the LR overidentification test[33]. At this point, we consider a SVAR(1) model considering the results of the information criteria.

As in the previous estimations, we first focus on the transitory shock with the following results (figure 2.10 and 2.11, table 2.4). We reach the same significant conclusions as in previous analysis concerning the evolutions of share prices and the current account. However, contrary to the previous estimations, the Chinese reserve accumulation shock has significant effects on the evolution of long-term interest rates imposing a downward pressure according to the CIs, particularly regarding the studentized Hall CI. Moreover, despite the significant results, the evolution of house prices is unexpected since the reserve shock should trigger

[31] IRFs and FEVD results p.157-158.

[32] We consider a new variable $reserve_t = \log (TIC_t^{china})$.

[33] The LR test shows that the null hypothesis cannot be rejected since P-value $= 0.9 > \propto = 0.05$.

house prices appreciations, not a decrease. Finally, the pattern of US consumption is also not in line with our theoretical hypothesis and our earlier findings, nevertheless, the reserve shock is not significant on US consumption.

Considering the results from the accumulated responses to the Chinese reserve accumulation and the FEVD, the previous transitory results are confirmed as the reserve shock permanently deviates the patterns of interest rates, the share prices and the US current account accumulated responses. We also notice that the accumulated responses of house prices and consumption are not significant to a permanent structural shock. The FEVD results confirm the previous finding of the limited consequences of the structural shock on the variance decomposition of the other endogenous variables.

2.5.4. Policy implications: what to address concerning the excessive demand for international reserves?

Our main results confirmed the destabilizing effects of the accumulation behavior in the reserve-issuing country, particularly the notable effects on asset prices, current account and in a lesser extent, the long-term interest rates in the US. These findings are in line with the literature investigating the links between global liquidity and reserve accumulation, particularly Djigbenou et al (2015). As hoarding reserves tend to exert destabilizing influences in the reserve issuing countries, an important question for policymakers is what policies to adopt in order to mitigate such influences. According to IMF (2010, 2011, 2012) and Farhi and al (2012), these policy recommendations could be summarized into two points: on one hand, policies to mitigate the demand for international reserves and, on the other hand, recommendations for the diversification of supply of reserve assets. As we focused our empirical analyze on the consequences of the hoarding reserves, we only review the recommendations' considering the flaws in the demand for reserve assets. Accordingly, the need to mitigate the demand of international reserve makes consensus amongst policy makers, but there is still discussion concerning the policies to address it. In particular, it is important to distinguish the policies according to the precautionary and non-precautionary motives for IR accumulation. Moreover, several issues as capital flow volatility and the ease of financing need to be taking into account by policy makers on these recommendations.

2.5.4.1. Dampening precautionary reserve accumulation

Despite the difficult task of differentiating the different motives for reserve accumulation, Obstfeld et al. (2008) investigate the concerns about reserve holding, the trilemma and financial stability for a sample of 71 countries over the period from 1980 to 2004. They consider different factors explaining the reserve hoarding behavior, such as financial openness, access to foreign capital markets, potentially convertible domestic financial liabilities and exchange rate policies. Their results suggest that the precautionary motive represents half to two-thirds of the total reserve holding. According to IMF (2010), one possible solution to this driver is a concerted reduction in accumulation of precautionary reserves, attributing the difficult mission of providing guidance on desirable ranges of precautionary levels to a supranational organization as the IMF. These recommendations could take into account each country's specificities (IMF, 2011), discriminating the countries between Advanced economies (AMs), EMEs and Low-income countries and the particular shocks that they may face. The countries, in turn, could agree to align their reserve accumulation policies to these proposals over time.

For instance, EMEs countries are vulnerable to shocks affecting the capital account such as sudden stop and currency crisis. This vulnerability rests on their increasing integration to world capital markets and also from the accumulation of financial imbalances. Interestingly, traditional metrics (STD, Broad money and Import cover) do not explain well the actual reserve holding for this group of countries. As a result, the desirable reserve for precautionary purpose should be based on models addressing in a formal way reserve adequacy. Such model-based approaches have the advantages to define the appropriate level of reserves by solving an optimization problem under various parameters assumptions according to the countries specificities. The hypotheses used in these models are typically the costs-benefits of holding reserves lowering the probability of crisis and smoothing consumption during a crisis (Garcia and Soto, 2004). Some parameters are especially important, such as the probability of sudden stop, the potential loss in output and consumption, the opportunity cost of holding reserves and the degree of risk aversion. The model commonly used by IMF is the framework developed by Jeanne and Rancière (2006), which includes the previous assumptions, and in addition, the degree of risk aversion of policy makers whose main objective is to maximize welfare in a small open economy vulnerable to sudden stops in capital flows. Moreover, to determine the desirable range of reserve, the IMF could use alternative methodology in order to take into account country-specific adverse scenario (IMF, 2011). This approach tests the

consequences of specific shocks to various components of the current account and the financial account over a period of time. The magnitudes of these shocks are determined considering the country's specificities, past experiences and projections. The resulting financing gap compared to the country projection is converted into potential drains on reserves that provide information on adequacy of reserve. This methodology has the benefit of yielding information that numerical metrics are unable to provide.

2.5.4.2. Mitigating non-precautionary reserve accumulation

According to IMF (2010), as the non-precautionary reserves is not a policy objective in itself, but the consequence of other policy choices such as export-led growth strategy or country structural characteristics (running large current account surpluses or large public savings), this driver should not be mitigated through policy adjustments. Considering the fact that non-precautionary accumulation has negative externalities on the international financial stability and specifically on the international monetary system (IMS), the solutions to mitigate this driver is more challenging since it requires that every reserve accumulating countries have a common understanding of the factors allowing the stability of the IMS. In addition, it is important to appraise to what extent the factors driving non-precautionary reserves may harm this stability. Two approaches are considered by policy-makers to address the non-precautionary motive. The first concerted approach requires a multilateral framework amongst the members of the Funds and requires that they implement policy adjustments for the sake of the IMS. For example, the systemic countries should adopt pre-specified horizon flexible exchange rate with limited or no interventions on the foreign exchange market, or they should shift their peg currency to a fully flexible currency. On the other hand, reserve issuing countries should adopt a medium-term fiscal rules policy to sustain the credibility of their currencies and reduce the concerns of a modern version of the Triffin's dilemma. The second approach is the restrictive solution whose objective is to internalize the negative externalities due to excessive reserves in the demanding countries or the deficits experienced by the issuing countries. According to the literature (Eichengreen, 2009a), this binding solution should be based on penalties; for instance, systemic countries running persistent current account imbalances should be penalized with an automatic tax when they reach a certain threshold. The penalties could be based in term of global GDP to capture the systemic impacts of the reserve accumulation on the IMS.

2.6. Conclusion

At the crossroad between the global liquidity and the reserve accumulation topics, our main objective in this chapter has been to review the challenges raised by the hoarding reserves observed in the Asian EMEs and identify the links between the reserve accumulation and its influence on the development of the global liquidity. To this end, we choose to undertake an empirical analysis based on SVAR methodology to distinguish the destabilizing consequences of the hoarding reserve on the main reserve-issuing country, i.e. the United States. In addition to the consequences on macroeconomics and financial variables, we isolate the main transmission channel of the surge of demand for safe reserve into the US economy by choosing to focus on the US TIC as one of the main reserve assets desired by the EMEs. Our main results confirmed some destabilizing consequences of the surge in demand for reserve assets, particularly the significant effects on asset prices and the current account imbalances in our benchmark model, and the significant results on the long-term interest rates in the United States when we focus on the Chinese behavior. However, this later finding must be interpreted with caution considering the mixed results across our specifications.

In line with previous studies investigating the links between global liquidity and reserve accumulation (Djigbenou et al, 2015; Baduel, 2012), our contribution is twofold. On the one hand, we use an original indicator to modelize the hoarding behavior in the EME. On the other hand, we focus on the consequences on the main issuing country. It is important to stress that, to our best knowledge, few empirical studies investigate these two topics in a unique empirical framework. Specifically, the choice of the SVAR methodology is not random since this approach allows us to meticulously identify theoretical relationships between the selected variables and isolate the main transmission channel of the liquidity flow from the surge in demand for the reserve assets issuing country. However, further research is needed to complete this study by generalizing the results to other issuing countries such as the euro area and investigating on the long-term consequences of the hoarding behavior by testing, for example, the probability of Triffin dilemma in issuing countries.

Chapter 3
Global excess liquidity, capital flows and monetary policy in EMEs

3.1. Introduction

Studies on the *global liquidity* concerns tend to focus their analysis on the financial stability perspective; particularly from the originator advanced countries[34] (AMs). More recently, BIS (2011) baseline study introduced consensual definitions and measures to put clarifications amongst the different measures developed in the literature. From this perspective, this study proposes the first synthesis concerning the global liquidity issues from the financial stability standpoint. While the major empirical papers focus on advanced economies, a recent strand of literature investigates the implications of global liquidity issues on the receiving economies perspective, mainly in the emerging economies[35] (EMEs). This literature focuses most notably on the financial stability concerns (BranaandPrat, 2012; Djigbenou et al, 2015); then investigates on reserves accumulation and global imbalances issues (Fourel, 2012; Parks, Fourel, and Djigbenou, 2015) A last strand of the literature assesses the impact of the global liquidity expansion on capital flows into the receiving economies (Shin, 2013, 2015).

This chapter adopts a different perspective by considering the debates on global liquidity issues from the monetary policy perspective on a country level analysis. To this end, the main question investigated in this chapter is the following: how monetary authorities of the selected countries (Brazil, Chile, China, India, Malaysia, and Thailand) reacted during surges in global liquidity during the period 2000 – 2015?

In order to provide some answers to this question, the chapter is structured in three sections as follows: in the first one, we analyze the historical economic environment in which the EMEs conducted their monetary policies; then we analyze the choices of monetary policies in the EMEs during the two last decades. The second section focus on the links between the global liquidity developments – specifically, we consider the global excess liquidity issues – and the capital flows in the EMEs. The third section focuses on an

[34] See, for instance, the seminal paper by Baks and Kramer (1999).
[35] See IMF (2010) reference study.

empirical approach based on a Time-Varying Parameters Vector Autoregressive (TVPVAR) to assess the effectiveness of the monetary policies during surges in global liquidity. We choose this empirical approach as it one of the few methodologies that allow us to precisely analyze the estimation results during selected identified dates of surge during the period.

3.2. Overview of the monetary policies in EMEs since the late 90's

To understand changes in the global liquidity spillovers on EMEs over time, we first focus on identifying the major trends amongst the monetary policy implemented in By EMEs central banks. To this end, we rely our analysis on Pradhan (2013, 2014) period's classifications to analyze the determinants of monetary policy since the beginning of the century.

3.2.1. Monetary policy during the Pre-crisis period (early 2000 – mid 2007): the beginning of the hoarding reserves

From the monetary policy viewpoint, the period is largely dominated by one major tendency in the EMEs, especially in the Asian EMEs and the oil exporting countries, the "*reserves accumulation*" policy. Indeed, in the aftermath of the Asian crisis, the EMEs central banks started to accumulate large foreign exchange reserves as precautionary motives to prevent their economy from the negative outcomes of future macroeconomic or financial shocks. However, according to the literature on the optimal level of international reserves (Noyer, 2007), it is essential to take also into account the mercantilist motives to fully understand the hoarding reserves phenomena in the EMEs.

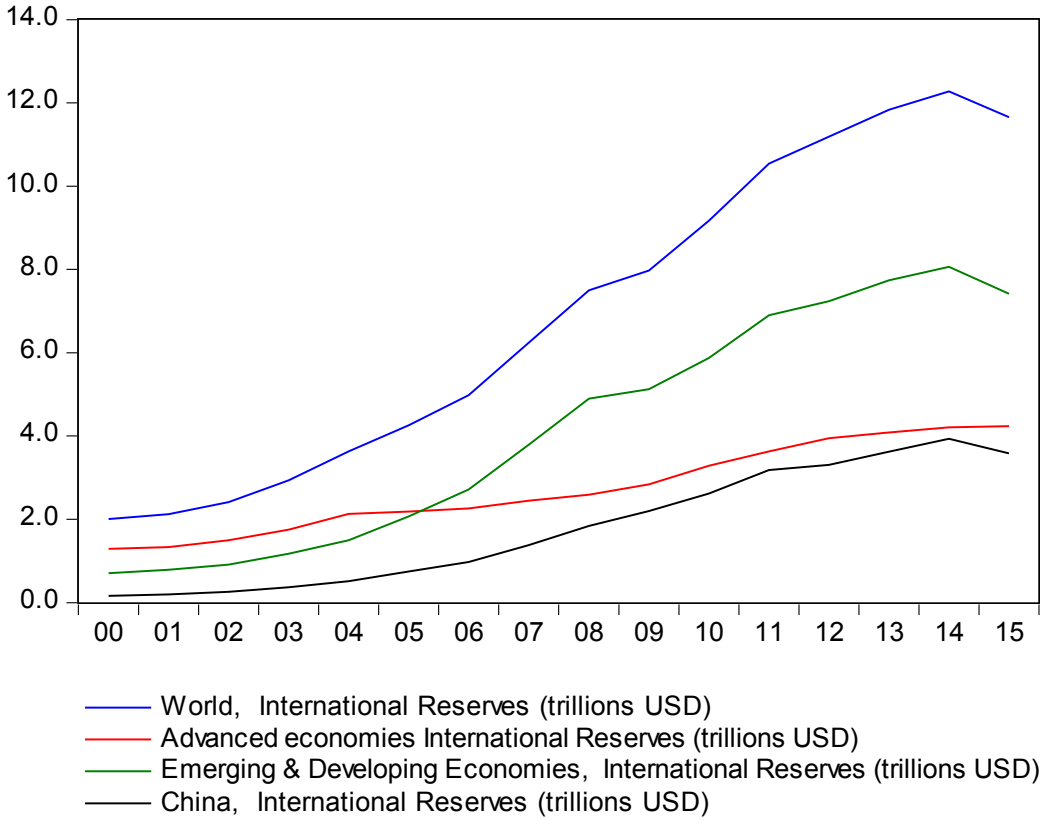
Firstly, EMEs central bank's international reserves accumulation for precautionary purpose is driven principally by their motivation to not revive their dreadful experiences during the Asian crisis. Specifically, since most of the countries used pegged exchange rates regimes before the crisis, they experienced a rapid depletion of their foreign exchange reserves that led their policymakers to reevaluate their optimal level of international reserves. Thanks to their persistent current account surpluses, they could implement the policy as "self-insurance" to prevent these negative consequences. Moreover, building up large international reserves reduces greatly their exposures to outside and internal shocks;

especially by reducing speculative attack on their currency and help to dampen macroeconomic consequences during times of stress.

Secondly, the complementary reason inciting EMEs central banks to conduct this policy rely on the mercantilist approach that partly driving the international reserves accumulation (Dooley et al, 2007; Noyer, 2007). This second motive is closely related to their economic developments during this period. Indeed, as the world demand for goods increases, especially to satisfy the consumption in the AMs, the EMEs started trade competitions in order to answer that demand. As a result, they developed export-led growth strategies for this purpose and they considered the international reserves accumulation as a mean to sustain these strategies. As a matter of fact, building up large reserves puts depreciation pressures on the exchange rates, so pursuing these policies helped to maintain the exchange rate undervalued in order to promote their exports against the other regional countries.

Concerning the reserve accumulation policy implications on the domestic monetary effectiveness, Smaghi (2010) states that the policy stimulates both domestic and cross-countries inefficiencies. As we focus on the domestic inefficiencies, reserve accumulation may lead to inefficient monetary policy in three points, especially in the pegged exchange rates EMEs. First, pegged exchange rate involves importing the monetary stance from the anchoring countries and domestic monetary policy may become inefficient, as the underlying EMEs economy conditions may be too different from those of the anchor country, especially when growth differentials are too important. Second, excessive reserve accumulation in a context of pegged currency increases the difficulty of the sterilization concerns, as the central bank has to withdraw the liquidity that it injects when purchasing foreign assets and those operations are costly. Third, in case of insufficient sterilization, excessive reserve accumulation may result in higher inflation expectations and/or stimulates asset bubbles in the EMEs.

Historically speaking, during the pre-crisis period, the international reserves hold by EMEs grew by 528 percent between the early 2000 and early 2008. For comparison, during the same period, Chinese reserves grew by 1021 percent allowing the country to become the largest holder of foreign exchange reserves in the world.



Sources: IMF, IFS

Figure 3.1: Reserve accumulation in China, EMEs and AMs

3.2.2. Monetary policy during the first post-crisis period (summer 2007 –Summer 2013): the two amplitudes economy

According to Pradhan (2009, 2013, and 2014), EMEs central banks were exposed to two main challenges during the period: "the two amplitudes economy" and "the research for a new growth model". In the following section, we focus on the determinants of the two amplitudes economy and its influence on the domestic monetary policy.

During the first post-crisis period; EMEs faced problems on the front of external and internal balances, mainly because of the evolutions of capital flows and exportations that impacts their financial account and their current account and the slow developments of their inner demand. But what are the policies implemented by central banks in this context of an economy with two amplitudes?

3.2.2.1. Converging liquidity policies and macro-policies

The adoption of quantitative easing policies across countries had the following impacts in the AMs and EMEs. As a matter of facts, the first QE (2008) implemented forced the investors to change their portfolio and redirect the capital flows to acquire the risky assets in the EMEs in a desperate search for yields. These important capital inflows were initially appreciated by EMEs as they provide unexpected positive effects on their growth during the context of modest recovery of the global economy. However, during the second QE (mid-2010), the situation was different, as their economies had fully recovered from the economic slowdown brought by the GFC. Indeed, this second capital inflows provoked some issues into the receiving economies as it appears that it was difficult for them to repeal correctly those inflows and isolate their countries from the spillovers of the monetary policies in the AMs. Several factors explained the difference outcomes in the EMEs between the first and second episodes of QE. According to Pradhan (2014), the factors explaining the hesitancy of EMEs central banks to repeal the destabilizing capital inflows may be summed up into three points: The balance between global and domestic risks, the exchange rates policy and the country economic performance.

In fact, during the second QE liquidity inflows, the receiving EMEs countries tried to reduce the appreciation pressures on their currencies in order to maintain their competitiveness against China mainly because there is a significant share of their exports that is destined for the Chinese market and Chinese products compete with their products in developed markets. This situation led to an arbitrary triangular challenge for EMEs, particularly in the Asian countries. First, Asian EMEs central banks must face the slow appreciation of Yuan against US dollars and second, they were reluctant to appreciate their currencies against the Yuan to preserve their competitiveness. This situation led their currencies into a flexible anchoring against the dollar if and only if the local currencies appreciate. In this configuration, the country central bank loses their monetary policy independence against the developments of foreign monetary policies. The loss of independence reduces the effectiveness of policy rates based macro-policies as an increase of the rates may only raise the attractiveness of domestic assets and accentuate capital inflows. To this end, the only viable solution for EMEs central banks was using liquidity based policies to prevent additional pressures on their economies, especially liquidity control as the surge of liquidity during the second QE (2009 - 2010) may have different outcomes on inflation, economic growth, and credit creation. For instance, if the central

banks choose macro-policies by increasing the policy rates, it could widen the interest rates spreads between AMs and EMEs, trigger liquidity inflows and without capital flows control, excess available liquidity in the domestic monetary system incite local banks to expand credit creation at times where monetary authorities should restrict bank activities. Moreover, increasing the rates would have negative effects on economic growth. In the opposite case, lowering the policy rates may reduce capital inflows, sustain economic growth but would stimulate inflation. However, choosing this policy would overheat their economy as EMEs had better growth prospects than AMs during the period. According to the limits of macro-policies for preventing the destabilizing effects of excessive global liquidity inflows, the only solution for EMEs central banks is the strict liquidity control as their second tool when external and internal balances developments are different, introducing the quantitative tightening policy.

3.2.2.2. Quantitative tightening: the tool against excess capital inflows

In front of the global excess liquidity available on domestic markets during the end of the second QE in the AMs (mid-2011), major central banks in the EMEs adopted simultaneously the same set of restrictive policy tools as they aimed to counter the negative effects of those important liquidity inflows into their economies such as loss of effectiveness of policy rates, credit expansion through the decline of interbank market rates and, as their economies were in the path of strong growth, an overheated economy. To prevent those situations, major EMEs central banks implemented the quantitative tightening approach through a combination of liquidity restricting tools and strict steering of key rates.

As their main objective is to reduce the excess liquidity available in the domestic a monetary and financial system, the monetary authorities proceed in two steps. Firstly, the central bank acts on the foreign exchange market by sterilizing the incoming foreign liquidity by increasing their foreign reserves in order to reduce the pressures on the exchange rates. Simultaneously, the sterilization procedures on the forex market are completed with strict capital flows control and in some countries, monetary authorities raised the reserves requirement ratio for commercial banks to prevent the credit expansion. Secondly, central banks used largely open market operations to absorb the excessive liquidity available on the domestic monetary and financial systems and raise policy rates also to prevent credit creation and rise in asset prices.

This tendency for restrictive liquidity policies is observed in the majority of EMEs during the second QE cycle. For instance, the people's Bank of China carried a set of restrictive measures to control international liquidity inflows. The central bank chooses to increase gradually the policy rates in September 2010 going from 5,31 percent to 6,51 percent until the end of the QE2 cycle. Besides, the interbank rates followed the same path as the key rates but the monetary authorities focused essentially on sterilizing the liquidity inflows by actively managing the foreign exchange reserves that had a growth rate of roughly 3,88 percent during the period. Finally, they imposed an increase in the required reserves requirement for domestic commercial banks to prevent the expansion of domestic private liquidity, essentially credit, by increasing the ratio by 6 percent during the QE2.

In India, the Reserve Bank of India (RBI) choose also specific restrictive policy tools by focusing on the increase of the cash reserves ratio for commercial banks during the first month of the QE2 by increasing the ratio by 1 percent until the end of the cycle going from 5 percent to 6 percent. To strengthen the liquidity control, the monetary authority chooses also to influence the interbank rates without changing the key policy rates, which remained unchanged at 6 percent (bank rate and discount rate for instance) since June 2003, by increasing the remuneration of deposits. This specific measure helped to balance the growth rate of credit since the growth rates of both credit and deposits were respectively 23 percent and 17 percent in March 2011. The measures were also completed by active management of foreign exchange reserves considering a growth rate of 15,32 percent between may 2010 to July 2011 before sensibly slowing down until the end of the QE2 cycle.

For its part, the Central Bank of Brazil proceeded to use the same set of restrictive measures to manage the international liquidity inflows. Firstly, the monetary authorities increased the key policy rates from 8,8 percent to 12,5 percent between January 2010 and July 2011. This first measure was also strengthened with a rise of interbank rates combined alongside an increase of foreign exchange reserves which grown by 48 percent during the period. Moreover, the central bank proceeded also to increase the tax on financial operations to prevent carry trade operations, reduce capital flows by making high-interest rates less attractive and avert overheated economy.

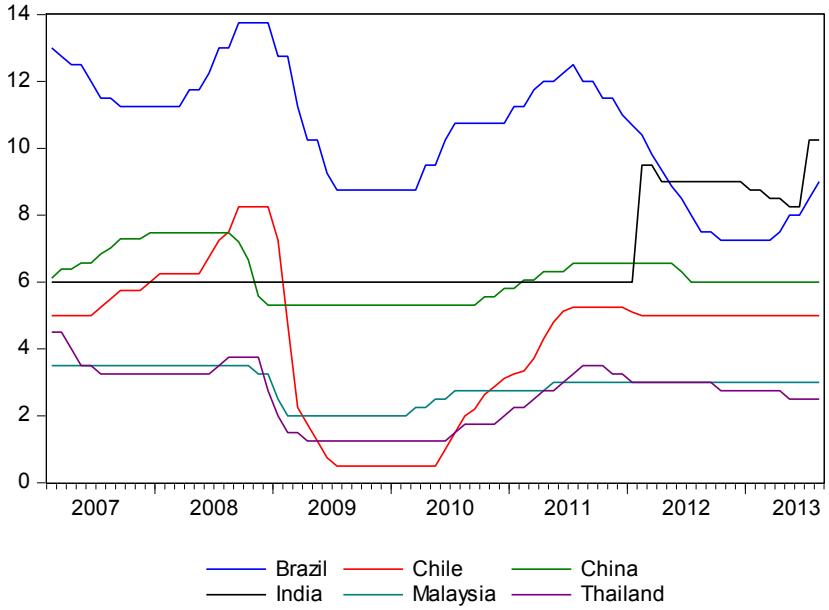
The Central Bank of Chile proceeded with the same approach as the other countries mentioned before as they choose to treat the incoming liquidity with the same tools of measures during the period. For instance, they also raised their policy key rates and interbank rates respectively from 0,5 percent to 5,25 percent and from 0,5 percent to 6,6

percent between May 2010 to July 2011. They also choose to actively manage their foreign exchange reserves to sterilize the liquidity inflows during QE2 cycle with a growth rate of 68 percent during the same period.

The case of Central Bank of Malaysia (Bank Negara Malaysia) is also interesting. The country experienced major capital flows fluctuations since 2009 with important outflows and surge of foreign liquidity that put important pressures on the exchange rates. Indeed, during the QE2 the BNM choose to actively manage their reserves to reduce exchange rates fluctuations and to sterilize the episodes of major liquidity inflows since 2010 by rebuilding the foreign exchange reserves with a strong growth rate of 44 percent during the QE cycle. They also choose to gradually raise the policy rates by 1 percent during the cycle to prevent stronger capital inflows in the context of international low yields. However, despite the increase in policy rates and interbank rates, the spreads between policy rates and lending rates were thinning reducing the effectiveness of the liquidity policies implemented by BNM to prevent excessive credit creation, for instance, the growth rate of credit was 26,68 percent from September 2010 to august 2011.

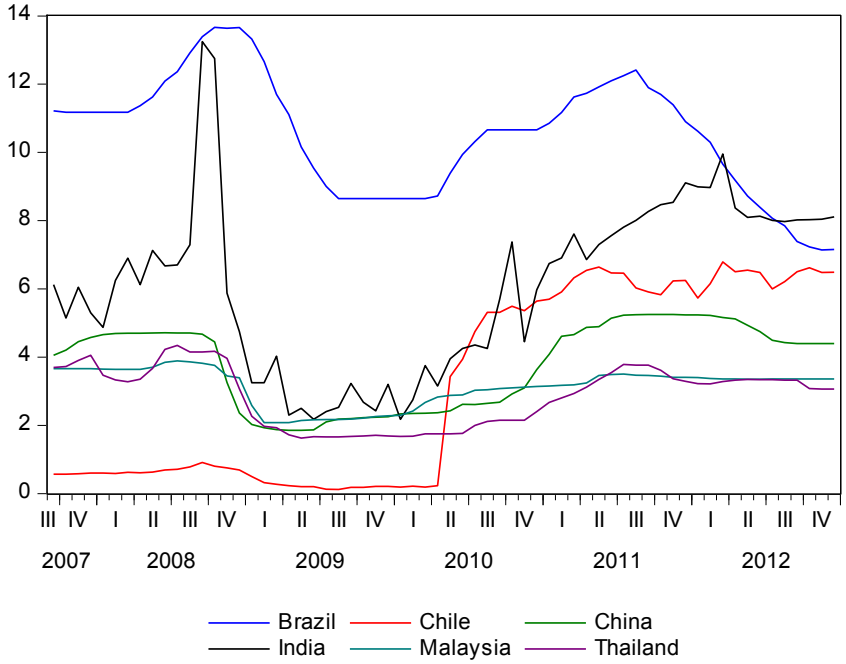
The case of Bank of Thailand (BOT) is also appealing. Their main policy during QE1 and QE2 focused essentially on foreign exchange management to reduce the pressures on exchange rate and lessen the capital inflows. The reserves steadily increased during the period with a growth rate of 88 percent since the beginning of the QE programs and rose by 11 percent during the QE2 cycle. The other policy measures were used as complementary tools to support the reserves management strategy. Indeed, like its other EMEs central banks, BOT increased their policy rates from the historically low 1,25 percent to 3,5 percent between May 2010 and august 2011. Simultaneously, the increase in policy rates influenced de facto the interbank rate from 1,76 percent to 3,79 percent during the same period, also in order to prevent excessive domestic private liquidity creation.

This prompt study case shows that, despite the large sets of available measures, EMEs central banks choose to implement equivalent liquidity restrictive policies to prevent their economy from spillovers of the global liquidity inflows induced by the QE programs. They succeeded into managing the external and internal balances that evolved at different speeds with different amplitudes (Pradhan, 2014).



Sources: IMF, IFS, National sources

Figure 3.2: Central banks Key rates (percent)



Sources: IMF, IFS, National sources

Figure 3.3: Interbank rates

3.2.3. Monetary policy during the second post-crisis period (September 2013 – late 2014)

To fully understand the differences in monetary policies between the two post-crisis periods, it is essential to realize the importance of the management of international reserves amongst the tools available to EMEs central banks. Indeed, during the first pre-crisis

period, the central banks relied mainly on the management of their reserves to sterilize the major liquidity inflows associated with the QE episodes implemented by the AMs central banks. Thus, to prevent the consequences on their exchanges rates, they did not hesitate to draw from their reserves to sustain their money since they did not have doubts that their reserves will be refueled as long as the AMs central banks keep producing liquidity. For instance, their reserve accumulation growth only slowed during the periods compared to the pre-crisis period. However, those policies came to an end after Ben Bernanke pre-announces on May 2013 and the following tapering tantrum that occurred.

3.2.3.1. Changes in monetary policy and consequences of 2013 tapering announce

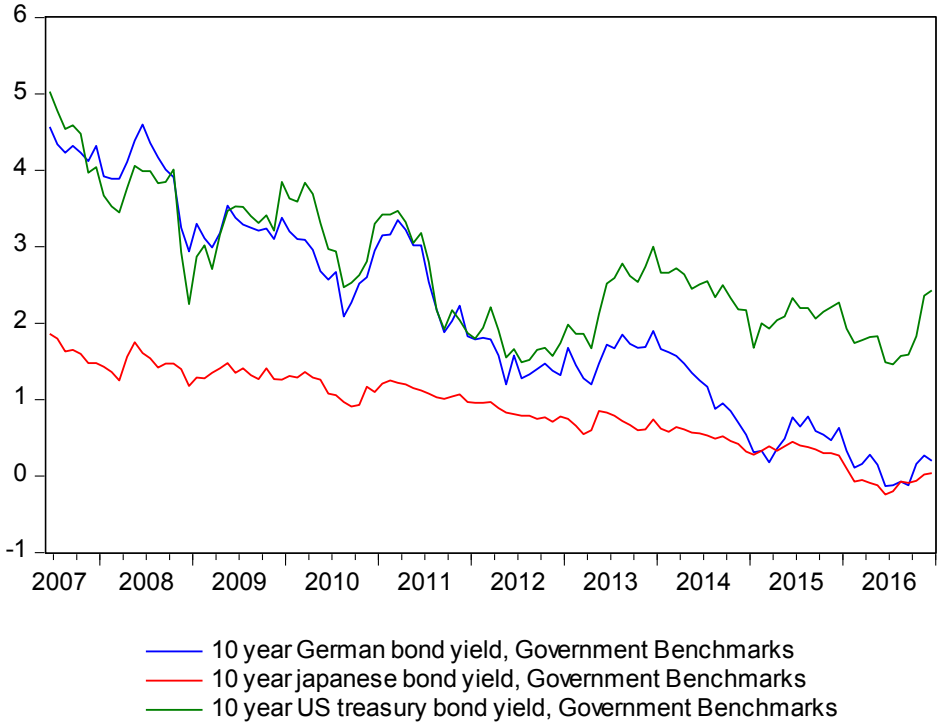
Bernanke's pre-announce about the reduction of Fed's assets purchasing programs provoked a panic in financial markets all over the world, particularly on the bond markets. The situation started a sell-off on government bond yield in major bond markets as the 10-year US bond yields gained 140 basis points between May and early September 2013. This trend was observed in the bond markets of the major countries with the 10-year German bond gained 80 basis points and the yield on the Japanese benchmark note gained 20 basis points. The main consequence for EMEs was a massive capital flight during the 2013 summer in anticipation of the upcoming Fed restrictive policies. This situation drove pressures on EMEs central banks actions to prevent negatives outcomes on their exchange rates and their domestic growth.

From a monetary policy viewpoint, contrary to previous episodes of pressures on their exchange rates, EMEs central banks became reluctant to use their available reserves to defend their currency and according to Pradhan (2013, 2014), two motivations could explain their hesitations. First, as the probability of Fed's upcoming restrictive policies turned out to be increasingly relevant, the monetary authorities decided to switch their reserves management policy as it became clear that they could not bail out the reserves at the same pace as during the first post-crisis periods. Second, with the slowdown of reserves accumulation, the reason explaining the central bank's hesitancy to use their reserves is the uncertainty of the capital flows directions since the forthcoming increase interest rates in the AMs would dramatically affect the capital flows to the EMEs. Thus, with little room for maneuver, the only available solutions for central banks were to use monetary policies through the manipulations of policy rates to defend their currency and their domestic growth. However, this choice creates an issue since maintaining currency and defending

domestic growth as main policy objectives at the same time is nearly impossible to achieve. The reason relies on the mechanisms behind the key rates policies that affect these objectives differently as they are antagonistic, so EMEs central banks must choose between two possible outcomes.

On one hand, if the domestic growth objective is privileged through the modification of the key rates, it will put downward pressures on the exchange rates and accelerate the ongoing capital outflows. Since the monetary authorities are reluctant to actively defend their currency through the reduction of their reserves, the exchange rates will depreciate and in medium-term will impact negatively their domestic growth. On the other hand, if defending the domestic currency objective is emphasized, increasing the key rates in a context of capital outflows will dampen the domestic growth.

In sum, this period of "taper tantrum" following the Fed's tapering pre-announce triggered economic uncertainty times for EMEs central banks. Nevertheless, this period of uncertainty characterized by massive capital outflows from EMEs is different from the previous periods of capital flight, especially compared to the 80's and 90's episodes of capital outflows. Indeed, the emerging countries generally improved their economic environment and contrary to these years, they developed self-assurance mechanisms that dampen the required modifications of the policy rates to influence the domestic growth or to sustain the currency. However, despite those improvements at macroeconomic level, some disparities exist between the emerging countries that could affect the policies outcomes during the "taper tantrum" period.



Sources: Macrobond, national sources

Figure 3.4: 10-year government bond yields

3.2.3.2. Different outcomes between EMEs

According to Pradhan et al (2013), the current differences between EMEs could be explained by three main factors of which their current account vulnerabilities; their economic performances; and their vulnerabilities against external shocks. Accordingly, major emerging countries can be ranked from the more exposed countries to the least exposed (table 1) and this classification has implications from the monetary policy viewpoint. As a matter of fact, this first distinction allows monitoring precisely the effects of changes in key rates on their economy and, according to the possible outcome, if we take into account their degree of exposure, the previous ranking could be reduced into two groups of countries.

The first group consists of the most exposed countries with vulnerabilities on their balance of payments. These fragilities imply that this specific group of countries will be vulnerable to external shocks that will affect them depending on their degree of fragilities in their balance of payments. Accordingly, these countries will tend to use the "traditional" restrictive monetary policies in order to defend their currency and in turn, this choice will have negative impacts on both their domestic demand and growth.

The second group consists of the least exposed countries that will tend to use the new model of monetary policy whose main objective is to sustain domestic growth. Since they could withstand external shock without relying on their reserves, their growth target could be achieved using this tool.

In sum, there are disparities amongst EMEs during the summer 2013 episode of capital flight. However, the central banks were not prepared for the upcoming event, with the Fed's announce in September 2013 that took everyone by surprise as they chose to renew their asset purchase policy and continue their quantitative easing program instead of opening the way to a restrictive cycle. As a result, EMEs central banks were unprepared for the new cycle of quantitative easing following Fed's announcement.

Most exposed countries	***Countries with noticeable problems***
Brazil	Argentina
Mexico	Hungary
South Africa	Indonesia
Turkey	Poland
Ukraine	
Moderately exposed countries	***Least exposed countries***
Columbia	China
Chile	Israel
Czech republic	Peru
India	Russia
South Korea	
Malaysia	
Thailand	

Sources: Pradhan et al (2013), Pradhan (2014)

Table 3.1: EMEs exposure to capital outflows

3.2.3.3. Fed's renewed QE program and monetary policy consequences

On September 2013, contrary to expectations, the Federal Open Market Committee (FOMC) delayed its tapering on the QE program by continuing their asset purchases policy with 40 billion USD monthly for mortgage-backed securities and 45 billion USD monthly for long term treasuries and the policy rates stayed unchanged with the funds target rate

between the range of zero to 0.25 percent. In reaction to this surprise announcement, the EMEs did not change directly the restrictive measure started during summer 2013 to counteract the anticipated effects of the tapering. Indeed, they only choose to add complementary measures in order to sustain their growth in short term. For instance, in Indonesia the central bank (BSRI) decided a pause in the increase of policy rates, Turkish central bank (TCMB) did not also increase their policy rates, the Brazilian central Bank, in turn, continued the rise of policy rates they added easing policy on the credit market and the Chinese central bank (PBOC) decided to not change their policy rates but added selective easing policies to specific sectors of its economy.

Generally, EMEs monetary authorities choose to not fundamentally change the policies decided during the tapering tantrum, though they added easing measures to sustain their policies as they thought that the return of the QE program would bring the same effects as during the previous cycle, particularly low-interest rates and major capital inflows. Nevertheless, this QE episode would have different effects on EMEs economy because of growing structural problems within the countries. Indeed, these policies main objective was only to protect and sustain the internal growth at the expense of other measures as improving the growing situations of bad allocations of capital that could increase the risks and exacerbate the structural imbalances within their economies. Finally, the second post-crisis finishes with the end of the Asset purchase facility in the AMs, notably in the US on October 2014 as the Fed halted their program after accumulating nearly 4.5 trillion USD in assets since 2008.

In this section, our objective has been to identify the major trends in the monetary policies implemented in the EMEs since the beginning of this century as we consider three periods between 2000 and 2015. First, the pre-crisis period that is illustrated by the hoarding reserves trend in order to sustain the economic growth model in the EMEs and isolate their countries from the dreadful consequences of foreign financial markets evolution, particularly in the Asian economies. Second, the first post-crisis period which is characterized by accommodative monetary policies following the GFC in order to sustain their economy and the use of quantitative tightening monetary policies to dampen the consequences of major capital flows experienced in the EMEs. Finally, the second post-crisis period that is mainly characterized by the "tapering tantrum" following Ben Bernanke's pre-announcement and the major turnaround made by the Fed that put EMEs central banks into intense pressures. The identification of these sub-periods has implications for the global liquidity has the first two periods are characterized with

significant expansion of the global liquidity and the third periods are characterized with its slowdown. Moreover, as the identified periods shows changes of monetary policy regimes in EMEs, the outcomes of the global liquidity expansion on the receiving economies should be different across the periods.

3.3. Global excess liquidity and capital flows

In this section, we investigate the links between the global liquidity – especially the periods of global excess liquidity – and capital flows as the major transmission channel of the global liquidity conditions into EMEs economy. To this end, we analyze first the concept of global excess liquidity and how to measure it. Second, we focus on identifying the periods of excess global liquidity since 2000. Thirdly, we analyze the relationships between periods of global excess liquidity and surges in capital flows and their consequences into the receiving EMEs.

3.3.1. What is the Global excess liquidity and how to measure it?

3.3.1.1. Literature review of global excess liquidity measures

In their seminal paper, Baks and Kramer (1999) have introduced the concept of global liquidity, and more specifically that of excess global liquidity. Since this paper, literature on global liquidity flourished by focusing on various indicators measuring the global excess liquidity. These measures follow the classification established by BIS (2011) for the main global liquidity indicators and distinguish the excess-based global liquidity indicators between the quantity-based measures and the price-based measures. Contrary to the main indicators, the definition of the global excess liquidity follows the hypothesis developed by the literature studying the excess liquidity concerns on a country level, in particular since Borio, Kennedy and Prowse (1994) excess liquidity indicator, the ratio of the quantity of money to nominal GDP.

3.3.1.1.1. Quantity-based indicators

The quantity-based indicators follow BIS (2011) basic considerations that center the indicators on monetary aggregates, credit aggregates – cross-border credit or domestic

credit- and international reserves. Accordingly, Baks and Kramer (1999) constructed three monetary aggregates indicators for the G7 countries that express the excess nature of the global liquidity including two indicators based on growth rates of both narrow money and broad money – GDP-weighted and unweighted – and one indicator using the Divisia index of the global money growth to assess the consequences of global excess liquidity. Gouteron and Szpiro (2005) and Ruffer and Stracca (2006) followed also the previous Money aggregate to GDP ratio to express global excess liquidity without converting the indicators into growth rates. Moreover, Gouteron, and Szpiro (2005) also introduced GDP-weighted credit aggregate to express the evolution of global excess liquidity mainly because domestic credit is considered as the major counterpart of the money supply. Also, Various papers in the literature used the foreign exchange reserves as quantitative measures of global liquidity (De Nicolo and Wiegard, 2007; Radde, 2010; Matsumoto, 2011; Belke et al, 2013) mostly because of the nature of foreign exchange reserves as the main counterpart of central bank's reserve money. In addition, Artus and Virard (2010) considered the world monetary base – the money created by each central bank in the world – as global liquidity indicator and it has the particularity to take into account the money created by developing and emerging countries.

Baks and Kramer (1999) first introduced the expression of excess global liquidity with the use of aggregate money to GDP growth rates ratio with the GDP growth rates as the threshold to monitor the evolution of the global liquidity. Indeed, the explication ensues from the quantity theory of money, which stipulates that the growth rates of money should not exceed GDP growth rates that could result in overheating economy and inflation pressures in case of excessive domestic liquidity since the GDP growth rate is the only level that assures price stability (Gouteron and Szpiro, 2005). Berger and Harjes (2009) introduced the real money gap from the quantity theory of money and defined as the deviation of quantity of money – in real terms – relative to an equilibrium value to assess the global excess liquidity. From the credit viewpoint, Borio and Lowe (2002) introduced the credit gap defined as the deviation – measured as the variance of the ratio – of aggregate credit to GDP ratio relative to a threshold specific value. The threshold is based on Kaminsky and Reinhart (1999) methodology that specifies that the deviation must exceed four percentages points to consider the credit aggregate as excessive.

3.3.1.1.2. Price-based indicators

Despite the various indicators identified by BIS (2011), the empirical literature is scarcer for the price-based indicators to assess global excess liquidity. One indication comes from the literature of excess liquidity with the price gap indicator proposed by Polleit and Gerdesmeir (2005) defined as the difference between real money – adjusted from trend velocity – and the real potential GDP. This specification allows measuring the effect of inflation, which appears only when "there is excessive money for too few goods". Considering the literature on global liquidity, the first approach came from Gouteron and Szpiro (2005) that defined the excess monetary liquidity from the difference between real short-term interest rates and the natural interest rates identified from the long-term growth of the economy. De Nicolo and Wiegand (2007) proposed a second approach on global excess liquidity centered on the deviation of short-term nominal interest rates from the Taylor rates. The Taylor rates express the central bank's monetary policy preferences and result from their reactions to output gap and inflation differentials.

3.3.1.2. Global excess liquidity: measurement and period identification

3.3.1.2.1. Measurement

In practice, the empirical studies on global excess liquidity focus exclusively on the short-term nominal interest rates gap or the money/credit aggregates ratio to GDP – derived from money gap – and their deviations from an equilibrium value. We focus on this approach to construct two indicators in order to identify the period of excess liquidity since the early 90s and as a corollary the liquidity shortfall.

According to Gouteron and Szpiro (2005), the ratio to GDP approach have the advantage to not require any reference date to identify the excess periods of liquidity and using the logarithm allows comparing the growth rates of money and GDP. Nevertheless, we focus on Borio and Lowe (2002, 2004) cumulative imbalances approach to identify precisely the periods of excess global liquidity by comparing the ratio Money/credit aggregates to GDP relative to the trend – considered as the equilibrium value – obtained by HP filter. According to this methodology, a period of excess global liquidity occurs if and only if the ratio Money/credit aggregates to GDP exceeds positively its trend for at least three successive quarters. The later studies using the previous methodology expanded the

definition of excess periods notably by considering four quarters of persistent global liquidity growth as an excess period during five consecutive quarters, and they allow one negative gap quarter between the four quarters (Roffia and Zaghini, 2007). Brugman (2007) kept the three quarters rule but expand the definition of the global excess liquidity period by allowing up to four quarters of negative gap between two recognized periods of global excess liquidity and identify the whole 10 quarters as only one period of global excess liquidity. However, we focus only on a strict definition by considering only the three months rule to define a period of excess global liquidity.

The first indicator is based on the sum of G6 monetary aggregates[36] relative to their GDP (expressed in US dollars). We choose the broader monetary aggregates available for each country since it can capture both public and private liquidity developments through the monetary, market liquidity and funding liquidity conditions. We select two versions of the first indicator to assess the hypothesis of global excess liquidity, the first is related to Baks and Kramer (1999) specification and the second is related to Borio and Lowe (2002) and Ruffer and Stracca (2006) specifications.

$$GL_1 = \log\left(\sum_{i=1}^{4}\left(\frac{M_i}{GDP^i}\right).\frac{1}{S_i}\right) - trend\left(\log\left(\sum_{i=1}^{4}\left(\frac{M_i}{GDP^i}\right).\frac{1}{S_i}\right)\right)$$

$$GL_2 = \sum_{i=1}^{4}\left(\frac{M_i}{GDP^i}\right).\frac{1}{S_i} - trend\left(\sum_{i=1}^{4}\left(\frac{M_i}{GDP^i}\right).\frac{1}{S_i}\right)$$

Where $M_i$represents the monetary aggregates and S_i is the exchange rates between the local currency and US dollar.

The second indicator is based on GDP-weighted cross-border credit to non-resident aggregates[37] for the United States, Euro Area, Japan and the United Kingdom expressed in the same currency and we also choose to construct two versions of the indicator. According to BIS (2011), using credit aggregates has its advantages when assessing the global liquidity phenomenon. Indeed, the private sector credit covers a broad range of sources from the banking sector to the securities markets and captures the interactions between market and funding liquidity that are important drivers for the expansion of domestic private liquidity. Moreover, credit aggregates take into account the cross-border positions of domestic Banks, which is an important measure of changes in liquidity

[36] We focus on the largest monetary aggregate available per country, Mostly M2 and M3 for UK.
[37] The crossborders credit are from BIS locational statistics.

conditions that are transmitted internationally and affect financial stability in the receiving economies. Furthermore, considering the cross-border and international credits allows the analysis of the global liquidity conditions from various viewpoints. One of such perspective is the "receiving economy" approach that informs if the growing cross-borders credit flows are associated with the developments of vulnerabilities into the receiving economies. The second indicator is defined by the following specifications.

$$GL_3 = \log\left(\sum_{i=1}^{4}\left(\frac{credit_i}{GDP^i}\right).\frac{1}{S_i}\right) - trend\left(\log\left(\sum_{i=1}^{4}\left(\frac{credit_i}{GDP^i}\right).\frac{1}{S_i}\right)\right)$$

$$GL_4 = \sum_{i=1}^{4}\left(\frac{credit_i}{GDP^i}\right).\frac{1}{S_i} - trend\left(\sum_{i=1}^{4}\left(\frac{credit_i}{GDP^i}\right).\frac{1}{S_i}\right)$$

Where $credit_i$represents the cross-border aggregates and S_i is the exchange rates between the local currency and US dollar.

3.3.1.2.2. Identifying the periods of excess liquidity

As developed in the previous section, we choose to center our analysis on the "*money gap*" approach. According to this methodology, the difference between the GDP-weighted monetary/credit aggregates ratio and its trend should be positive for three consecutive quarters to assess the presence of global excess liquidity during the period. For this purpose, we collect quarterly data from 1995Q1 to 2015Q4 for money aggregates, cross-border credit and GDP of the G6 countries and Euro area from the IMF and BIS database to construct our indicator. The trend for each indicator is obtained by filtering each ratio with the Hodrick & Prescott filter using smoothing parameters of 1600.

The analysis of the measures based on the monetary aggregates (table 3.2 and figure 3.5) suggests that six periods of global excess liquidity are identified between early 1990 to late 2015. According to the results, some periods of global excess liquidity could be replaced in the context of monetary policies in the AMs. Actually, the third period of excess global liquidity occurred during the pre-crisis period also entitled as the first phase of global liquidity (Shin, 2013, 2015). The period is characterized by loose monetary policies and policy rates that deviated from the Taylor rates, which allows the developments of the private liquidity, especially the market and funding liquidity through securitizations, the real estate dynamics and bank leverage. Furthermore, the periods 4 to 6 refers to the

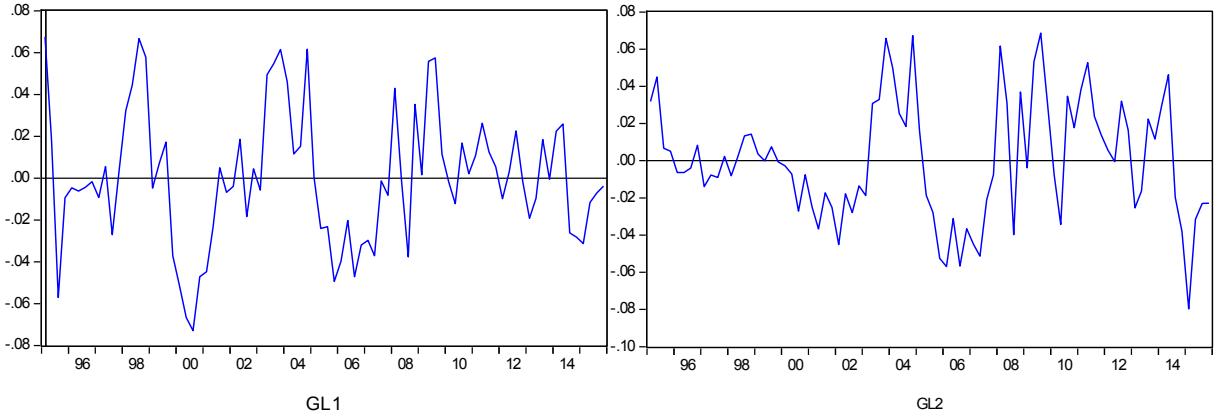
unconventional monetary policies implemented in the AMs during the post-period crisis. The QE programs flood liquidity into the global economy that had consequences not only on the issuing countries but induced also concerns for financial and macroeconomic stability into the receiving countries.

The results based on the cross-border credit aggregates (table 3.3 and figure 3.6) confirm the presence of four periods of excess global liquidity and refined the first indicator's analysis as they refer to another viewpoint. Indeed, the periods 2 to 4 of excess global liquidity refers also to the second phase of global liquidity established by Shin (2013, 2015). The global liquidity growth during these periods is driving by the bond markets in the emerging countries and mainly motivated by search for yields of asset managers with global reach. Moreover, BIS (2011) stated that despite the GFC, the global credit still expanded because of the cross-border and foreign currency credit in the Asian countries and especially receiving countries with strong credit booms such as China.

In sum, various drivers produced the global excess liquidity and focusing on only one indicator is not enough to capture its evolution, from the actions of AMs central banks, Global banks to investors in search of higher yields. These excess global liquidity episodes raised concerns amongst policy makers to what extent these situations may affect the capital inflows and broadly their economy.

Period n°	***Dates***
1	1995Q1 – 1995Q4
2	1998Q2 – 1999Q1
3	2003Q2 – 2005Q1
4	2009Q2 – 2009Q4
5	2010Q4 – 2012Q1
6	2013Q3 – 2014Q2

Table 3.2: identified global excess liquidity periods from the monetary aggregates

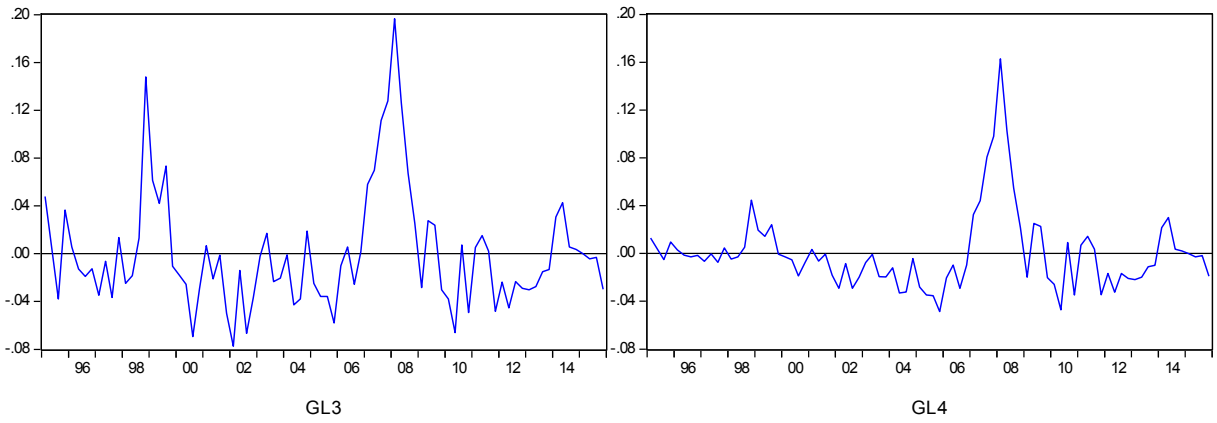


Source: Author's calculations

Figure 3.5: Global excess liquidity indicators

Period n°	***Dates***
1	1998Q3 – 1999Q3
2	2007Q1 – 2008Q4
3	2011Q1 – 2011Q3
4	2014Q1 – 2015Q1

Table 3.3: identified global excess liquidity periods from the cross-border credit aggregates



Source: IMF, Author's calculations

Figure 3.6: Global excess liquidity indicators based on cross-border credit aggregates

3.3.2. How global excess liquidity affects capital flows into the receiving economies

3.3.2.1. What drives the capital flows into the EMEs from the global liquidity perspective

Global liquidity's cycle and capital flows are closely correlated, particularly since the growing importance of EMEs in the global economy and the increasing integration of their capital markets. Indeed, differential growth coupled with differential interest rates in favor of EMEs allowed their financial markets to receive important capital flows since the early 2000s (figure 2.2). However, despite these classic drivers in their favor, we focus also on the global liquidity's push factors, such as accommodative monetary and quantitative easing policies (IMF, 2011; IMF, 2016), to analyze the drivers of capital flows episodes into the receiving EMEs relative to the evolution of global excess liquidity. Specifically, according to Shin (2013, 2015), the global liquidity expansion could be summarized into three phases and for each period its main particular drivers and type of capital flow into the receiving EMEs. In our analysis, we mainly focus on the first two phases of the global liquidity expansion as our main concerns are related to the outcomes of global excess liquidity and their effects on capital inflows into the EMEs. Moreover, since the last phase is associated with the tapering tantrum and its implications, the concerns about the global excess liquidity outcomes from the EMEs perspective become less relevant.

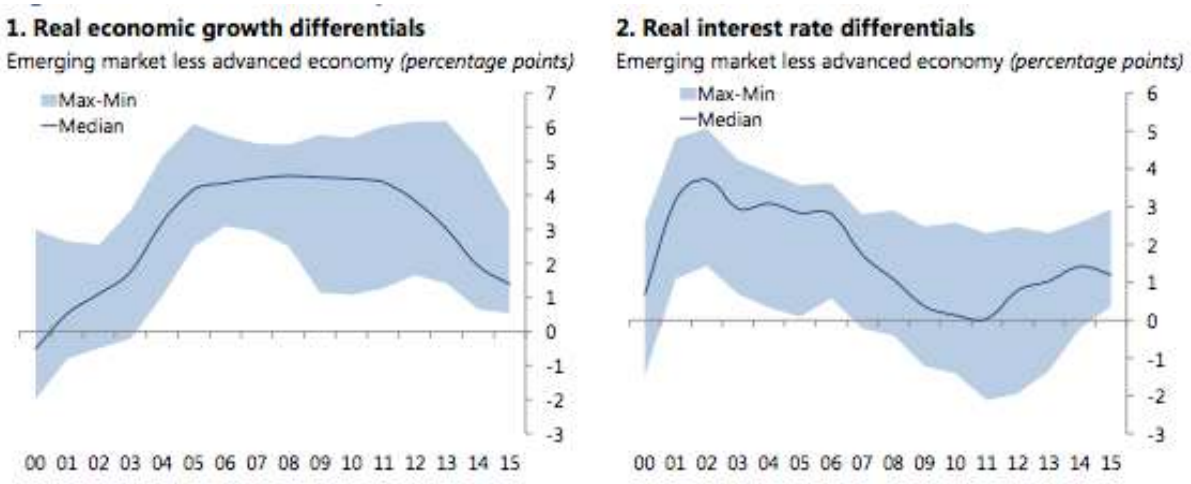
The first phase of global liquidity expansion started roughly around 2003 and end during the beginning of the GFC. The period is characterized by the preponderance of bank leverage and non-core bank funding as main drivers for the global liquidity expansion under the "*banking glut*" hypothesis (Shin, 2011). Under this hypothesis, the main actors for the global liquidity growth are international banks intermediating cross-border credit worldwide. This situation of "*ease of financing*" in the banking sector in the AMs triggered banking flows into the receiving economies and corresponded also with episodes of elevated risk appetites and compressed risk premia that produced a search for yields behavior, which conducted to two periods of excess liquidity according to the identified periods of surge of global liquidity in the previous section. The interesting parts rely on the cross-border credit aggregates that show that the international banks continued their intermediating activities during the turmoil of the GFC (until 2009), especially in their cross-border activities into the Asian EMEs (IMF, 2011) before they were bound by the new micro-prudential and macro-prudential regulations. Furthermore, according to this

bank leverage driver, the main transmission channel to the receiving economies is through the international bank flows that affected mostly the financial stability of the EMEs through changes in the domestic credit conditions and induced strong credit growth and asset prices appreciations into the receiving economies.

The second phase of global liquidity cycle is set between early 2010 to summer 2013 and is mostly driven by the bond markets dynamics in the EMEs. Indeed, the QE policies initiated by AMs central banks, especially their asset purchasing programs affected the attractiveness of their bond markets as the successive QE policies lowered significantly the bonds yields and the long-term interest rates in the advanced countries. This situation led the investors – especially fund managers with global reach- to shift their preferences into EMEs bond markets in an active search for yields behavior. Precisely, according to shin (2015), the bonds driven global liquidity growth may be explained by three elements that also increased the vulnerabilities of the receiving emerging countries. The major elements are low long-term interest rates and compressed risk premia for fixed income securities in EMEs; currency mismatch on the balance sheets of EMEs firms borrowing cross-border credit with foreign currency and growing pressures on domestic banks to chase marginal borrowers related to growing deposits of corporate deposits; large issuance of EMEs corporate debt held by foreign investors motivated by the sentiment of search for yield. According to the identified driver, the main flows into the EMEs during the period are portfolio flows and in a lesser extent cross-border credit still in the Asian EMEs. Following the results of the previous section, the period is also characterized by periods of surge in both monetary and credit liquidity driven respectively by the QE policies and international banks despite the reduction of their role in favor of long-term assets managers. Finally, the period ended by the "*taper tantrum*" that put the EMEs economies into great stress, especially since the three elements that stimulate the bonds driver saw a huge reversal due to the concerns on the upcoming tapering of US QE programs. Indeed, long-term interest rates rose sharply in the EMEs; the local currency depreciates against the dollars and the self-reinforcing currency loop depreciation was a strong sign of currency mismatch; the investors participating in the EMEs financial markets witnessed the risk materialization and started to withdraw from the EMEs provoking a fire sales on the domestic bond markets.

The third phase started approximately in September 2013 and follows the tamper-tantrum aftermaths. Despite the renew of the QE cycle in September 2013, the vulnerabilities identified during the tapering tantrum episodes triggered massive capital outflows from the

EMEs aggravating their situations and put their monetary authorities to stress. From the global excess liquidity perspective, the QE programs fueled again the evolution of the global liquidity indicator based on the monetary measure with one identified period of excessive liquidity roughly during the application period of the last QE cycle. Additionally, the cross-border credit based global excess liquidity indicators show that the international credit intermediation raised again even after the end asset purchasing programs in October 2014. However, contrary to the previous global liquidity phases, the EMEs did not experience similar level of capital inflows into their economies. Precisely, they experienced a decline in both gross and net capital flows since the taper tantrum's aftermath until the capital outflows exceeded the capital inflows in 2015 (IMF, 2016). The explanation relies on reversal of the bonds and bank flows into the AMs, which witnessed an increase of gross and capital flows during the same period.



Source: Capital flows and global liquidity, IMF (2016)

Figure 3.7: Standard Pull factors for capital flows

3.3.2.2 Trends in capital inflows into the EMEs relative to the surge of global liquidity

Global capital flows experienced large swings during the last 15 years; according to IMF (2016), there have been changes in both volume and composition of the global capital flows during the period. The global gross flows[38](figure 3.7) increased strongly during the

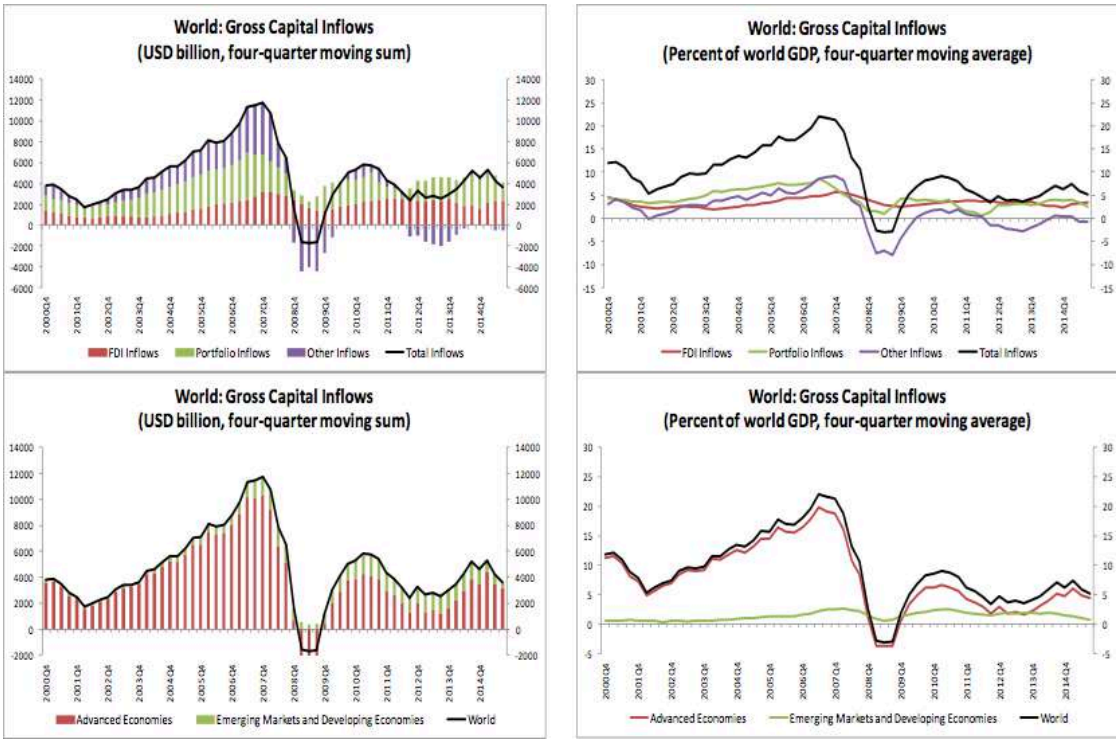
[38] Sources *IMF BOP statistics*. Gross capital inflows are defined as net changes in domestic resident liabilities to non-residents. Gross capital outflows are defined as net changes in foreign assets owned by domestic residents minus reserve assets. Net capital inflows are defined as gross inflows minus gross outflows.

first phase of global liquidity (2002-2007) reaching an all-time peak of 12 trillion USD, nearly 20 percent of world GDP before falling during the GFC. During the Period, both AMs and EMEs experienced large capital inflows – particularly loans, deposits, trade credit and derivatives – that reached 88 percent of total flows to AMs. During the post-crisis 2008-2009 period, the components of the Global capital flows showed a sharp decline, except for the direct investment that remained stable and became the main driver of capital flows during the period. The global capital flows only recovered in early 2010 during the second phase of global liquidity but never returned to the pre-GFC level. Moreover, since 2010, the share of EMEs in the global capital flows increased, reaching 50 percent of the total flows before 2013's tapering tantrum incident. The main component driving the global capital flows are portfolio flows while the other investment flows declined in both AMs and EMEs. The tapering tantrum started also the reversal of the global capital flows from EMEs, since their share decline rapidly from 50 percent to 13 percent of total flows with the decline of all investment flows components by the end of 2015.

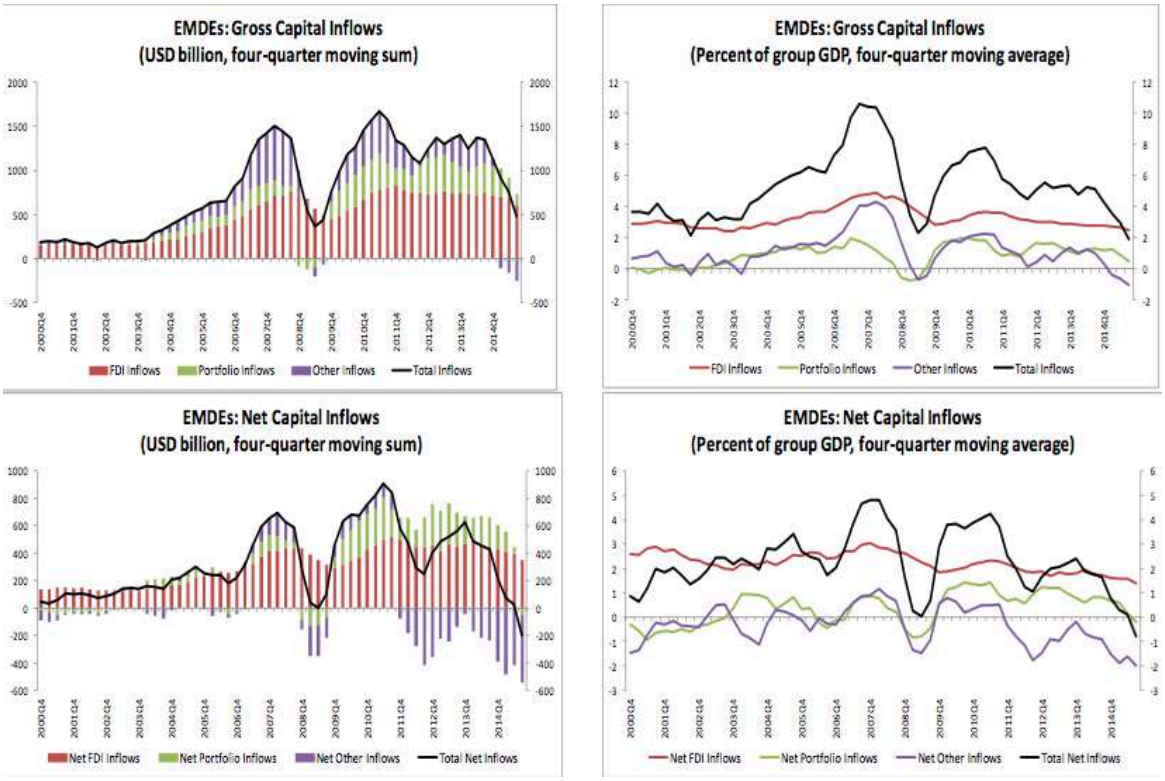
Regarding EMEs, capital flows are considered more variable in EMEs than in AMs since they saw significant swings during the beginning of the second phase of global liquidity. Indeed, both gross and net capital flows to EMEs follow the same patterns (figure 3.8) and the net capital flows experienced both periods of sharp increase between 2005 – 2007 (reaching the peak of 5 percent of EMEs GDP in 2007), 2009 – 2011 and 2012 – 2013; and periods of decline between 2008 – 2009, 2011 – 2012, and 2014 – 2015. The capital flow reversal amplified since the GFC particularly since the flows are driven mainly by volatile portfolio flows. Finally, the EMEs experienced negative net capital inflows since 2015, after a persistent decline started in 2013.

According to the global liquidity standpoint, the identified periods of sharp increase of net capital inflows are related to each phase of global liquidity's expansion and its identified periods of global excess liquidity. The pre-GFC periods of sharp capital inflows to EMEs are correlated with the bank-led driver of global liquidity, precisely according to Shin (2015), the surge of capital inflows during the 2003 – 2008 in Asian EMEs are led principally by bank flows, particularly debt flows. The post-GFC periods of surge of capital inflows are related to the bond driver of global liquidity. Indeed, as the share of debt and bank flows declines since 2009 relative to equity flows, for instance, surges in capital inflows episodes explained by portfolio flows are increasing since the beginning of the second phase of global liquidity.

In sum, there is strong linkage between the drivers of capital inflows into EMEs and the global liquidity expansion into the EMEs.



Sources: Capital flows and global liquidity, IMF (2016)
Figure 3.7: Global capital flows



Sources: Capital flows and global liquidity, IMF (2016)
Figure 3.8: Global liquidity inflows into Emerging countries and developing countries

3.4. Surge of global liquidity and monetary policy in the receiving EMEs

In this section, we investigate on a country level the consequences of the global liquidity expansion on specific Emerging countries from the monetary policy standpoint. Indeed, we center our analysis on how their monetary authorities reacted to the capital inflows provoked by the global liquidity expansion over time, especially during identified periods of surge of global liquidity, and in a lesser extent the effects on domestic private liquidity and inflation. In order to evaluate the global liquidity outcomes in these countries, we rely on a time-varying parameters VAR (TVP-VAR). Our approach on the spillovers of global liquidity is original amongst the literature considering the EMEs, mainly because previous studies choose to focus on the financial stability perspective, particularly the destabilizing effects on domestic assets price and long-time interest rates (Branaand Prat, 2012; Djigbenou et al, 2015) rather than the monetary perspective.

3.4.1. Data and preliminary treatment

For the purposes of our analysis, we collect data for 6 emerging liquidity-receiving countries and choose to focus on the global liquidity indicators developed in the previous section[39] – the aggregate monetary liquidity indicator and the aggregate private liquidity indicator – from the main global liquidity issuing countries. The liquidity-receiving countries contain Asian and Latin American EMEs such as Chile, Brazil, China, India, Thailand and Malaysia. The choice of these countries relies on their characteristics, especially their monetary policy stance in order to sterilize the liquidity inflows. To construct our database, we needed to collect:

- The real effective exchange rates to model the selected country's exchange rates stance during the period.
- International reserves to simulate the central bank's reserves management.
- Indicators of short-term interest rates modeled by policy rates, interbank rates, discount rates and money market as proxy for monetary policy stance.
- Domestic credit, to model the domestic private liquidity evolution.
- Consumer price index as proxy for the domestic inflation indicator.

[39] Particularly, we choose both simple aggregate indicators for our monetary-based indicator and credit-based indicator.

These data are collected from 1990Q2 to 2015Q4 in quarterly frequency from the IMF IFS database, World Bank database, BIS database and Macrobond database.

Before implementing the empirical methodology, we first treat our data to fit our requirements. Indeed, some data require preliminary treatment before estimating our country level model. In addition to the necessary transformation in the same currency, we perform a logarithm transformation on our variables of interest. Moreover, we undertake Unit root tests[40] on all of our variables of interests and we choose to keep stationary variables for our analysis.

The general specification of our 6×1 vector of endogenous stationary variables[41] y_t is defined as:

$$y_t = (\Delta GL_t; \Delta reer_t; \Delta reserve_t; \Delta i_t; \Delta credit_t; \Delta price_t)'$$

Where Δ defines the first difference operator, GL_t the global liquidity indicator, $reer_t$ the exchange rates stance, $reserve_t$ the country's level of international reserves, i_t the short time interest rates, $credit_t$ the level of domestic credit and $price_t$ the level of inflation.

3.4.2. Methodology

Contrary to previous empirical literature on spillovers of Global liquidity – since Baks and Kramer (1999) and more recently Djgbenou et al (2015) – that focus on a regional or global level, we choose to focus on a country level analysis to assess the global liquidity spillovers from the EMEs receiving countries monetary policy perspective. We use Primiceri's (2005) TVP-VAR with stochastic volatility methodology[42] over a simple VAR model to allow our coefficients to fluctuate over time, and especially to refine our analysis by focusing on the particular periods of surge of global liquidity defined in the previous sections and their implications for the monetary authorities. Moreover, we focus also on the effect of the global liquidity inflows on the domestic private liquidity and inflation when taking into account the possible changes in monetary policy during the period. So, we consider the following reduced form of the VAR representation of a multivariate time

[40] See appendice p. 195-198 for the unit root tests results.

[41] The specification may differ across countries because some variables are stationary in level and do not need the first difference transformation.

[42] Particularly the second algorithm of Primiceri and Del Negro (2015) and the R computed version made by Kruger (2015).

series model with both time-varying coefficients and time-varying standard errors of structural innovations defined as:

$$y_t = c_t + B_{1,t}y_{t-1} + \cdots + B_{p,t}y_{t-p} + u_t \quad (1)$$

Where y_t defines the 6×1 vector of endogenous variables, c_t a vector of time-varying constants, $B_{i,t}(i = 1, \dots, p)$ are 6×6 matrices of time-varying lagged coefficients and u_t are heteroscedastic unobservable shocks with variance-covariance matrix Ω_t. We consider the triangular reduction of Ω_t defined by:

$$A_t\Omega_t A'_t = \Sigma_t\Sigma'_t \quad (2)$$

Where A_t is the following triangular matrix

$$A_t = \begin{pmatrix} 1 & 0 & \dots & 0 \\ a_{21,t} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{61,t} & \dots & a_{65,t} & 1 \end{pmatrix}$$

And Σ_t is the following diagonal matrix

$$\Sigma_t = \begin{pmatrix} \sigma_{1,t} & 0 & \dots & 0 \\ 0 & \sigma_{2,t} & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \dots & 0 & \sigma_{6,t} \end{pmatrix}$$

Considering the previous elements, we have the following equation:

$$y_t = c_t + B_{1,t}y_{t-1} + \cdots + B_{p,t}y_{t-p} + A_t^{-1}\Sigma_t\varepsilon_t \quad (3)$$
$$V(\varepsilon_t) = I_6$$

Stacking in a vector B_t all the R.H.S coefficients, the equation (3) can be rewritten as:

$$y_t = X'_t B_t + A_t^{-1}\Sigma_t\varepsilon_t \quad (4)$$
$$X'_t = I_6 \otimes \left[1, y'_{t-1}, \dots, y'_{t-p}\right]$$

Where the operator $\otimes$ represents the Kronecker product and it allows us to use a modeling strategy consisting of modeling the coefficient processes in equation (4) rather than equation (1). According to the previous approach, we observe that there is a one to one mapping between the two previous equations that justify the approach.

For the following developments, let a_t be the vector of non-zero and non-one elements of the matrix A_t (stacked by rows) that gathers the elements of the matrix of contemporaneous relationship A_t, b_t the vector that contains the stacked columns of the matrix B_t and $h_t = \ln(\sigma_t)$ with $\sigma_t = (\sigma_{1,t}, \dots, \sigma_{6,t})$. We define a_t and b_t as:

$$a_t = (a_{21,t}, \dots, a_{61,t}, a_{32,t}, \dots, a_{62,t}, a_{43,t}, \dots, a_{63,t}, a_{54,t}, a_{64,t}, a_{65,t})$$
$$b_t = (c_t B_{1,t}, \dots, B_{6,t})$$

Finally, the dynamics of the model's time-varying parameters is specified as:

$$a_t = a_{t-1} + \nu_t \quad (5)$$
$$b_t = b_{t-1} + \zeta_t \quad (6)$$
$$h_t = h_{t-1} + \eta_t \quad (7)$$

Where the elements of b_t are modeled as random walks, as are the free elements of the matrix A_t. The standard deviations σ_t are assumed to evolve as geometric random walks, introducing the stochastic volatility into the model. The random walk specification has benefits for modeling macroeconomic models. It allows breaks in the evolution of parameters during the estimation period. Moreover, it focuses on permanent shifts and reduces the number of parameters in the estimation procedure.

The innovations in the reduced form model are assumed to be jointly normally distributed with the following assumptions on the variance-covariance matrix:

$$\begin{pmatrix} \varepsilon_t \\ \nu_t \\ \zeta_t \\ \eta_t \end{pmatrix} \sim \mathcal{N}(0, V) \quad with \quad V = \begin{pmatrix} I_6 & 0 & 0 & 0 \\ 0 & Q & 0 & 0 \\ 0 & 0 & S & 0 \\ 0 & 0 & 0 & W \end{pmatrix} \quad (8)$$

where the matrix V is block diagonal with I_6, Q, S and W corresponding respectively to the covariance matrix of the structural innovations ε_t, the innovations of lagged coefficients ν_t, the innovations of contemporaneous coefficients ζ_t and the innovations of (log) standard

errors η_t. The covariance matrix S is assumed to be block diagonal, i.e. the blocks of S—corresponding to the contemporaneous relations among variables of each separate equation—are assumed to be mutually independent.

Concerning the estimation, the TVP-VAR methodology uses Bayesian estimation on our quarterly data from 1990Q2 to 2015Q4. The lag length is set to be $p = 1$ for all of our country-model, as the TVP-VAR is a data consuming methodology and since our period is relatively short (103 observations per series). Moreover, the inference from the Bayesian approach use key prior information[43] following Primiceri's (2005, 2015) recommendations to determine the true values of our parameters over the sample period. According to Primiceri, the key priors are estimated using a time-invariant VAR process on the training sample, i.e. a small initial subsample our dataset, especially the first 40 observations per series in our case. Accordingly, we estimate a time-invariant VAR model for each country over the 1990Q2-2000Q2 period, it means that the first 10 years of data are used as the training sample to obtain the priors for the estimation beginning in 2000Q2.

3.4.3. Ordering the endogenous vector

Technically, the structure of the variance-covariance matrix of the reduced-form residuals Ω_t in equation (2) implies a Cholesky decomposition scheme amongst our endogenous vector in order to restrict the contemporaneous relationship matrix to be lower triangular.

Firstly, we consider that the most exogenous variable of our model is the global liquidity indicator because it is the aggregate liquidity created in the issuing advanced countries. Secondly, according to the effects of global liquidity on capital flows, the surge of global liquidity triggers surge of capital inflows into the receiving economies that will affect the exchanges rates of the receiving economies according to their exchanges rates regimes. Thirdly, according to the reserve management policy of the receiving economies, the monetary authorities may resort to adjusting their international reserves in order to sterilize the upcoming surges in liquidity inflows and stabilize the exchange rates. Fourthly, the monetary authorities may also change their policy rates during the periods of surges in liquidity inflows, especially to prevent excessive evolutions of the domestic credit from the commercial banks. Fifthly, as the effects of liquidity inflows are not fully sterilized, we expect that the global ease of financing due to the surge of global liquidity should affect the domestic credit creation and the commercial bank's behavior. Lastly, the most

[43] See appendice p.199, the prior information follows the assumptions implemented in Primiceri (2005, 2015).

endogenous variable is the domestic price inflation that should be affected lastly affected by the surge of liquidity inflows.

We consider the following order for endogenous vector defined in the previous section for our entire set of country model:

$$y_t = (\Delta GL_t; \Delta reer_t; \Delta reserve_t; \Delta i_t; \Delta credit_t; \Delta price_t)'$$

3.4.4. Empirical analysis

As already stated in the previous section, we have two main objectives concerning our empirical approach. First, we would like to evaluate on a country level analysis how the surges in global liquidity affect the liquidity-receiving countries from the monetary policy viewpoint, especially how the monetary policy stance affects global liquidity pass-through into the receiving economies. Second, according to the domestic monetary stance, how the ease of financing provoked by the liquidity inflows affect both the domestic credit market and price evolution. For this purpose, we center on analysis on six liquidity-receiving EMEs (China, Malaysia, Thailand, India, Brazil and Chile) according to their monetary policy stance – such as using or not inflation target policy, exchanges rates regimes, reserves management policy – and focusing also on their vulnerabilities as suggested by Pradhan (2013) typology[44] during the period.

The empirical analysis is based on the TVP-VAR impulse response functions (IRFs) and residuals[45]for each liquidity indicators[46] developed in the previous section during the entire period. Moreover, thanks to the TVP-VAR methodology, we are able to focus on IRFs at specific dates according to the surge of global liquidity identified in the previous section in order to evaluate the degree of global liquidity pass-through into the receiving economies relative to one specific IRFs estimated for a normal period. For this purpose, we use the peak dates of three selected periods of excess global liquidity relative to one regular arbitrary date for comparison. For the monetary aggregate global liquidity indicator, we focus on 2008Q1; 2011Q2 and 2014Q2 dates from the periods of identified global excess liquidity and for comparison, we choose 2002Q4 from the beginning of the global liquidity cycle. For the cross-border credit aggregate indicator, we focus on 2008Q4; 2011Q2; 2014Q2 for the surge dates relative to 2003Q4 for comparison.

[44] See p.97.
[45] We also display for comparison the residuals from a simple VAR(1) estimation.
[46] We focus on the aggregate version of the global liquidity indicators.

3.4.4.1. Country level analysis: China

Firstly, we focus on the model based on the monetary aggregate indicator of global liquidity. According to the results of the residuals analysis (figure 3.9), our variables residuals show signs of variability over time contrary to the residuals of a simpler VAR (1) model, particularly, we show that the exchanges rates and the interest rates show the most variability patterns hinting the facts that the variables are subjected to different changes across the period contrary to the other variables of interests. It also indicates that these variables have been subject to sharp evolutions or pressures during our period. Interestingly, we find that inflation and reserves do not exhibit such time-varying changes, which hint on the lack of transmission of the foreign liquidity inflows into Chinese's economy. Moreover, the IRFs (figure 3.10) show that a positive shock of global liquidity inflows does not exert a significant impact into the Chinese economy. From a monetary policy standpoint, the results are relevant since China is considered as one of the least vulnerable EMEs to liquidity inflows, which confirms the effectiveness of the choice of monetary policies made by the People's Bank of China. Finally, according to the IRFs magnitude comparison (figure 3.11), the results do not show any huge discrepancy between the magnitudes of the IRFs of our variables of interests between the different periods of excess global liquidity and also relative to the IRF from the regular period.

Secondly, we focus on the model based on the aggregate cross-border credit as global liquidity indicator in order to refine our analysis[47]. The residuals results (figure 3.12) show the same patterns as the first model, with relative changes in the exchange rates, the international reserve and the interest rates patterns. However, the IRFs result (figure 3.13) for the entire period shows different outcomes on our variables of interests. Indeed, we show that contrary to surges in monetary liquidity, the Chinese economy is more receptive to international bank flows, especially since we have positive significant effects on the reserves and short-term interest variables contrary to the other variables of interests. It means that the surge of bank flows encourage the monetary authorities to change their reserves in order to sterilize the incoming liquidity and limit their effects on the exchange rates, especially since those banks flows are expressed in foreign currency. Moreover, we notice that the significant increase in the interest rates is to reduce the domestic creation over the period without significantly affecting the domestic price inflation. According to

[47] For convenience, we display the results on appendice p.162-164.

the IRFs magnitude comparison (figure 3.14), the only noticeable result relies on the Reserves IRFs that are different from the date of surge of global liquidity, it appears that the bank flows from the surge of 2014Q2 have the most important effects on the international reserves of People's Bank of China.

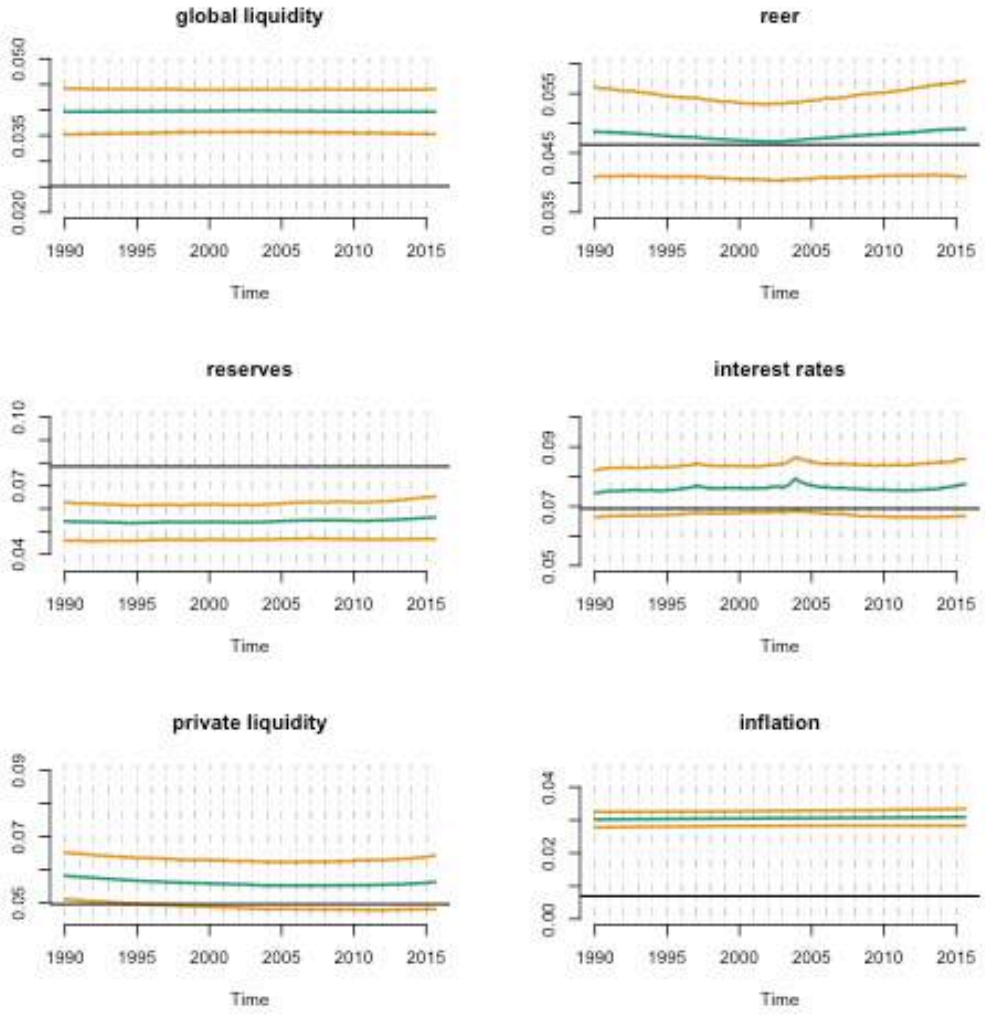


Figure 3.9: TVP-VAR Residuals and VAR (1) residuals (black line) based on the monetary aggregates indicator

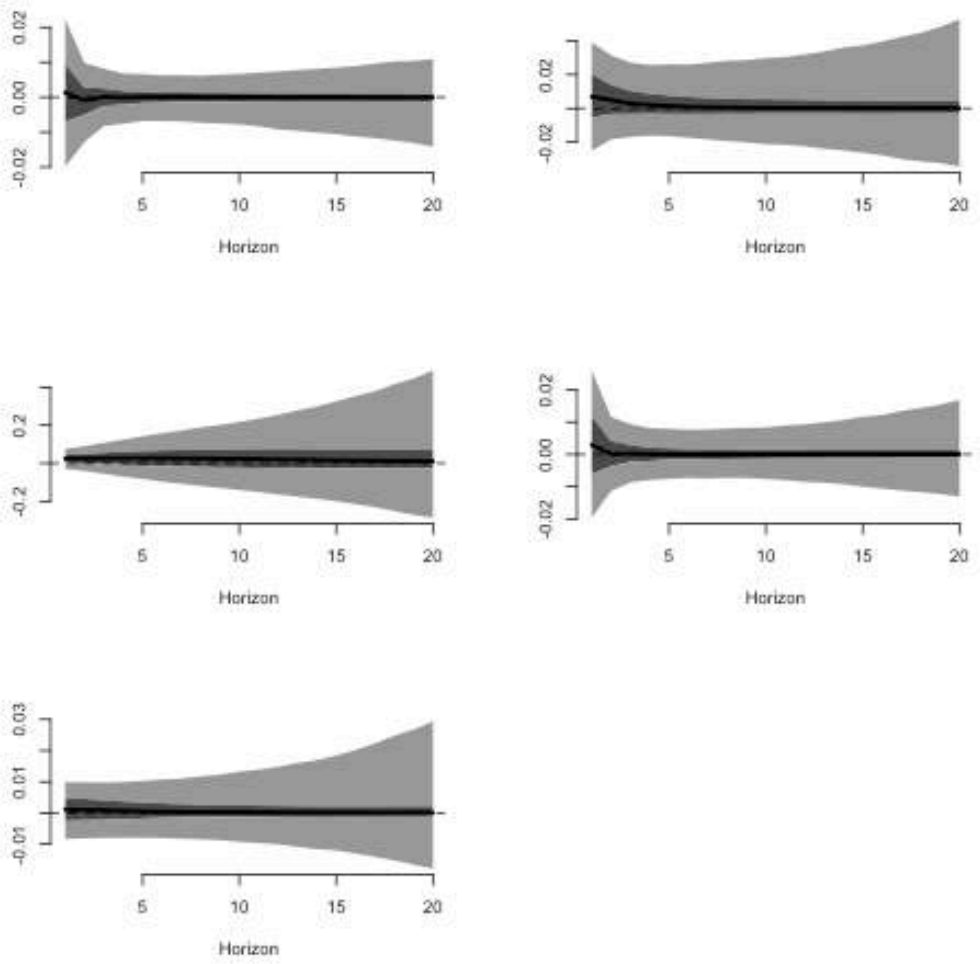


Figure 3.10: responses of exchange rates(top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

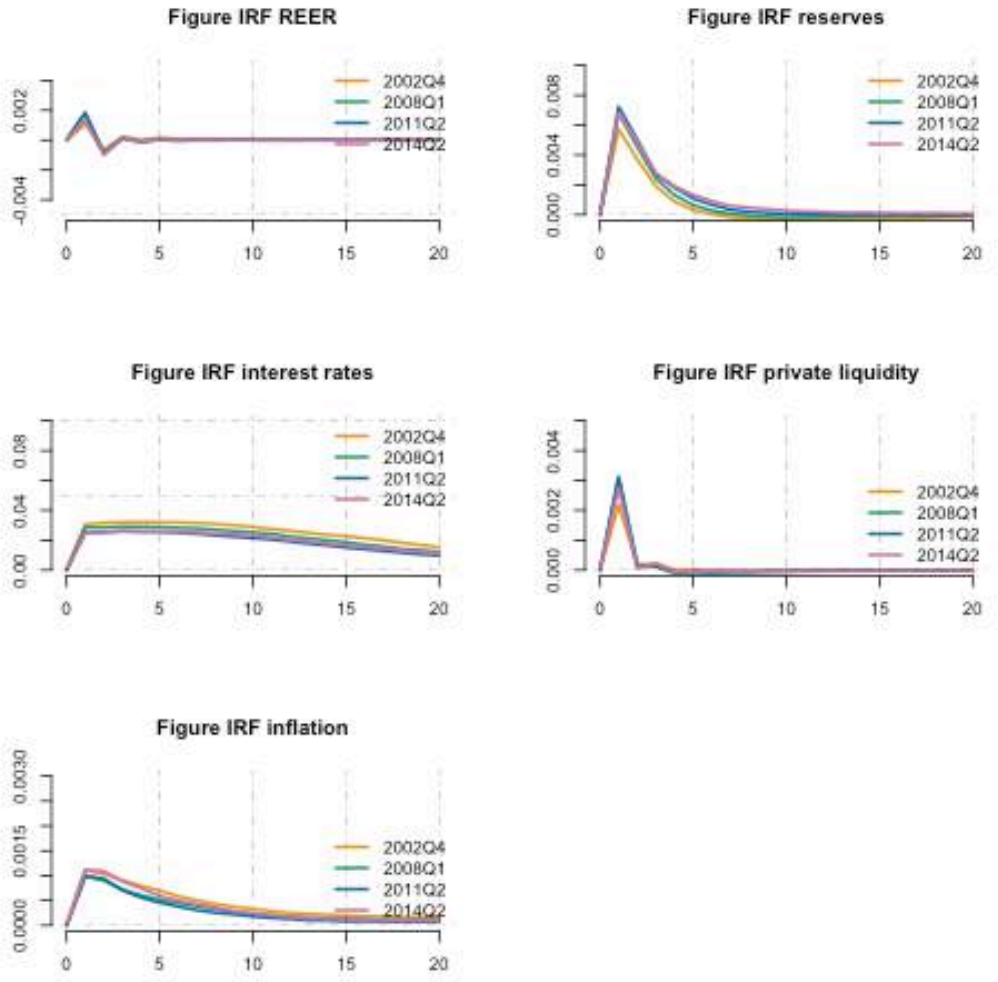


Figure 3.11: IRFs according to selected dates

3.4.4.2. Country level analysis: Thailand

Contrary to China, Thailand results[48] are slightly different considering the type of surge of global liquidity. According to the first model based on monetary aggregates indicator, the main results over the residuals (figure 3.15) shows variability of the exchange rates, the reserves and the interest rates. The other variables residuals do not show such signs of major changes over the period. The main results from the IRFs analysis (figure 3.16) show that all of our variables of interests are not significantly affected (considering the 5 and 95% percent quantiles) by a positive shock of global monetary liquidity despite their reactions to it. Indeed, a positive shock of global liquidity provokes appreciation pressures on exchange rates, tends to increase the reserves, puts downward pressures on short-time

[48]See results appendice p.165-167

interest rates, increases domestic credit and does not affect the domestic prices. We can interpret the non-significance of the liquidity inflows into Thailand's economy by the effectiveness of their monetary policies, especially if we take into account their achievements with target inflation policy implemented since early 2000 that explain partially the lack of reaction of the domestic prices. Moreover, as they also implement reserves accumulation policy, it could affect the exchange rates if we focus on the mercantilist motives for international reserves. We also notice that liquidity inflows may ease credit condition in the country as the inflows may reduce the policy rates inciting to domestic credit creation by commercial banks, yet the effects remain non-significant. According to the IRFs comparison (figure 3.17), the only noticeable result is related to the reserves variables responses that are different depending on the selected dates, notably as the magnitudes are important for the excess dates relative to the response from the regular date.

According to the second model[49] the residuals (figure 3.18) follow the same patterns as the previous model, especially considering the variability of the reserves, interest rates and the exchanges rates. If we refer to the IRFs, the results (figure 3.19) follow also the general consequences from the first model with two major differences. It appears that the bank flows do not really affect the domestic reserves but they significantly (according to the 5 percent quantile) affect the short time interest rates by increasing them during the 3 quarters following the shock. It seems that the Bank of Thailand reacts vigorously the policy interest rates to prevent the transmission of foreign ease of financing into the domestic credit. Nevertheless, it seems that the increasing interest rates do not significantly affect the price evolution, which indicates that the monetary authorities may strongly monitor the effects of their other monetary policies on their inflation targeting. Finally, the IRFs comparison (figure 3.20) shows that a positive shock of cross-border credit has greater magnitudes on interest rates during the dates of excess relative to the regular date. It reveals the commitment of the central banks to limit the effects on their domestic credit markets. It shows also the different effects of the interest rates magnitudes on domestic price evolutions demonstrating that despite the effects are non-significant, it appears that central banks reactiveness on their policy rates affects also the paths of domestic prices.

[49]See results p.168-170.

3.4.4.3. Country level analysis: Malaysia

Concerning the results[50] of the first model based on the monetary aggregates as global liquidity indicator, the residuals (figure 3.21) show that only reserves and domestic credit signs of variabilities across time, especially if we keep in mind that the country uses also the target inflation framework with managed floating exchange rates that could explain the stability of the exchange rates and the inflation during the considered period. According to the IRFs results (figure 3.22), a positive shock of our global liquidity indicator shows that the majority of our variables of interests are not significantly affected by the surge of global liquidity inflows apart from the reserves variable that responds positively and significantly to the shock during 3 quarters. This result on the reserves is related to their commitment to both manage their exchange rates and isolate their economy from the global liquidity inflows, especially their domestic credit market and domestic price. Lastly, the IRFs comparison (figure 3.23) does not reveal any significant difference of magnitudes between the IRFs of our variables according to the selected dates.

Concerning the second model[51] of the second model, the residuals (figure 3.24) show the same patterns as the first model, particularly the reserves and domestic credit. Moreover, the IRFs (3.25) from the estimation of the considered period reveal the same findings as the first model, the significance positive effects on the reserves variables in order probably to isolate their economy from the ease of financing in the foreign credit markets, despite the relative zero effect on interest rates. Finally, the IRFs comparison (figure 3.26) shows that the only noticeable difference of magnitudes amongst of our variables of interests relies on the interest rates IRFs. Indeed, the results reveal different responses of interest rates by central bank of Malaysia during the selected dates. The 2008Q1 and 2011Q2 positive shocks of bank flows induce restrictive responses from the domestic central bank by increasing the interest rates while the 2014Q2 – and in a lesser extent the bank flows from the regular date 2003Q4 – positive shock provokes accommodative responses from the central bank by reducing the interest rates. Accordingly, the outcomes on the private domestic liquidity are different, notably the important magnitude of the response of domestic credit – considering the policy rates evolution – during the 2014Q2 relative to the other selected dates. It exposes that the monetary authorities choose different policies during the period, according to the different responses of the interest rates variables.

[50] See appendice p.171-173.
[51] See appendice p.174-176.

Nevertheless, it seems that these choices allow sustaining the inflation target policy, as the bank flows have not affected the domestic price.

3.4.4.4. Country level analysis: India

According to the first model[52], the residuals (figure 3.27) are varying significantly for every domestic variable of interests, especially for the exchanges rates, the reserves, the interest rates, private liquidity and the inflation. Particularly, the results show that the GFC had been accompanied by a peak of variability during the crisis period. Regarding the IRFs (figure 3.28), we find that a positive shock of global liquidity exerts a significant impact, with a positive sign, only for the reserves while the effects on the other variables of interests are not significantly different from zero. This main result indicates the commitment of the Bank of India over their reserves management policy in order to control their managed floating exchange rates. The result also displays how the positive variation of reserves helps to reduce the foreign liquidity pass-through into the Indian economy according to the non-significant results of the other variables. As we refer to the IRFs comparison results (figure 3.29), it is important to stress that the policy rates in India didn't have any major change until last 2011 as the major liquidity inflows during the second phase of global liquidity cycle compel the monetary authorities to raise their policy rates. Considering the information about the policy rates, the lack of magnitude of the interest rates IRF from the 2011Q2 shock is mainly explained by the important global liquidity pass-through into the Indian economy, which the changes in policy rates could not fully sterilize. As a result, the IRF magnitude of the credit is important than the IRFs from the other selected dates.

The second model results[53] based on the cross-border credit aggregates are more interesting than the first model. Specifically, the residuals (figure 3.30) follows the same patterns – including the major GFC effect – but the main difference relies on the IRFs that show that the Indian economy is more vulnerable to international bank flows. According to the IRFs (figure 3.31), the majority of our variables react significantly to surge of bank flows except for the exchange rates. The lack of effects on exchange rates rests on the commitment of the central bank to sustain the managed floating currency. Such result is closely related to the fact that we observe significant effects of the reserves. Indeed, in order to prevent undesirable appreciation pressures on their currency, the Indian central

[52] See appendice p.177-179.
[53] See appendice p.180-182.

bank intervened heavily on foreign exchange markets leading to official reserves changes. Interestingly, we find that the significant positive response on the policy rates does not fully prevent the domestic credit expansion. Specifically, surges in global liquidity inflows have accompanied by a significant increase in domestic credit expansion. These results show that the ease of financing in the global liquidity issuing countries are transmitted into the Indian economy despite the fact that one of their main policy objectives of Reserve Bank of India (RBI) is based on the control of domestic credit. Nevertheless, the positive effect on the interest rates may also be interpreted as the choice of the RBI to focus on inflation instead of their domestic credit as the inflation exhibits a negative significant variation to a shock of global liquidity. Concerning the IRFs comparison (figure 3.32) the main noticeable result relies only on the discrepancy of the outcomes of one positive shock of global liquidity – according to the selected dates – on the exchanges rates IRFs. The results show that each period of surge of global liquidity affects the exchanges rates differently, but according to our previous results on the Indian economy, we show that the appreciation pressure on the exchanges rates may be fully prevented by monetary authorities' reserves management.

3.4.4.5. Country level analysis: Brazil

According to the first model[54], the residuals (figure 3.33) show that all of our domestic variables display variability patterns during the period, especially the reserves, interest rates and private liquidity. Regarding the IRFs (figure 3.34) analysis, we notice that one positive global liquidity shock has significant positive effects on the exchange rates, reserves and domestic credit contrary to the non-significant effect on interest rates and inflation. As Brazil follows floating exchange rates, Brazilian Real undergoes appreciation pressures in the aftermath of liquidity inflows. However, Brazilian authorities intervened on the foreign exchange markets, as suggested by the positive response of their international reserves. In addition, they adopted important capital controls measures since the GFC in order to sterilize the liquidity inflows. Moreover, we notice that the Central Bank of Brazil does not rely on their interest rates to reduce the effect of foreign liquidity inflows into their economy, especially since our results show that the global liquidity developments are transmitted to the domestic credit market, which reacts significantly to positive shock of global liquidity. However, the absence of reaction of monetary

[54] See appendice p.183-185

authorities on the interest rates may be interpreted as their willingness to achieve the inflation target policy, as domestic price are not affected by foreign liquidity inflows. The IRFs comparison (figure 3.35) shows that the magnitudes discrepancies between the IRFs from the periods of excess global liquidity and the IRFs from the normal period display the importance of the liquidity inflows spillovers on the Brazilian during the period of excess global liquidity, particularly the effects on exchange rates, reserves and domestic credit. Moreover, these results show that the country interest rates reacted differently regarding the different dates of shock. However, the interest rates responses are not significant, which indicates that the monetary authorities may not rely on interest rates policy tools to control the domestic credit expansion, mostly because they focus on their inflation targeting as their main monetary policy objective. Finally, the main interpretation that stems from the first model can be summed up by the vulnerability of Brazilian's economy to foreign developments particularly on the domestic credit market that is affected by global credit conditions.

The results[55] from the second model indicate that the residuals (figure 3.36) follow the same patterns as the previous first model. The IRFs (figure 3.37) display the same evolutions for the significant variables – exchange rates, reserves and domestic credit – and also the same outcomes for the remaining variable of interests. The results suggest that the Brazilian economy is also vulnerable to international bank flows as one positive shock of global liquidity affects significantly the expansion of domestic credit. We retrieve the moderate effects on the interest rates and domestic prices that show the choice of the Central Bank of Brazil to protect their inflation objective over their domestic credit market. Finally, the IRFs comparison (figure 3.38) confirms the results we observe on the previous model except for the IRFs from the selected regular date. We confirm that the disparity over the IRFs of interest rates and inflation shows that the monetary authorities reacted differently during each selected dates in order to control the inflation.

3.4.4.6. Country level analysis: Chile

The results[56] from the first model display that only the residuals (figure 3.39) of reserves and interest rates show variability over time. Moreover, as the country is one of the first economies experiencing the inflation-targeting framework, the lack of volatility shown by the inflation residuals – and in a lesser extent the exchanges rates residuals – may be

[55] See appendice p.186-188.
[56] See appendice p.189-191.

explained by their choices of monetary policies in order to reach their inflation target. Indeed, the Bank of Chile is acknowledged to achieve their target inflation for nearly three decades and reached low and stationary inflation since mid-1990, which may explain the stability path of the inflation's residuals. As the Chilean monetary policy is anchored to annual inflation, the monetary authorities rely mainly on the policy rates as main channels of transmission of change in monetary policy into the Chilean economy explaining de facto the variability of the interest rates variables over time. According to the IRFs (figure 3.40), the results display that a positive shock on global liquidity affects only significantly the domestic international reserves. It means that Central Bank of Chile relies also on reserve management to reduce the effect of liquidity inflows into their economy, as they do not use any major capital control policy. The IRFs comparison (3.41) shows disparities amongst the responses of our variables according to the selected dates except for the reserves responses that show homogeneity. The results confirm their reliance on the reserve management to sterilize the liquidity inflows in a context of liberalized capital account and floating exchange rates. The disparities amongst the interest rates responses, according to the selected dates, may demonstrate also their choices of policy rates to achieve both their inflation target objective and to limit domestic credit expansion.

The second model shares common results[57] with our first one, particularly considering the residuals (figure 3.42) that follow the same patterns. The differences are exposed by the IRFs analysis (figure 3.43) as we see that a positive shock on the international credit does not have relevant effect on the reserve contrary to the previous model. However, we notice that the positive shock implies a positive significant response of the interest rates. Moreover, all of the remaining variables responses are not significant. The interpretations of the results may rely on the willingness of the monetary authorities to focus on interest rates in order to prevent the effect of international bank flows into their economy in a context of capital account liberalization and inflation targeting policy. We notice that the interest rates relevant effect (during one-quarter) means probably that the monetary authorities want to effectively prevent – as the effect on domestic credit is not significant – the international ease of financing transmission to their domestic credit market. Also, the interest rates variations do not affect their inflation targeting policy, as the domestic prices are not significantly different than zero following the positive shock of international bank flows. The IRFs comparison (figure 3.44) does not show any disparities over our variables of interests according to the selected excess dates and the regular date.

[57] See appendice p.192-194.

3.4.5. General remarks on the country-level analysis

Overall, three major lessons could be stated regarding our findings. First, the countries identified fragilities relative to the global liquidity expansion are in line with Pradhan (2013, 2014) assumptions regarding their choices of monetary policies relative to major capital inflows during the global liquidity phases stated by Shin (2015). Accordingly, we find that China is the least exposed country, mostly because of Chinese main monetary policies tools such as the pegged currency, capital controls, reserves requirements and key interests rates that help the monetary authorities to isolate the country from foreign developments. The other countries of our sample follow the typology we made previously[58] as we confirm that Chile, India**,** Malaysia**,** and Thailand are moderately exposed to the global liquidity developments. At the opposite, despite the active management of capital inflows through capital controls, we find that Brazil is the most exposed country of our sample. Second, amongst the moderately exposed countries, some differences are noticeable. Actually, countries following the inflation targeting policy are able to limit the consequences of the global liquidity expansion and achieve their target inflation with minor consequences on the developments of domestic private liquidity. On the other side, India shows signs of exposures, especially to international bank flows, as we find that domestic private liquidity expansion and prices are influenced by global liquidity. Third, despite the fact that Brazil is also following the inflation targeting framework, our results confirm that this country is the most exposed country of our sample. Indeed, despite that the monetary authorities are committed to the inflation targeting framework, the global liquidity's expansion have major consequences on the Brazilian economy through appreciation pressures on the exchanges rates and the transmission of the global ease of financing into the Brazilian domestic credit market as the complementary monetary policy tools cannot fully sterilize the global liquidity spillovers into the Brazilian economy.

[58] See table 3.1 p.97.

3.5. Conclusion

The main objective of this chapter has been to investigate the monetary effectiveness in the receiving EMEs during periods of surges in global liquidity. To this end, we have adopted a country-level approach that allows us to get some interesting findings. Firstly, the receiving countries tend to react differently to surges in liquidity inflows, particularly during periods of global excess liquidity. Secondly, our results confirm the typology established by Pradhan (2013, 2014), on the vulnerabilities of EMEs and how these vulnerabilities may affect their monetary policies efficiency. Thirdly, our results show that the countries of our dataset are generally affected at different degree by the private components of global liquidity, especially by the behaviors of international banks by transmitting the *"ease of financing"* into the domestic credit market. Fourthly, we find that countries following the inflation targeting framework – Thailand, Malaysia, Chile and in a lesser extent Brazil – are able to limit the consequences of the liquidity inflows on the domestic prices, sometimes at the expense of other monetary objectives, for instance the expansion of domestic credit or the currency's exchange rates. Fifthly, it appears that the choices of monetary policies – Pegged currency, active reserve management and capital controls – implemented by the People's Bank of China helps to isolate the country from the global liquidity developments, especially when the country is known as one the major liquidity-receiving country. Nevertheless, as we only focus on six countries, we cannot generalize our analysis over the other EMEs but our main findings help to identify tendencies on the effectiveness of the inflation targeting countries according to the vulnerabilities that may affect the countries. To generalize our previous findings, taking into account a large panel of countries may be necessary and new model could be constructed by using directly a time-varying panel approach to assess the results, an interacted Panel VAR. We could also expand our models by introducing net capital inflows into our empirical analysis to have a complete framework on the global liquidity pass-through into the receiving economies.

Conclusion

Les travaux développés dans le cadre de cette thèse s'inscrivent dans l'approche de la liquidité globale selon le point de vue des pays émergents. Le choix de centrer l'analyse sur la perspective des pays destinataires s'explique par l'importance de la littérature déjà consacrée, d'une part, à la perspective des pays émetteurs de cette liquidité, et, d'autre part, par l'importance des études qui ont déjà été développées dans la compréhension de la dynamique entourant son développement et les mécanismes de sa transmission. De plus, pendre le parti d'étudier la perspective des pays émergents est d'autant plus justifié dans la mesure où ces pays affichent des différences structurelles qui méritent d'être soulignées par rapport aux pays développés et qui peuvent induire des conséquences relativement différentes lors de la transmission des conditions la liquidité globale dans leur économie.

Dans cette optique, le premier chapitre contribue, tout d'abord, au débat sur la liquidité globale en confirmant les mécanismes de transmissions théoriques vers les pays émergents, les « *push factors* » du modèle d'économie ouverte de Mundell-Fleming rejoignant ainsi les résultats antérieurs de la littérature sur les pays développés. Cette justification du modèle théorique a permis la confirmation des conséquences déstabilisatrices de l'expansion de la liquidité globale concernant la problématique de la stabilité financière dans les pays émergents. En deuxième lieu, le chapitre contribue d'une manière originale à la littérature empirique en introduisant une distinction régionale parmi les pays émergents qui permet d'affiner l'analyse et démontre des différences dans la significativité de nos résultats en fonction des analyses régionales, principalement en confirmant le statut de destinataire historique de la liquidité globale au pays émergent asiatique. En dernier lieu, l'introduction d'une distinction des pays destinataires en fonction de leurs régimes de changes permet de confirmer que le choix du régime de change ne permet pas d'isoler complètement les pays du développement des conditions de la liquidité globale.

Concernant le deuxième chapitre, les principales contributions à la littérature se trouvent dans l'introduction d'un cadre d'analyse propice à l'étude des liens existants entre le processus d'accumulation d'actifs de réserves et l'expansion de la liquidité globale. Ce cadre permet d'analyser les effets de l'accumulation de réserves sur le principal pays émetteur d'actifs de réserves ainsi que contributeur de l'évolution de la liquidité globale. L'approche empirique développée dans le chapitre contribue aussi à mieux comprendre le

canal de transmission principal des conséquences de ce comportement d'accumulation dans les pays émergents dans les pays émetteurs de réserves. Ce comportement affectant d'une manière significative l'évolution des taux d'intérêt de long terme dans les pays émetteurs, permettant le développement de la composante d'origine privée dans le principal pays émetteur de la liquidité globale.

En ce qui concerne le troisième chapitre, plusieurs contributions peuvent être soulignées. La première est l'introduction de la perspective de la politique monétaire dans l'analyse empirique de la liquidité globale. La seconde contribution porte sur l'identification des périodes d'excès de liquidité globale qui s'avèrent importantes concernant l'analyse du rôle des flux de capitaux dans la transmission des conditions de la liquidité globale. De plus, l'identification des périodes d'excès joue un rôle très important dans l'analyse des déterminants des flux vers les pays destinataires, d'une part, et lors de l'analyse des conséquences de ces flux lors de la prise en compte des politiques monétaires des pays destinataires, d'autre part. La troisième contribution porte sur la méthodologie non linéaire employée (TVP-VAR) qui permet de tenir compte de l'évolution de nos variables d'intérêts et met en évidence l'existence de différences dans la transmission des conditions de la liquidité globale au cours du temps. Concernant la dernière contribution, l'approche retenue dans le chapitre permet de conclure sur une hiérarchisation des pays en fonction de l'efficacité leurs politiques monétaires, notamment en mettant en avant l'efficacité de la politique de ciblage d'inflation dans la modération des flux de liquidités étrangères dans les économies destinataires.

En somme, les travaux effectués dans le cadre de cette thèse ont permis de mettre en évidence l'existence de différences dans la transmission de l'expansion de la liquidité globale dans les pays émergents, spécifiquement en tenant compte de la nature des flux de liquidité, l'évolution des politiques monétaires adoptées par les banques centrales ainsi que des particularités des pays concernés.

Toutefois, même si les travaux développés dans la thèse se sont concentrés exclusivement sur le point de vue des pays destinataires, cette approche requiert encore des recherches supplémentaires. En effet, bien que les mesures de quantité développées par la BRI indiquent que les composantes de la liquidité globale ont connu une croissance continue depuis le début des années 2000, l'analyse des phases du cycle de la liquidité globale combinée à la méthodologie d'identification des périodes d'excès permet d'introduire une analyse plus complète du phénomène en estimant qu'il est aussi important de prendre en compte les périodes de pénuries de liquidité globale. La prise en compte de cette hypothèse,

d'un point de vue empirique, serait d'étendre la modélisation TVPVAR utilisée dans le troisième chapitre en introduisant des restrictions de signes pour une analyse par pays ou l'utilisation d'un IPVAR (*Interacted Panel* VAR) pour une analyse globale du phénomène et permettre d'évaluer les effets de reports de l'expansion de la liquidité globale au cours du temps. Ces deux dernières méthodologies permettraient d'introduire des prévisions « hors échantillon », d'une part, pour permettre de surveiller l'évolution de la liquidité globale et d'autre part, permettre la surveillance des effets de reports.

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Appendices

A. Chapter 1 appendice

A.1.PVAR model optimal lag determination

Benchmark model

Lag = k	Schwartz information criterion
k = 0	-17.97949
k = 1	-18.16101
k = 2	-18.16403*
k = 3	-18.13857
k = 4	-18.08803
k = 5	-18.02969
k = 6	-17.99225
k = 7	-17.96245
k = 8	-17.90152

We choose the optimal lag minimizing the Schwartz information criterion, in our case we select k = 2.

A.2. Impulse response function and variance decomposition

Regional model: Asia-pacific region

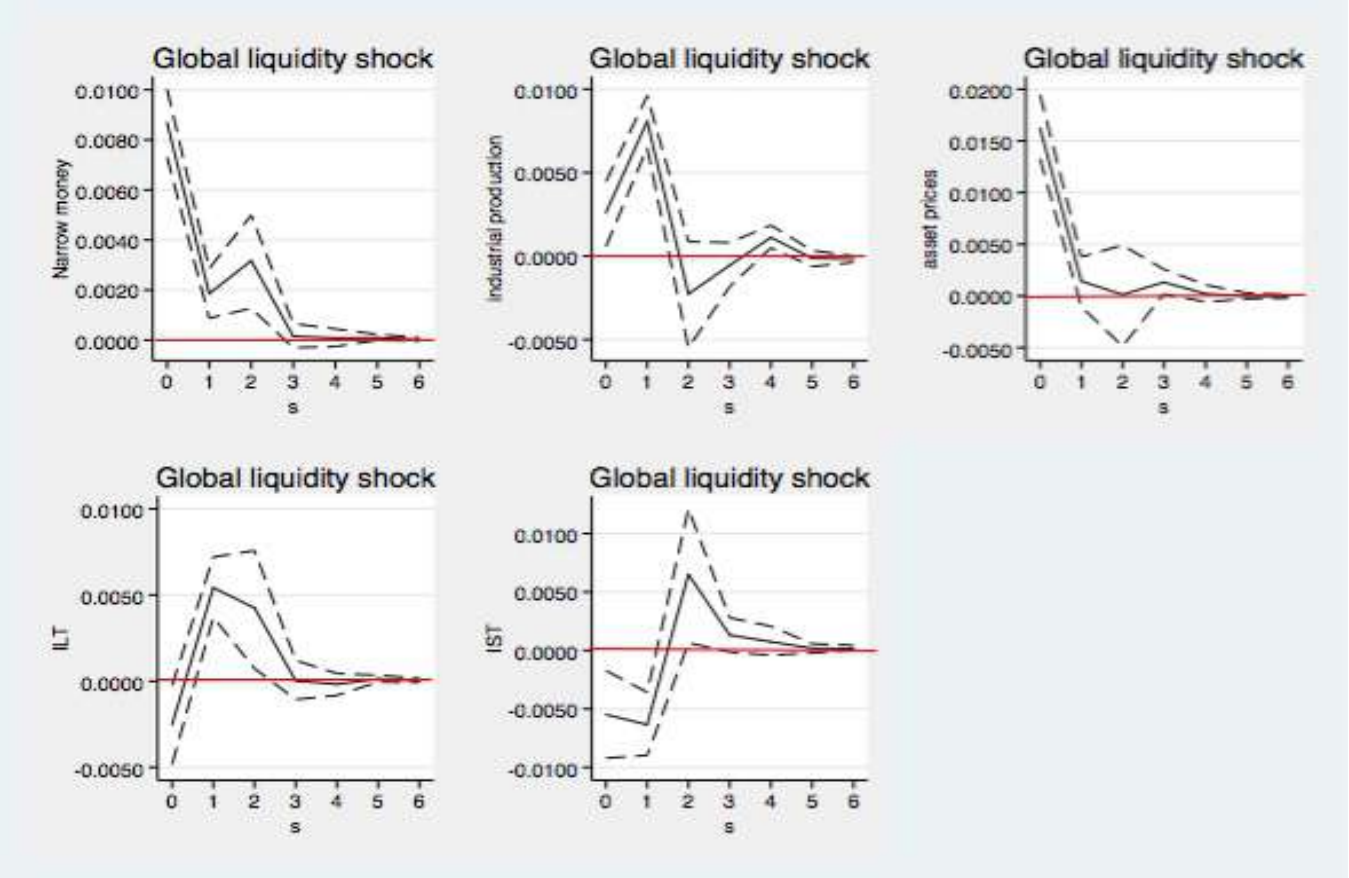

Figure 1.3: IRFs Asia pacific

	1 months	3 months	6 months
M1	6.1	7.0	7.0
IPI	0.2	2.5	2.6
MSCI	3.7	3.6	3.6
ILT	0.1	1.4	1.4
ICT	0.03	1.1	1.1

Table 1.2: Variance decomposition

Regional model: Eastern Europe region

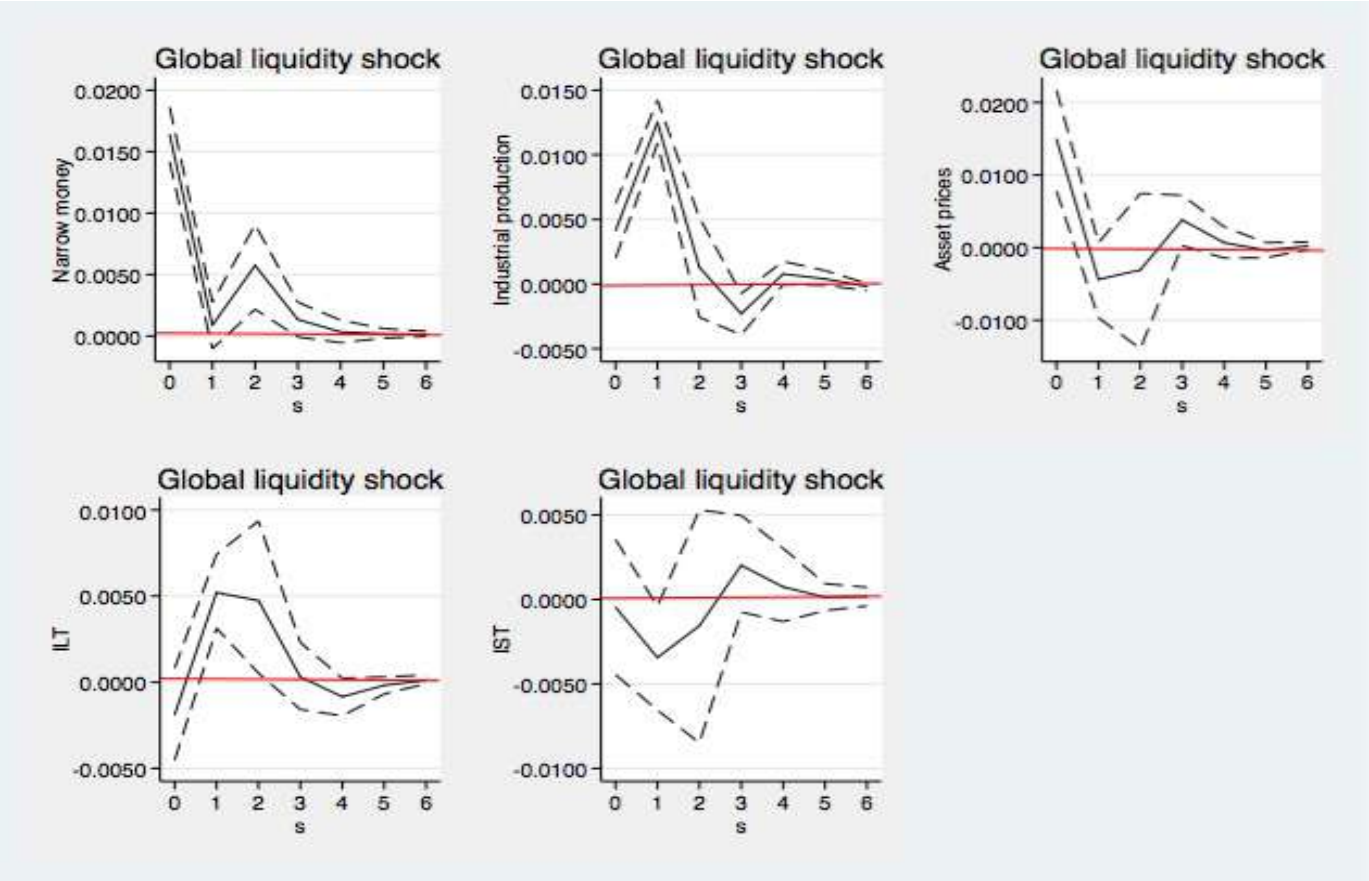

Figure 1.4: IRFs Eastern Europe

	1 months	3 months	6 months
M1	15.1	15.8	15.8
IPI	1.1	9.7	10.0
MSCI	1.3	1.4	1.5
ILT	0.1	2.0	2.0
ICT	0.003	0.2	0.2

Table 1.3: Variance decomposition

Regional model: South America region

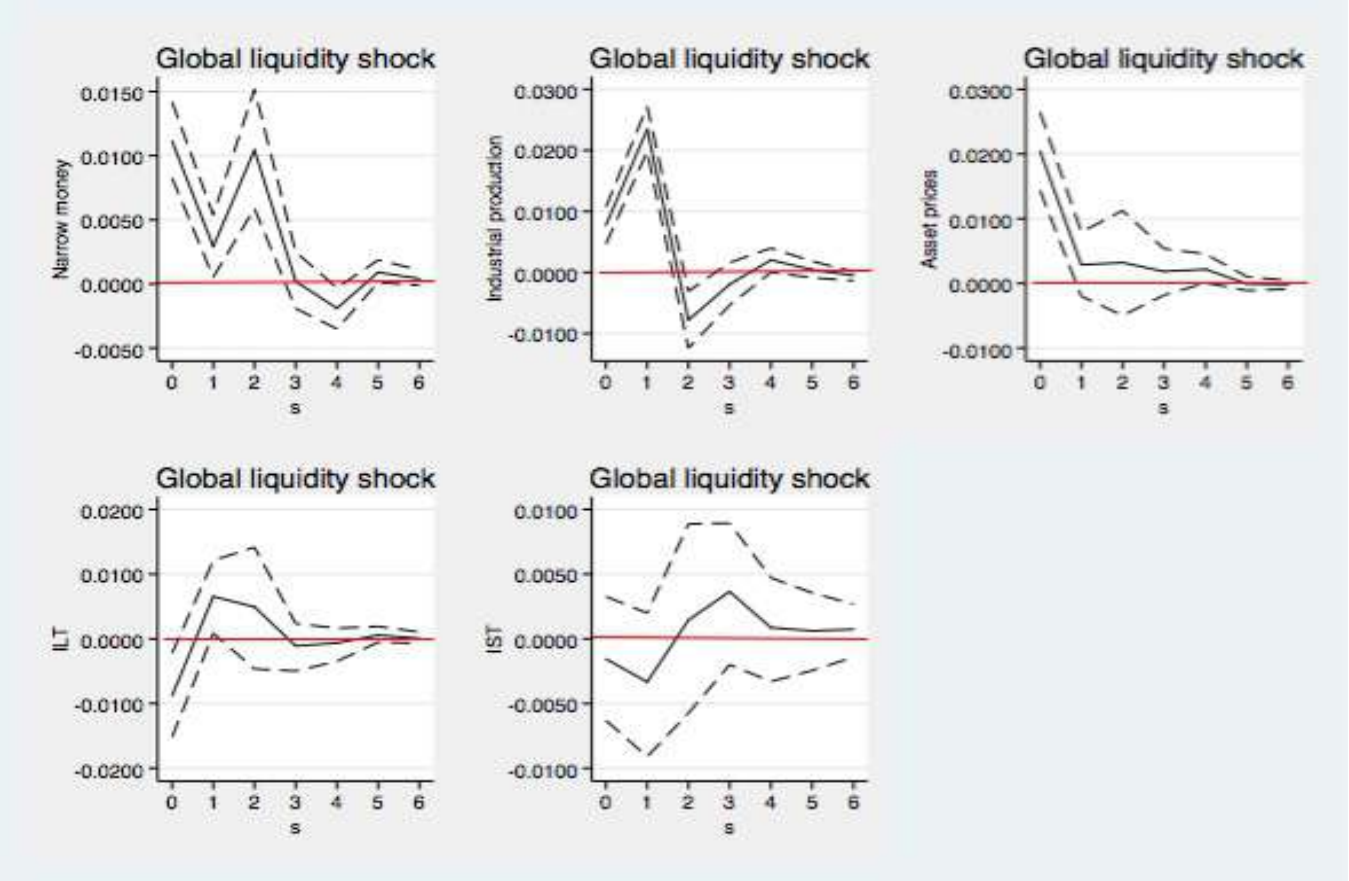

Figure 1.5: IRFs South America

	1 months	3 months	6 months
M1	5.8	10.1	10.2
IPI	2.9	21.5	21.5
MSCI	4.9	5.0	5.0
ILT	0.9	1.6	1.6
ICT	0.04	0.2	0.3

Table 1.4: Variance decomposition

Regional model: Middle East and Africa region

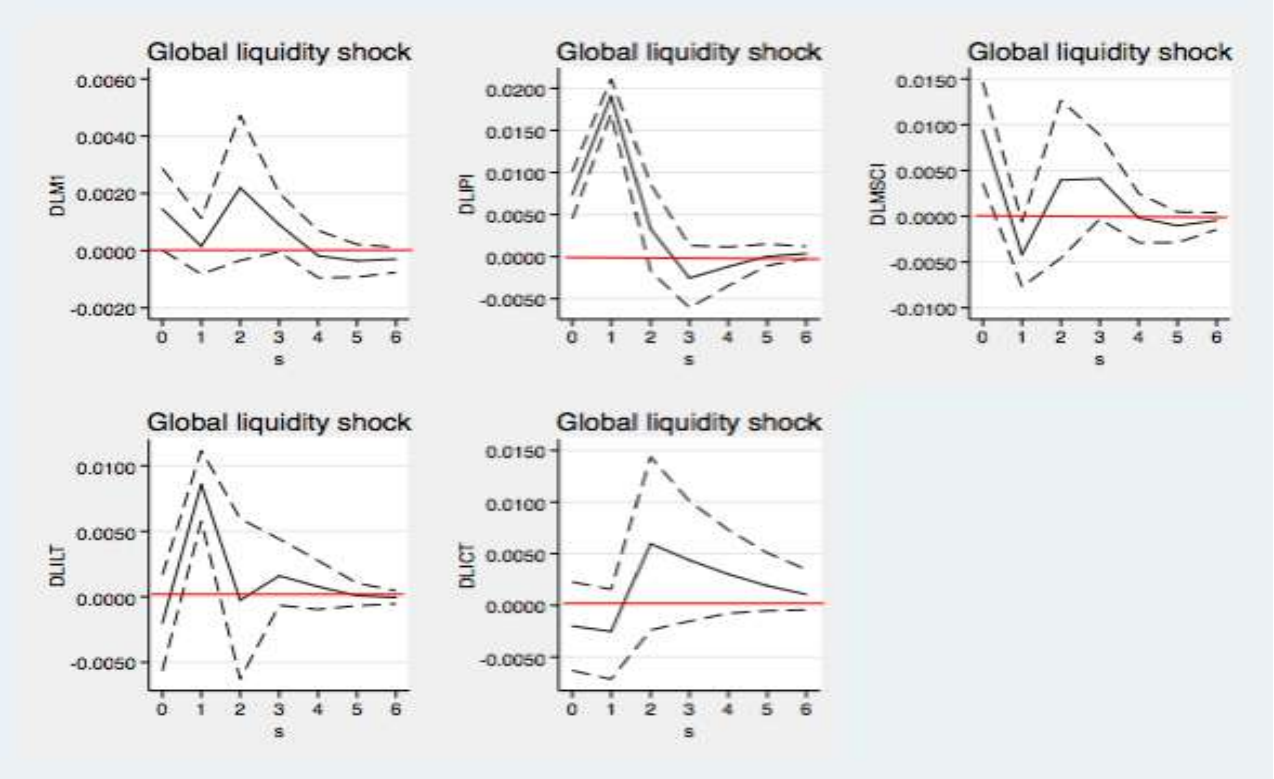

Figure 1.6: IRFs Africa and Middle East

	1 months	3 months	6 months
M1	0.4	1.3	1.4
IPI	3.2	20.7	20.9
MSCI	1.2	1.6	1.8
ILT	0.1	2.6	2.7
ICT	0.1	0.8	1.2

Table 1.5: Variance decomposition

A.3.IRFS and Variance decomposition exchange rates models

Fixed exchange rate model 1: Model using narrow money as monetary proxy

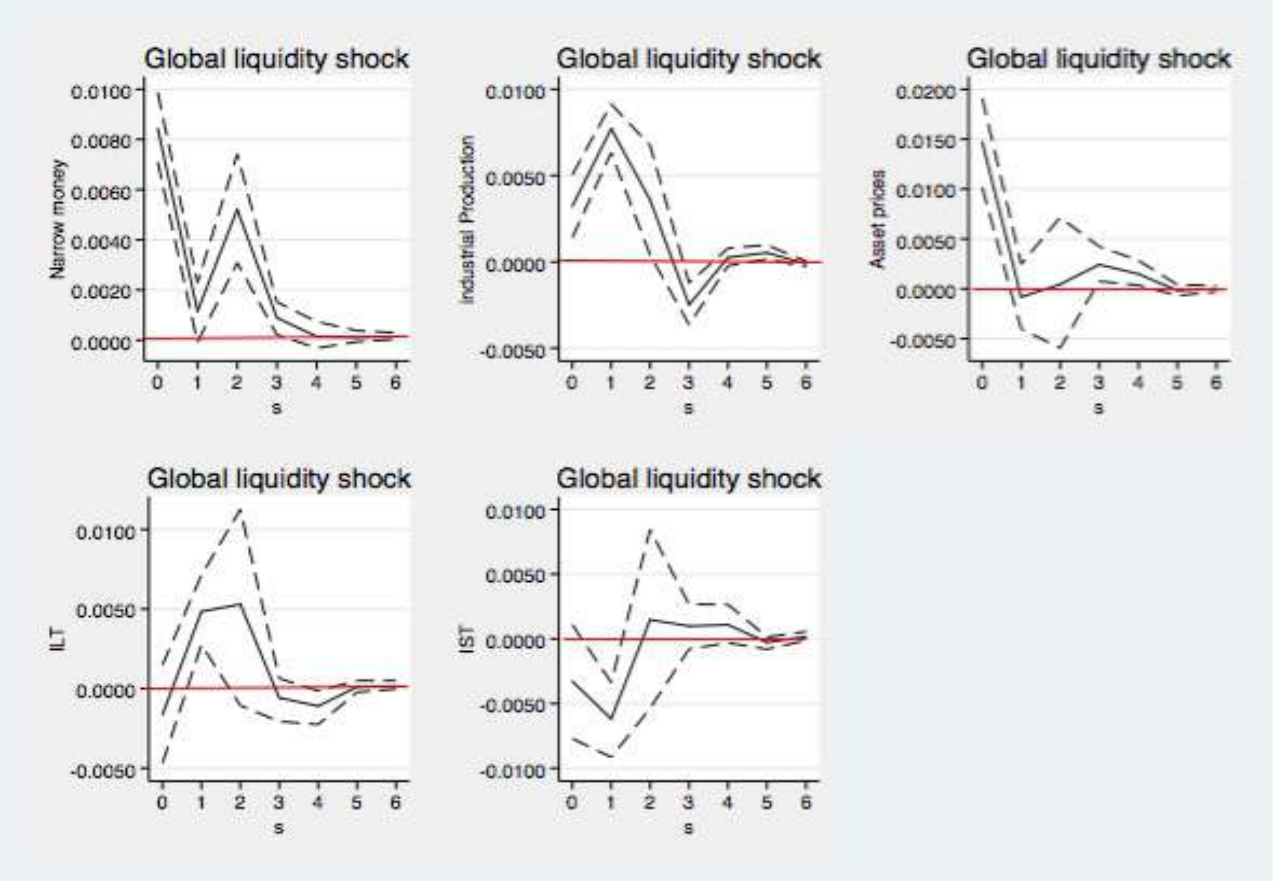

Figure 1.7: IRFs Fixed exchange rate model

	1 months	3 months	6 months
M1	5.7	7.6	7.7
IPI	0.5	3.7	4.05
MSCI	1.7	1.7	1.7
ILT	0.05	1.0	1.0
ICT	0.1	0.4	0.4

Table 1.6: Variance decomposition

Fixed exchange rate model 2: Model using broad money as monetary proxy

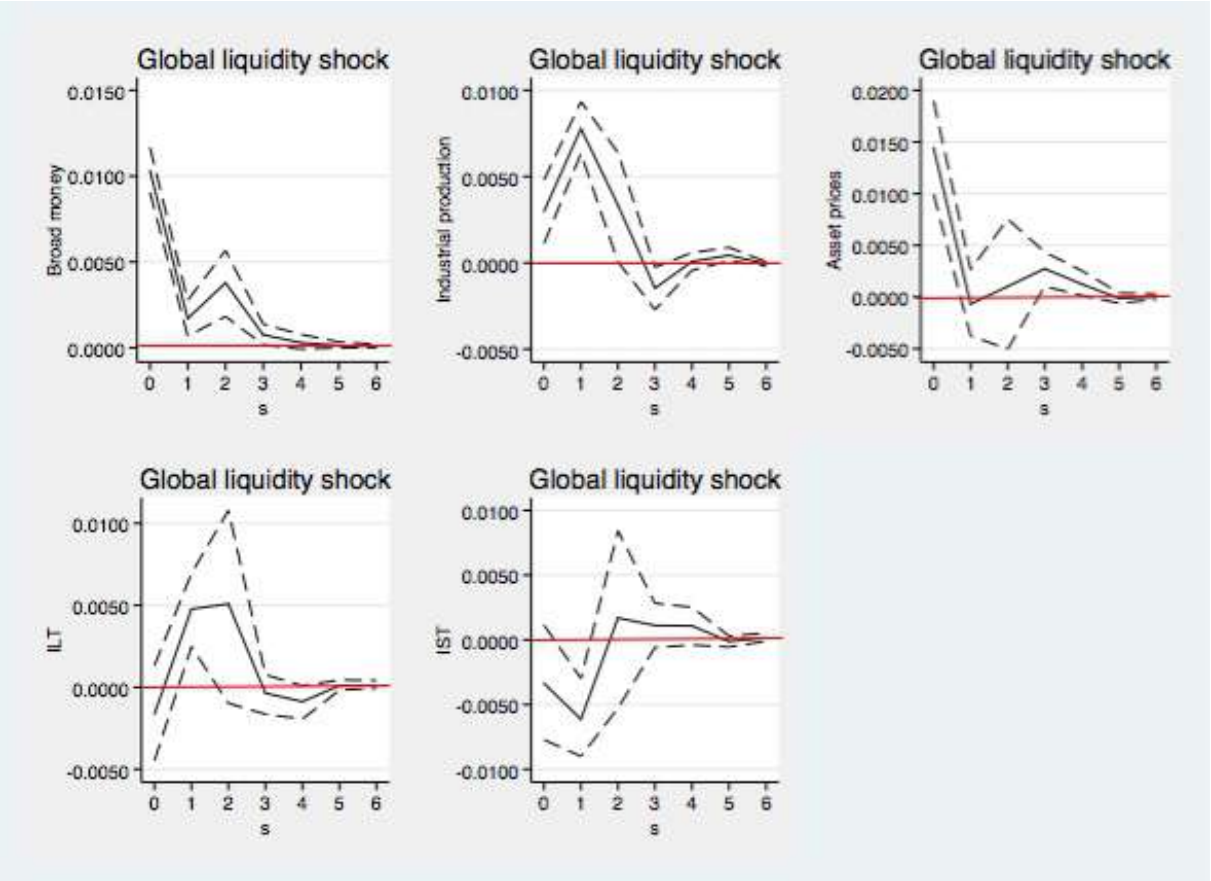

Figure 1.8: IRFs fixed exchange rate model

	1 months	3 months	6 months
M2	9.9	10.9	11
IPI	0.4	3.6	3.7
MSCI	1.7	1.7	1.7
ILT	0.05	0.9	0.9
ICT	0.1	0.4	0.5

Table 1.7: Variance decomposition

Floating exchange rate model 1: Model using narrow money as monetary proxy

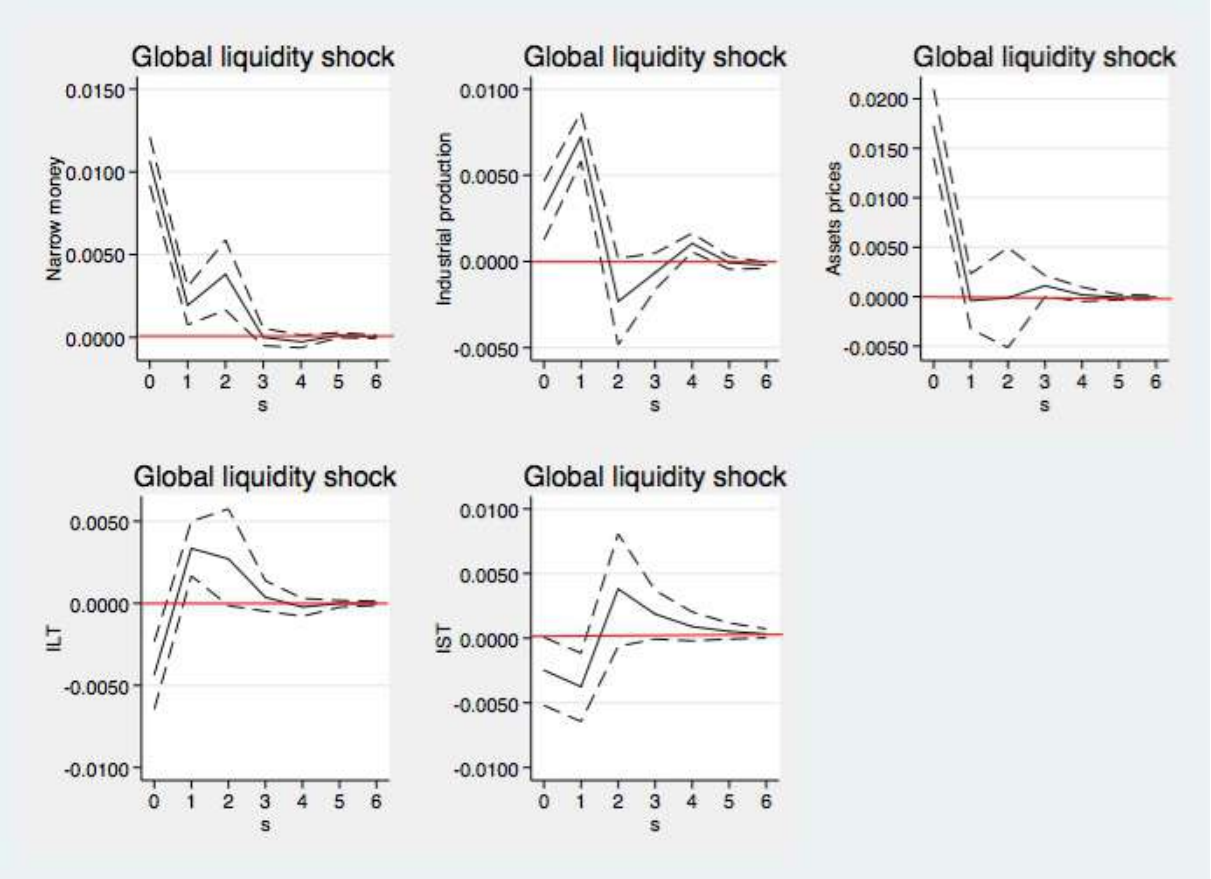

Figure 1.9: IRFs floating exchange rate model

	1 months	3 months	6 months
M1	6.7	7.5	7.5
IPI	0.4	2.5	2.5
MSCI	3.4	3.4	3.4
ILT	0.5	1.0	1.0
ICT	0.1	0.5	0.5

Table 1.8: Variance decomposition

Floating exchange rate model 2: Model using Broad money as monetary proxy

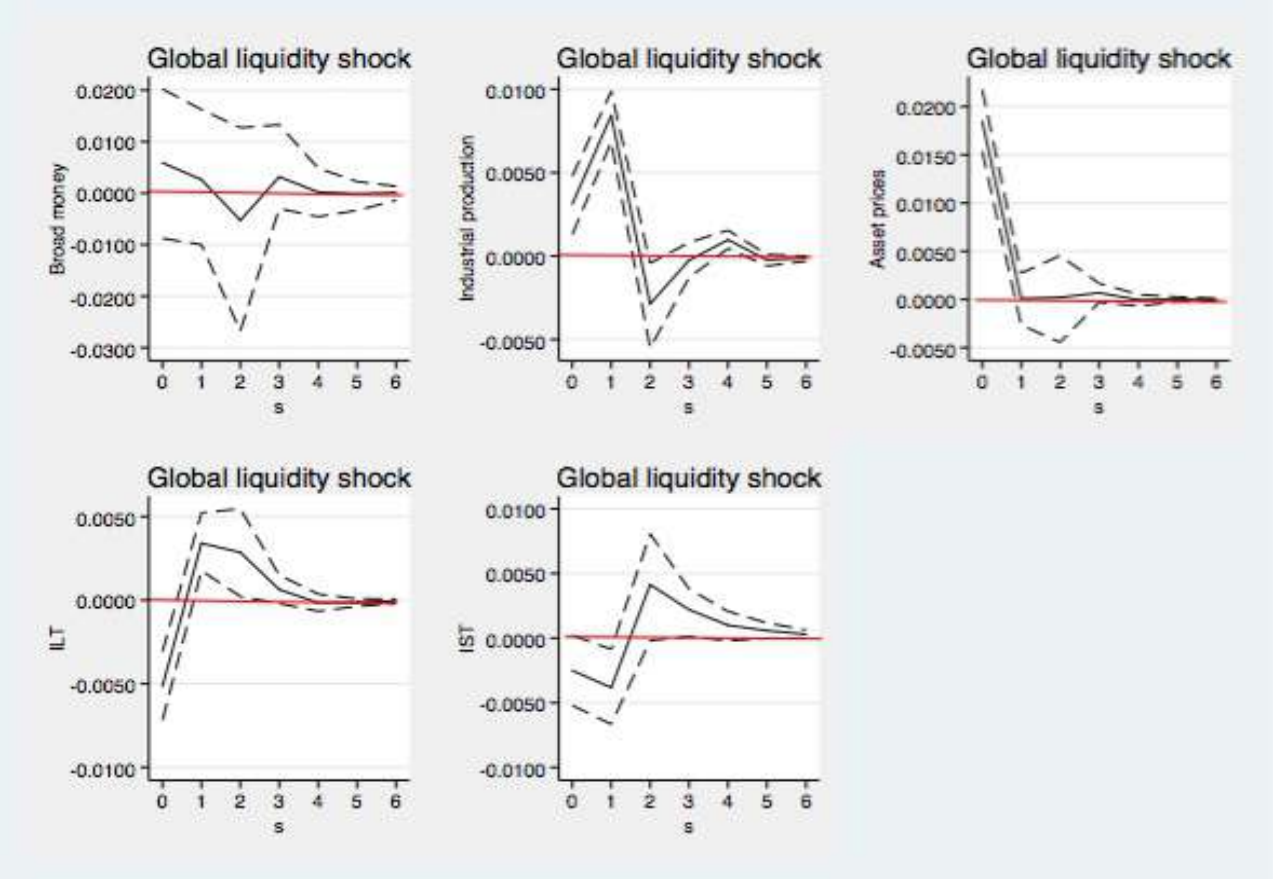

Figure 1.10: Floating exchange rate

	1 months	3 months	6 months
M2	0.02	0.04	0.04
IPI	0.4	3.0	3.3
MSCI	3.9	3.8	3.8
ILT	0.8	1.3	1.3
ICT	0.1	0.5	0.6

Table 1.9: Variance decomposition

A.4. Robustness model IRFs

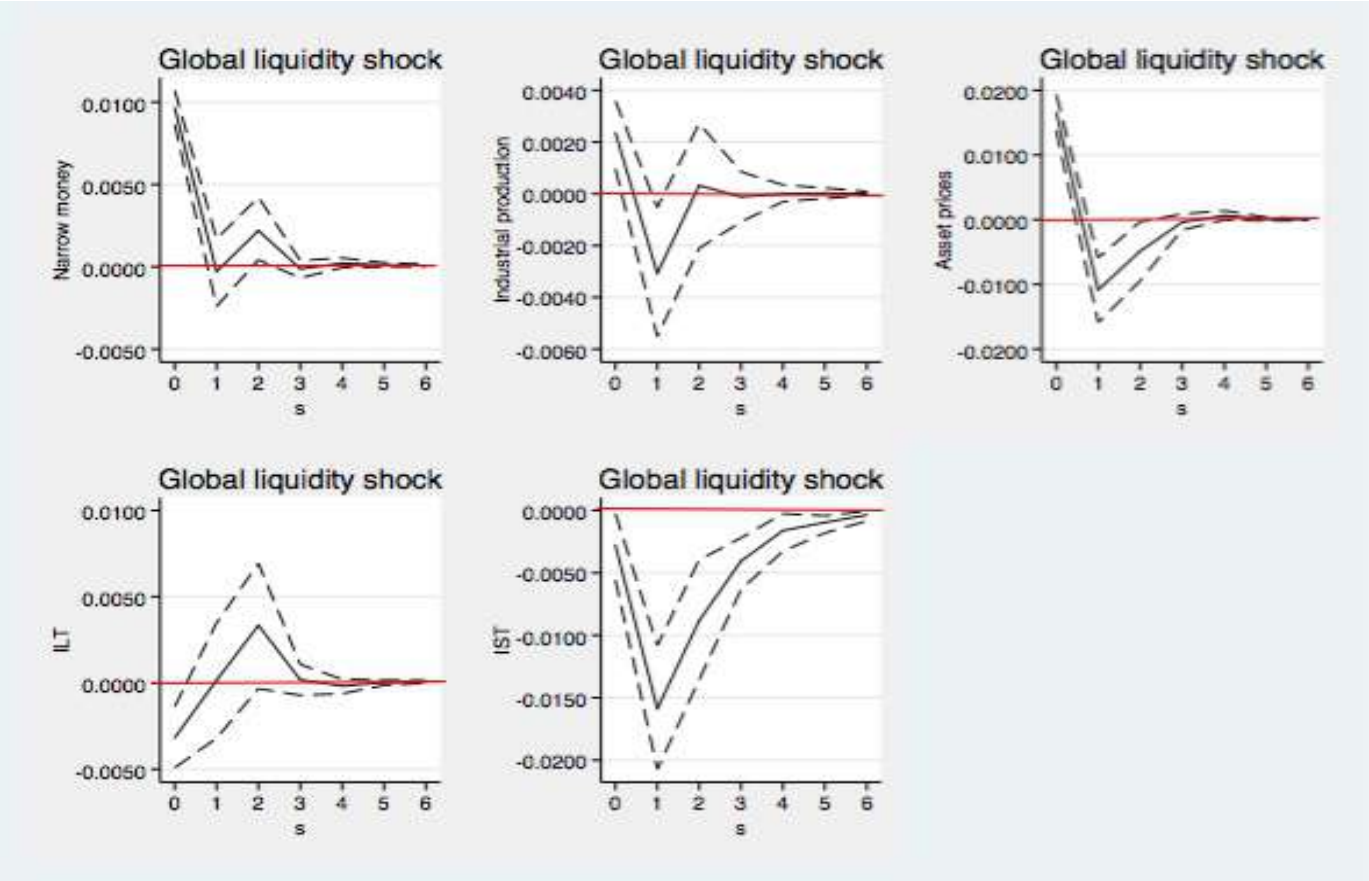

Figure 1.11: IRFs Global model new liquidity indicator

	1 months	3 months	6 months
M1	5.9	6.1	6.1
IPI	0.2	0.59	0.59
MSCI	2.5	3.7	3.7
ILT	0.2	0.4	0.4
ICT	0.09	3.7	3.9

Table 1.10: Variance decomposition

A.5. Panel non-causality test

Theoretical Framework

In order to identify the causal direction of the global liquidity transmission mechanism between our endogenous variables, we perform a panel non-causality test developed by Dumitrescu and Hurlin (2012). This procedure is an extension of the Granger (1969) test to heterogeneous panel data models. It preserves the heterogeneity of cross-sectional units; it allows us to test the direction of the relationship between macroeconomic imbalances without imposing the same dynamic model for all the countries of the sample. The procedure consists in estimating the following heterogeneous autoregressive model:

$$y_{i,t} = \theta_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \delta_i^{(k)} x_{i,t-k} + \epsilon_{i,t}$$

Where *x* and *y* are two stationary variables, observed on *T* periods for *N* countries. The model assumed that individual effects are fixed and the lag-order *K* is supposed to be common for all the countries of our sample. $\gamma_i^{(k)}$represents the autoregressive parameters and $\delta_i^{(k)}$are the regression coefficients slopes; both parameters differing across countries. By definition, x causes y if and only if the past values of the variable x observed on the i^{th} country improve the forecasts of the variable y for this country i only. The null hypothesis is the homogeneous non-causality (HNC), i.e there is no causal relationship from *x*to*y* for all the countries of the panel $(\delta_i^{(i)} = \left(\delta_i^{(1)}, \dots, \delta_i^{(K)}\right)' = 0, \forall i = 1, \dots, N)$. Under the alternative hypothesis, there exists a causal relationship from *x*to*y* for at least one country of the sample. The test statistic is given by the cross-sectional average of individual Wald statistics defined for the granger non-causality hypothesis for each country (W_{HNC}) and converges to a chi-squared distribution wih*K* degrees of freedom. There are two standardized statistics have been defined by the authors: the first one is based on the exact asymptotic moments of the individual Wald statistics (Z_{HNC}) and the second one on approximated moments of finite *T* samples ($\tilde{Z}_{HNC}$). In practice, the authors showed that the standardized version of the Wald statistic, appropriately weighted in unbalanced panels, follows a standard normal distribution($\bar{Z}_{HNC}$). The panel non-causality results are based on this alternative version of the Wald statistics that converges to a normal distribution. Furthermore, we perform the test with different lags as robustness check.

Panel non causality test results

Lag order	*Statistic tests*									
	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$
	ILT to ICT		**ICT to ILT**		**IPI to ICT**		**ICT to IPI**		**M1 to ICT**	
k = 1	4.28	11.48*	1.62	2.12*	0.10	-3.25*	2.99	7.13*	7.74	24.18*
k = 2	4.10	5.06*	1.11	-2.32*	1.99	-0.09	4.87	7.19*	8.94	17.49*
	ICT to M1		**GL to ICT**		**ICT to GL**		**MSCI to ICT**		**ICT to MSCI**	
k = 1	1.56	1.98*	4.04	10.88*	2.37	4.88*	5.20	15.06*	0.96	-3.29*
k = 2	8.34	15.98*	2.36	0.84	2.05	0.08	5.52	8.84*	0.96	-2.67*
	IPI to ILT		**ILT to IPI**		**M1 to ILT**		**ILT to M1**		**GL to ILT**	
k = 1	0.29	-2.55*	0.47	-1.92	0.36	-2.33*	-2.33	1.21	0.70	-1.13
k = 2	8.36	15.72*	1.16	-2.18*	0.81	-3.04*	4.26	5.54*	0.66	-3.43*

	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$	W_{HNC}	$\bar{Z}_{HNC}$
	ILT to GL		**MSCI to ILT**		**ILT to MSCI**		**M1 to IPI**		**IPI to M1**	
$k=1$	1.04	0.09	0.15	-3.06*	0.95	-0.23	0.68	-1.16	0.62	-1.38
$k=2$	1.83	-0.57	0.09	-4.83*	2.38	0.84	1.47	-1.39	17.66	39.63*
	GL to IPI		**IPI to GL**		**MSCI to IPI**		**IPI to MSCI**		**GL to M1**	
$k=1$	0.08	-3.34*	3.65	9.48*	0.04	-3.48*	0.05	-3.45*	1.06	0.20
$k=2$	3.78	4.46*	4.35	5.91*	3.70	4.26*	21.06	48.25*	2.27	0.63
	M1 to GL		**MSCI to M1**		**M1 to MSCI**		**MSCI to GL**		**GL to MSCI**	
$k=1$	8.08	28.02*	0.44	-2.03*	0.85	-0.57	1.21	0.71	1.64	2.25*
$k=2$	9.13	18.03*	0.41	-4.06*	4.31	5.70*	1.44	-1.48	3.44	3.58*

Note: "X" to "Y" means that we test the null hypothesis of homogenous non-causality (HNC) from X to Y

The sign * means the rejection of null hypothesis at 5% significance level

Table 1.11: Dumitrescu-Hurlin Panel non causality test results

A.6. Panel Unit root test results: Benchmark model

Variable	IPS Test			
	Intercept		Intercept and trend	
	t-stat	p-value	t-stat	p-value
i_{ct}	-2.10**	0.017	-1.80**	0.03
Δi_{ct}	-46.85	0.00	-47.5***	0.00
i_{lt}	-3.32***	0.00	-3.41***	0.00
Δi_{lt}	-49.93***	0.00	-50.57	0.00
$OUTPUT$	-0.39	0.34	-1.058	0.14
$\Delta OUTPUT$	-46.4***	0.00	-47.58	0.00
$MSCI$	1.319	0.90	-0.72	0.23
$\Delta MSCI$	-57.67***	0.00	-59.78***	0.00
$M1$	4.99	1	-1.13	0.12
$\Delta M1$	-58.35***	0.00	-60.61	0.00
$M2$	5.73	1	0.663	0.74
$\Delta M2$	-62.14	0.00	-65.06	0.00
GL_index	0.68	0.75	18.73	1
ΔGL_index	-39.39***	0.00	-39.97***	0.00

Note: The signs ***, ** and * means respectively the rejection of null hypothesis at 1%, 5% and 10% significance level

Table 1.12: Panel Unit Root results

The unit root tests are based on the unit root null hypothesis. We use first differences on the variables in levels to remove the unit root. We additionally differentiate our stationary variable in levels (i_{lt}, i_{st})as the PVAR procedure requires first differences variables to remove the fixed effect and perform the OLS estimation.

The Im–Pesaran–Shin test (2003) is a panel unit root test that relaxes the assumption of a common autoregressive parameter inside the panel data. Moreover, the IPS tests are best suited for our unbalanced dataset, as balanced dataset is not required to perform the Unit root procedure.

A.7. Benchmark model alternative IRFs

This alternative benchmark model use broad money as monetary proxy in the receiving economies. In this model, we find that the broad money is not sensible to global liquidity shock. It is the reason we choose the model using narrow money as monetary proxy in the receiving countries.

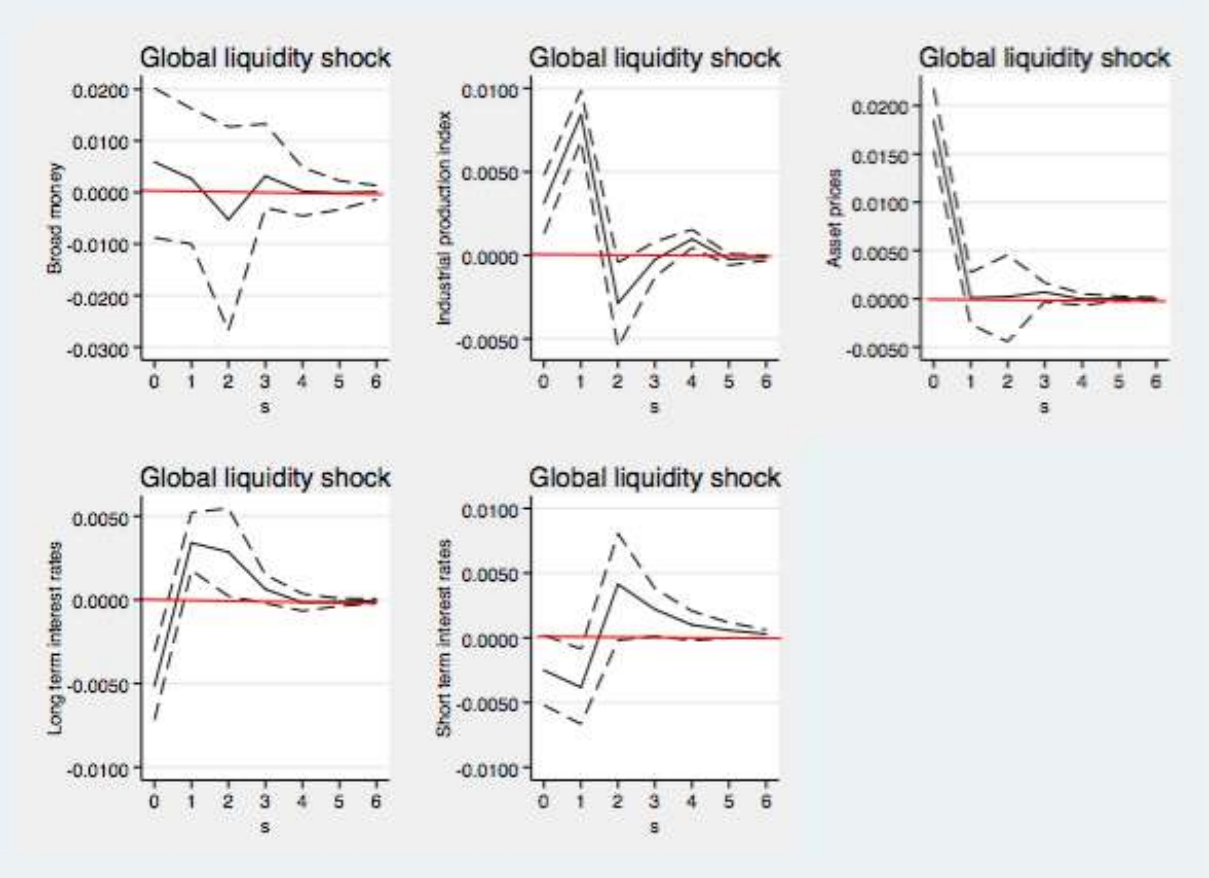

Figure 1.13: IRFs Global model using Broad money as proxy

A.8. Exchanges rate regime classification

	Argentina	Australia	Bulgaria	Chile	China	Czech Rep.	Egypt	Hungary	India	Indonesia	Israel	Jordan	Korea
Median	2	4	1	3	1	3	2	2	2	3	3	1	3
Average	2.51	4	1	3	1.57	2.63	1.71	1.71	2	3	2,51	1	3
Exchange rate regime	Fixed	Floating	Fixe	Floating	Fixed	Floating	Fixed	Fixed	Fixed	Floating	Floating	Fixed	Floating

	Lithuania	Malaysia	Mexico	New Zealand	Peru	Philippines	Poland	Russia	Singapore	South Africa	Thailand	Colombia
Median	1	1	3	3	2	3	3	2	3	4	3	3
Average	1.61	1.51	3	3	2	2.29	3	2.11	3	4	3	3
Exchange rate regime	Fixed	Fixed	Floating	Floating	Fixed	Fixed	Fixed	Fixed	Floating	Floating	Floating	Floating

NB: Coarse classification codes

Code	1	2	3	4
Exchange rate regime	De facto peg	Crawling peg	Managed floating	Freely floating

Table 1.13: Countries exchange rates regime classification

This exchange rates regime distinction is based on the monthly coarse classification developed by Reinhart and Rogoff. Taiwan is the only country in our dataset not included in their classification. Considering the fact that Taiwan historically use managed crawling peg, we assume that they use fixed exchange rate regime during the period.

B. Chapter 2 appendice

B.1. SVAR alternative model IRFs and FEVD results

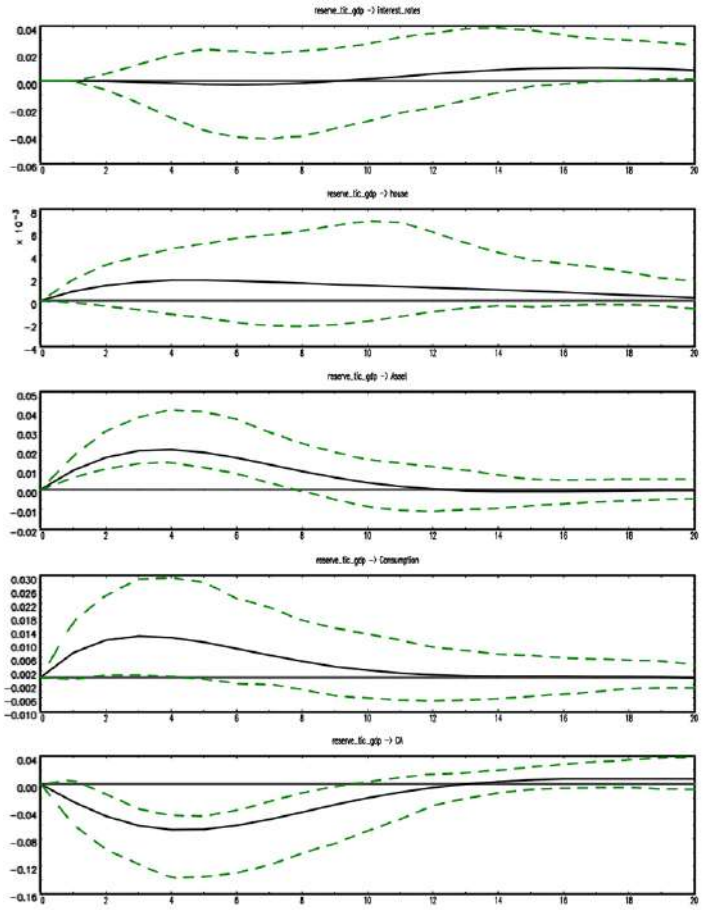

Figure 2.8: Responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a transitory shock of international reserve with studentized hall percentile 95% bootstrap confidence intervals based on 1000 bootstrap replications

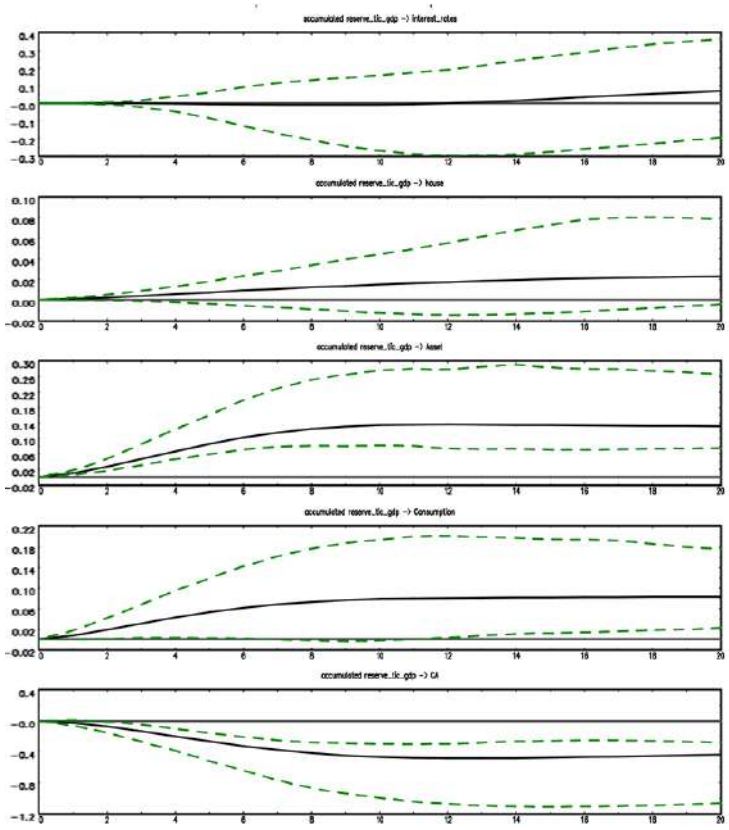

Figure 2.9: Accumulated responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a permanent shock of alternative reserve variable with studentized hall percentile 95% bootstrap confidence intervals based on 1000 bootstrap replications

	1 quarter	5 quarter	10 quarter	15 quarter	20 quarter
Interest rates	0	0	0	0	0
House prices	0	2	2	2	2
Asset prices	0	19	13	11	11
Consumption	0	2	2	2	2
Current account	0	8	14	14	13

Table 2.3: percent of FEVD explained by the alternative shock's structural innovations

B.2. SVAR China model IRFs and FEVD

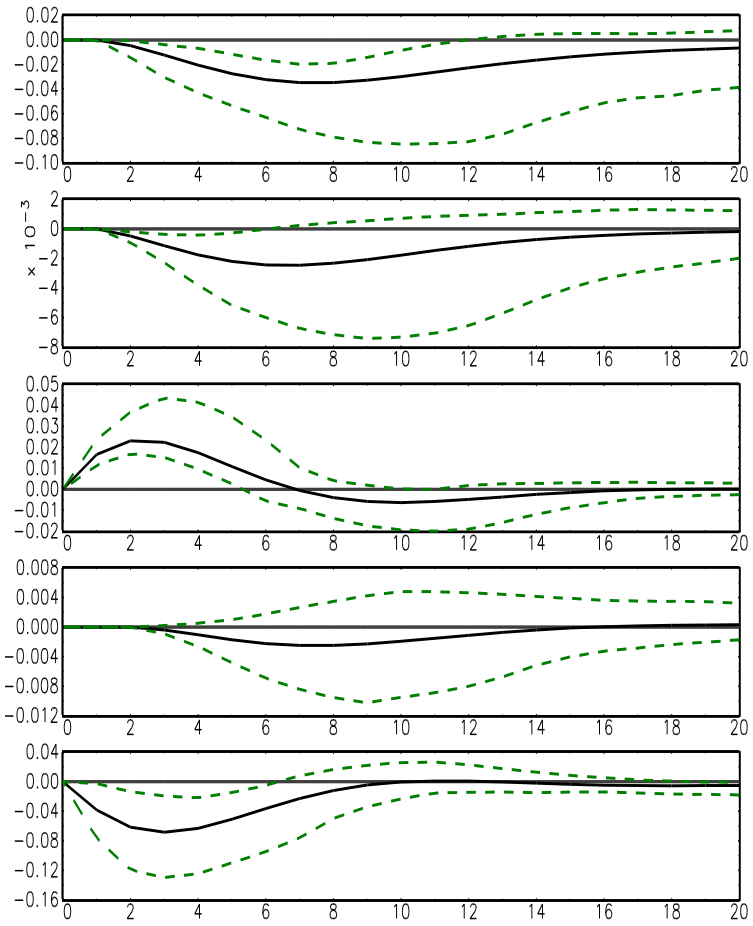

Figure 2.10: Responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a transitory shock of international reserve with studentized hall percentile 95% bootstrap confidence intervals based on 1000 bootstrap replications

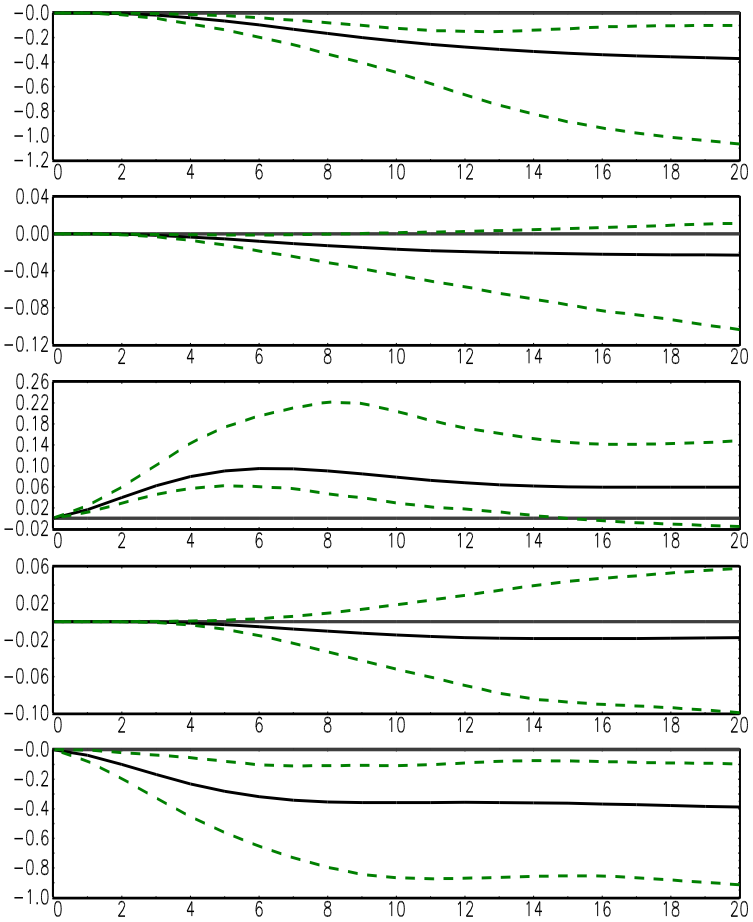

Figure 2.11: Accumulated responses of interest rates, house prices, asset prices, US consumption and US current account (top to bottom) to a permanent shock of alternative reserve variable with studentized hall percentile 95% bootstrap confidence intervals based on 1000 bootstrap replications

	1 quarter	5 quarter	10 quarter	15 quarter	20 quarter
Interest rates	0	1	4	5	5
House prices	0	1	4	4	4
Asset prices	0	18	14	14	14
Consumption	0	0	0	0	0
Current account	0	9	9	9	9

Table 2.4 : percent of FEVD explained by Chinese reserve shock's structural innovations

B.3. Preliminary Tests

Unit Root Tests

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reserve_t^1$	No intercept and trend	-3.92***	0.00	No intercept and trend	-2.60***	0.00
$reserve_t^2$	No intercept and trend	-2,48***	0.01	No intercept and trend	-2.17***	0.03
$reserve_t^{china}$	No intercept and trend	-4.67***	0.00	No intercept and trend	-3.71***	0.00
i_t^{lt}	No intercept and trend	-2.89***	0.00	No intercept and trend	-2.89***	0.00
$house_t$	No intercept and trend	-2.32***	0.02	No intercept and trend	-1.64*	0.09
$asset_t$	No intercept and trend	-3.71***	0.00	No intercept and trend	-2.69***	0.00
$consumption_t$	No intercept and trend	-3.88***	0.00	No intercept and trend	-3.93***	0.00
CA_t	No intercept and trend	-3.21***	0.00	No intercept and trend	-3.21***	0.00

Note: The signs ***, ** and * means respectively the rejection of null hypothesis at 1%, 5% and 10% significance level

Table 2.5: Unit root tests results

Bai-perron multiple breakpoints tests

Variables	Significant F-statistic largest Breaks	F-statistic For the largest break	Scaled F-statistic For the largest break	Weighted F-statistic For the largest break	Critical Value	Estimated Break dates
$consumption_t$	5	14.40*	14.40*	31.60*	3.91	2003Q2 2006Q2 2008Q3 2010Q4 2013Q1
$house_t$	5	72.08*	72.08*	158.1860*	3.91	2002Q2 2005Q1 2008Q2 2011Q1 2013Q2
$asset_t$	5	17.39*	17.39*	38.17*	3.91	2002Q2 2006Q1 2008Q1 2011Q1 2013Q2
i_t^{lt}	5	14.44*	14.44*	31.70*	3.91	2002Q3 2005Q4 2008Q1 2011Q1 2013Q2
CA_t	5	12.72*	12.37*	27.16*	3.91	2002Q2 2004Q3 2006Q4 2009Q1 2011Q2

Note: * means significant at 5% level

Table 2.6:Bai-Perron multiple breakpoints test results

The model

We consider a standard multiple linear regression model with T periods and m potential breaks, producing $m+1$ regimes. For the observations $T_j, T_{j+1}, \dots, T_{j+1}-1$ in regime j we have the following regression model:

$$y_t = X_t'\beta + Z_t'\hat{\delta}_j + \varepsilon_t$$

For the regimes $j = 0, \dots, m$. The regressors are divided into two groups, the X variables are the variables whose parameters do not vary across regimes, while$Z$ variables have coefficients that are regime specific.

Theoretical framework

The multiple breakpoint tests implemented in our study are based on the *Global L breaks VS None* hypothesis proposed by Bai and Perron (1998). This particular approach is a generalization of the Quandt-Andrews test (Andrews, 1993) in which we test the equality of δ_j accros multiple regimes. The procedure test the null hypothesis of no breaks against an alternative of l breaks. The test use an *F*-statistic to evaluate the null hypothesis that $\delta_0 = \delta_1 = \cdots = \delta_{l+1}$. The general form of the bai-perron statistic (bai-perron, 2003a) is:

$$F(\hat{\delta}) = \frac{1}{T}\left(\frac{T-(l+1)q-p}{kq}\right)\left(R\hat{\delta}\right)'\left(R\hat{V}\left(\hat{\delta}\right)R'\right)^{-1}R\hat{\delta}$$

Where $\hat{\delta}$ is the optimal l-break estimate ofδ, $\left(R\hat{\delta}\right)' = \left(\hat{\delta}_0' - \hat{\delta}_1', \dots, \hat{\delta}_l' - \hat{\delta}_{l+1}'\right)$, and $\hat{V}\left(\hat{\delta}\right)$ is the estimate of the variance covariance matrix of $\hat{\delta}$ which may be robust to serial correlation and heteroskedasticity. For further informations about the formulae and the large number of cases, see Bai-Perron (2003a)

This particular version of the Bai-perron procedure assumes that the maximum alternative number of breakpoints l is prespecified (we assume that $l=5$ according to our sample size). For simplicity, we choose to only focus on the *F*-statistics than using the alternative *UDmax*and*WDmax*test statistics, described by Bai and Perron (2003b).

C. Chapter 3 appendice

C.1. TVPVAR China: model 2 results

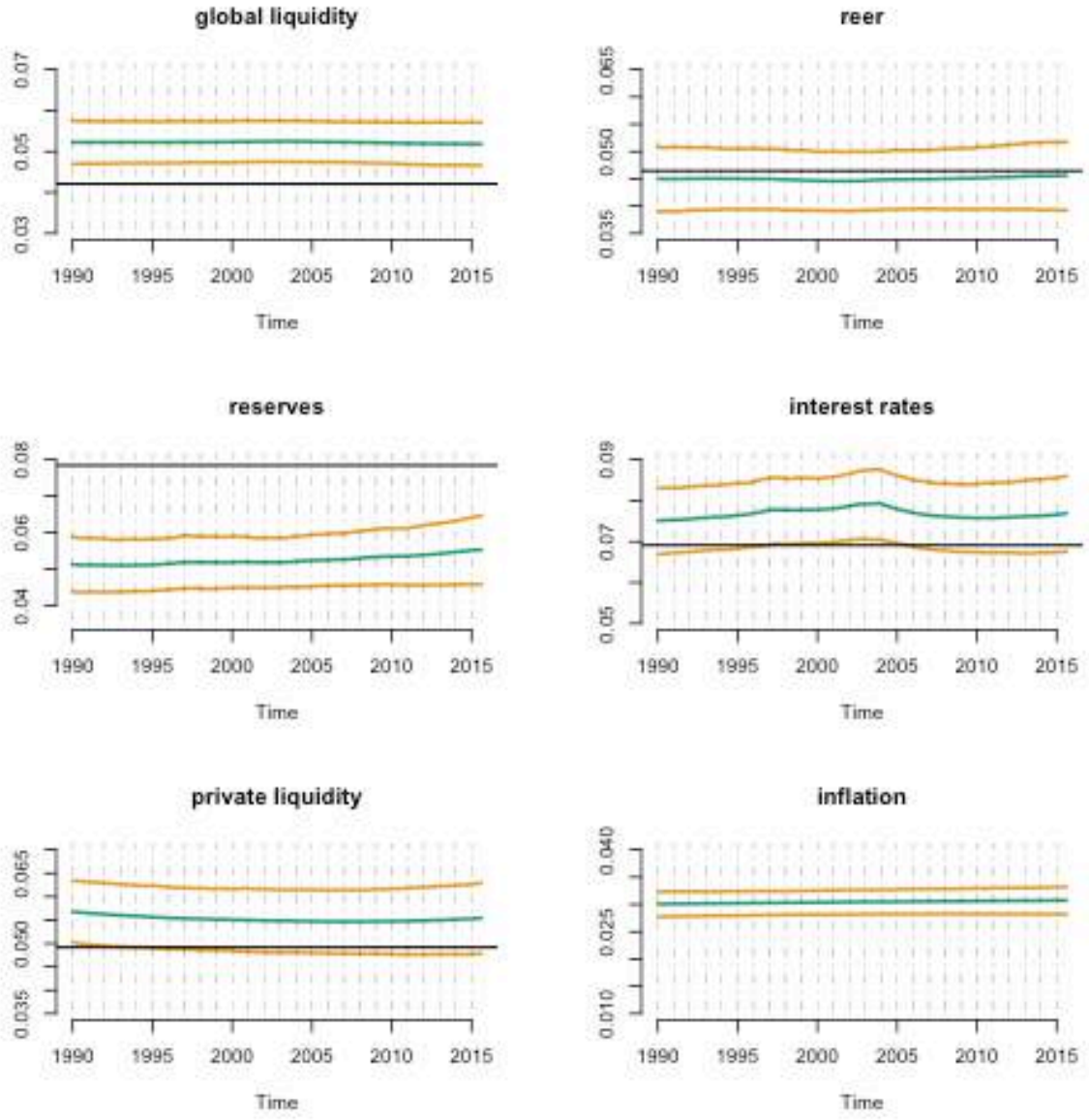

Figure 3.12 : Time-varying residuals standard deviations

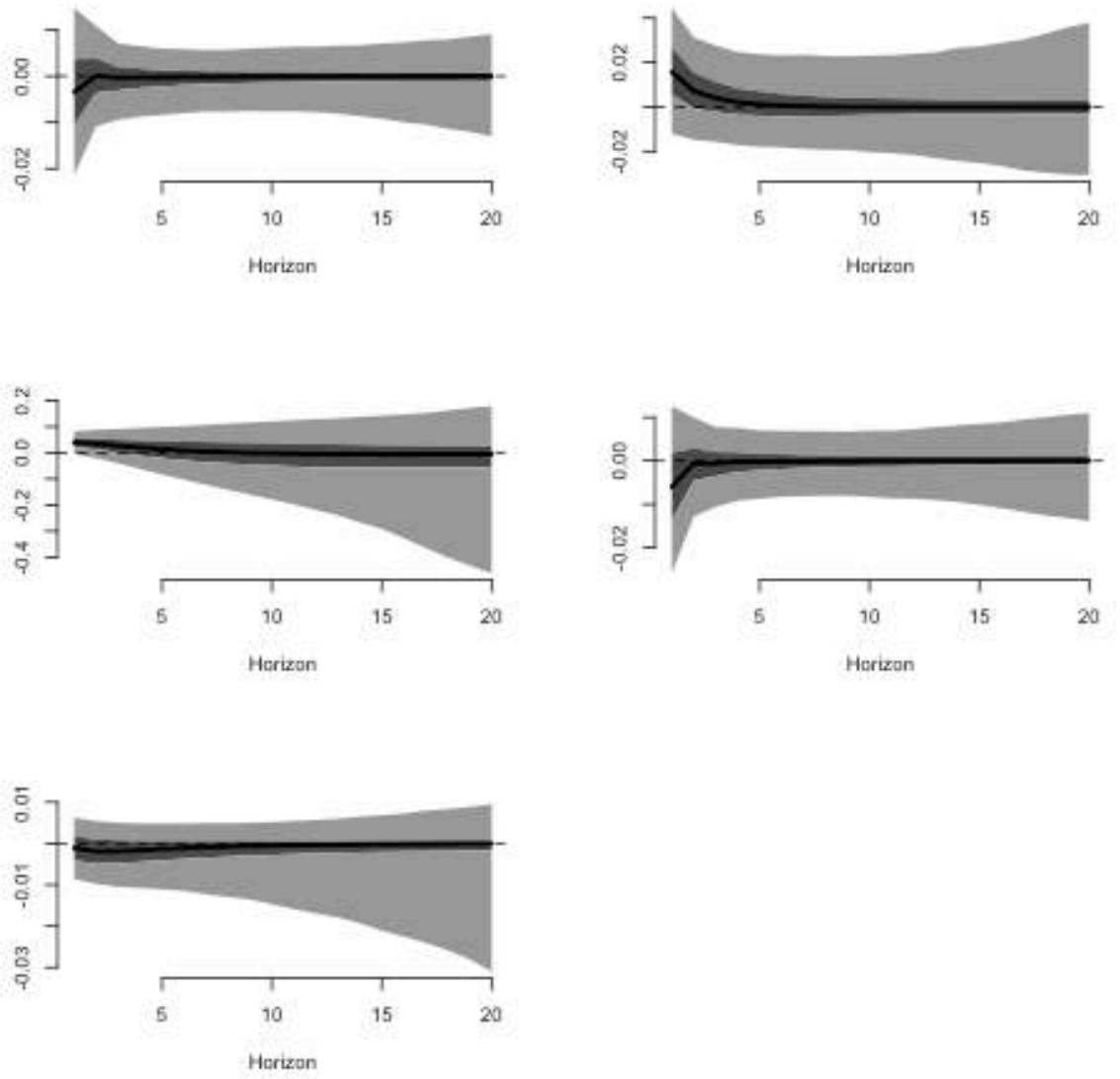

Figure 3.13 : Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

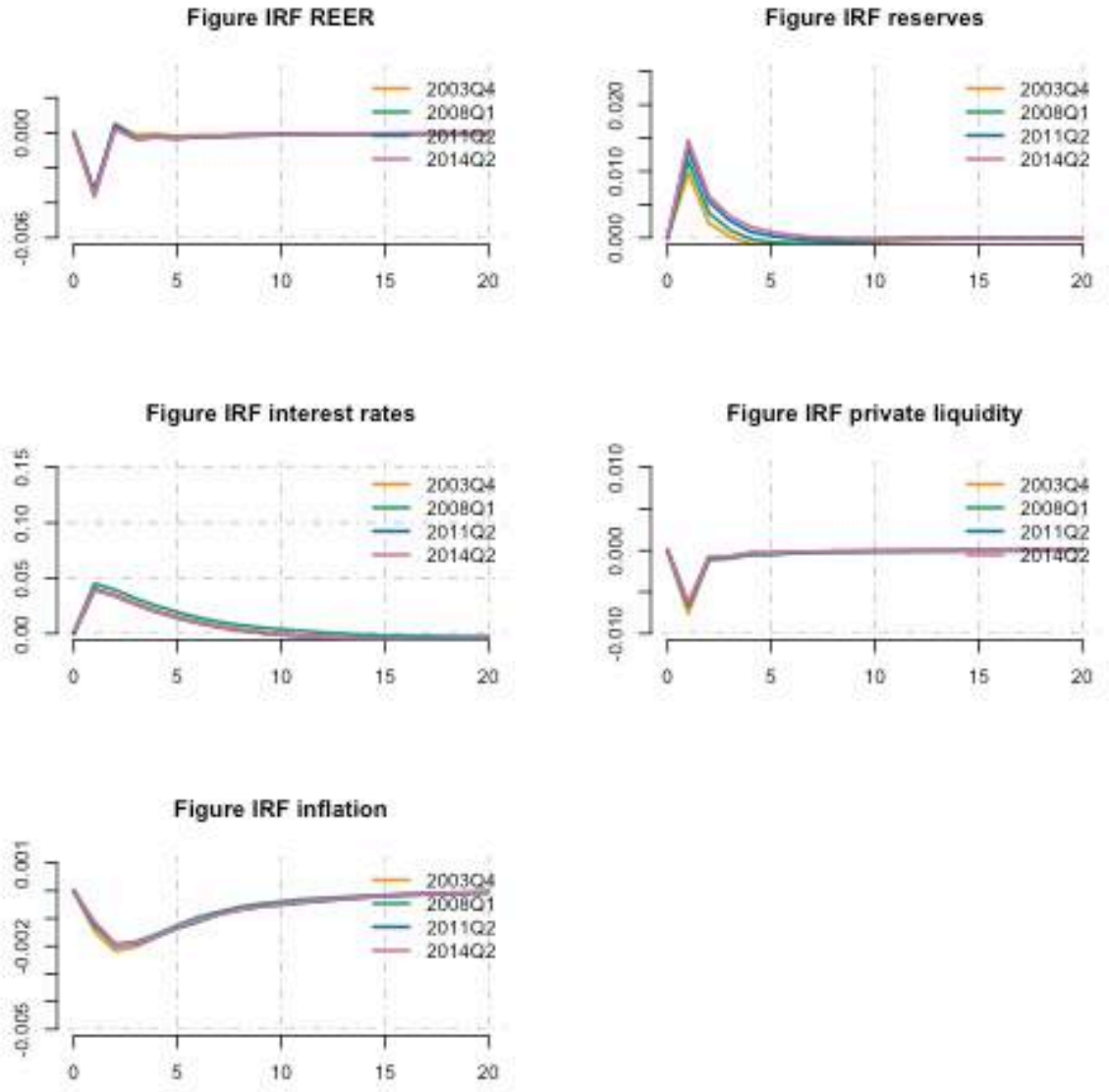

Figure 3.14: IRFs according to selected dates

C.2. TVPVAR Thailand models

Model 1

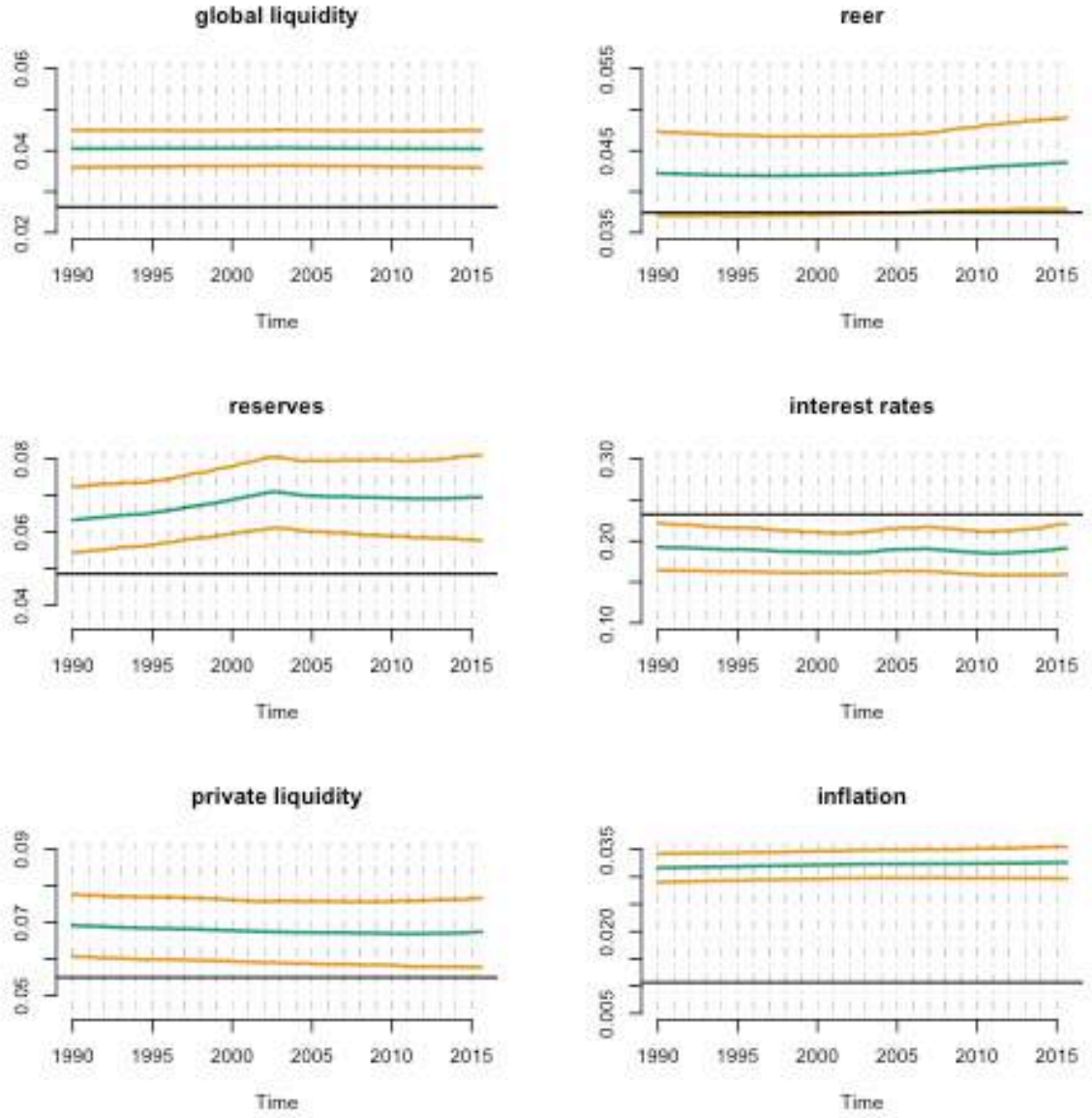

figure 3.15: Time-varying residuals standard deviations

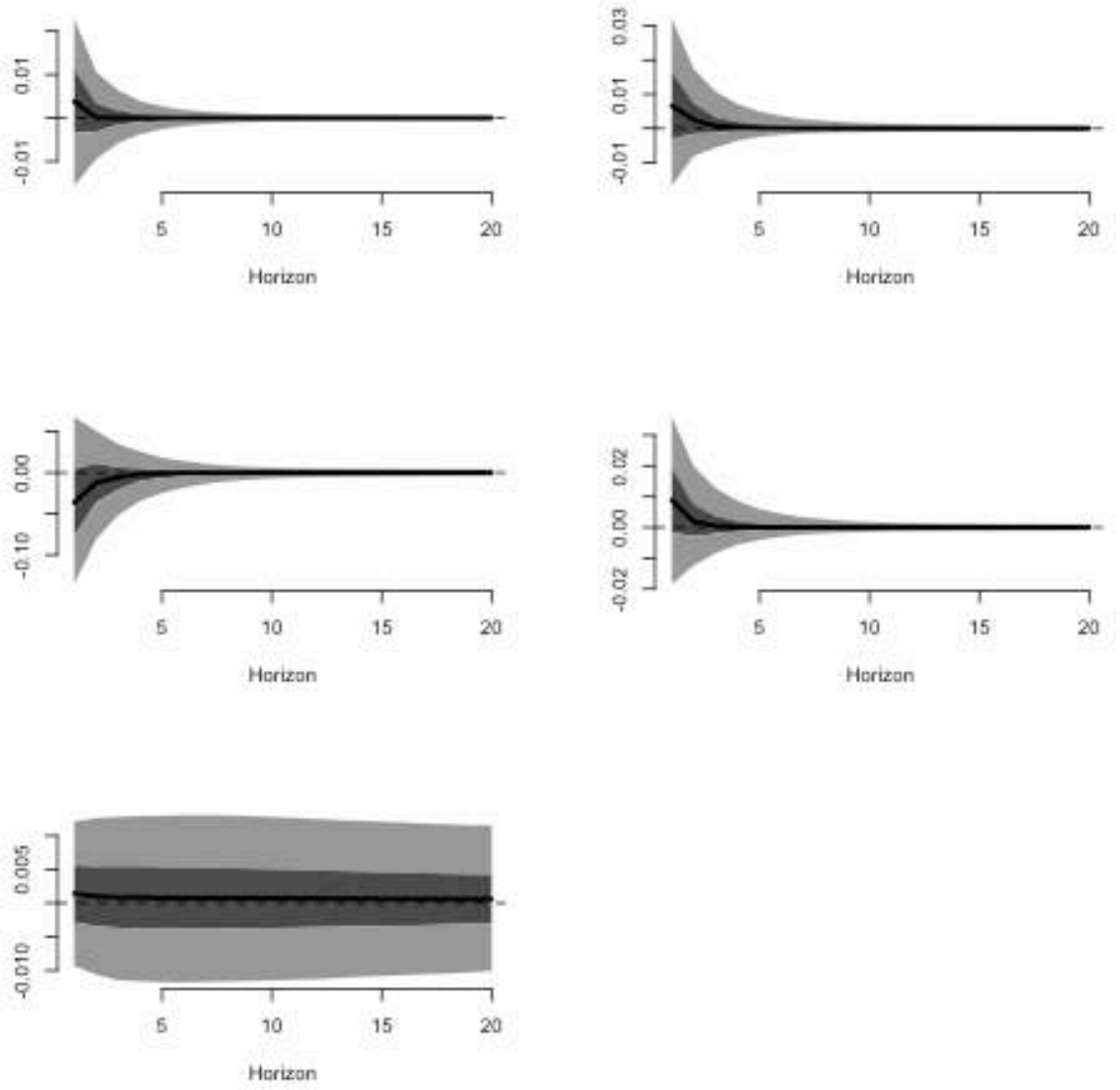

Figure 3.16: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

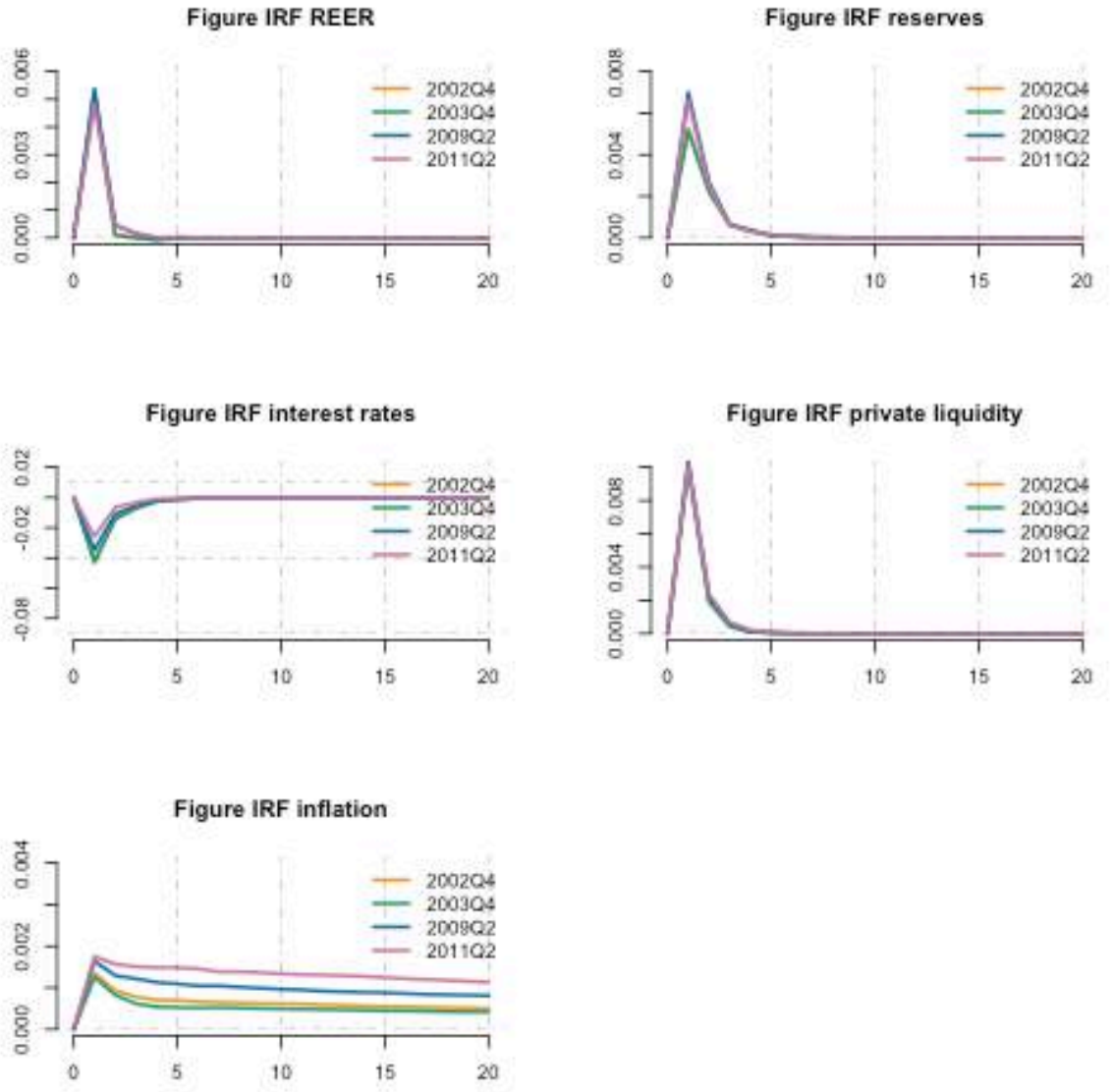

Figure 3.17: IRFs according to selected dates

Model 2

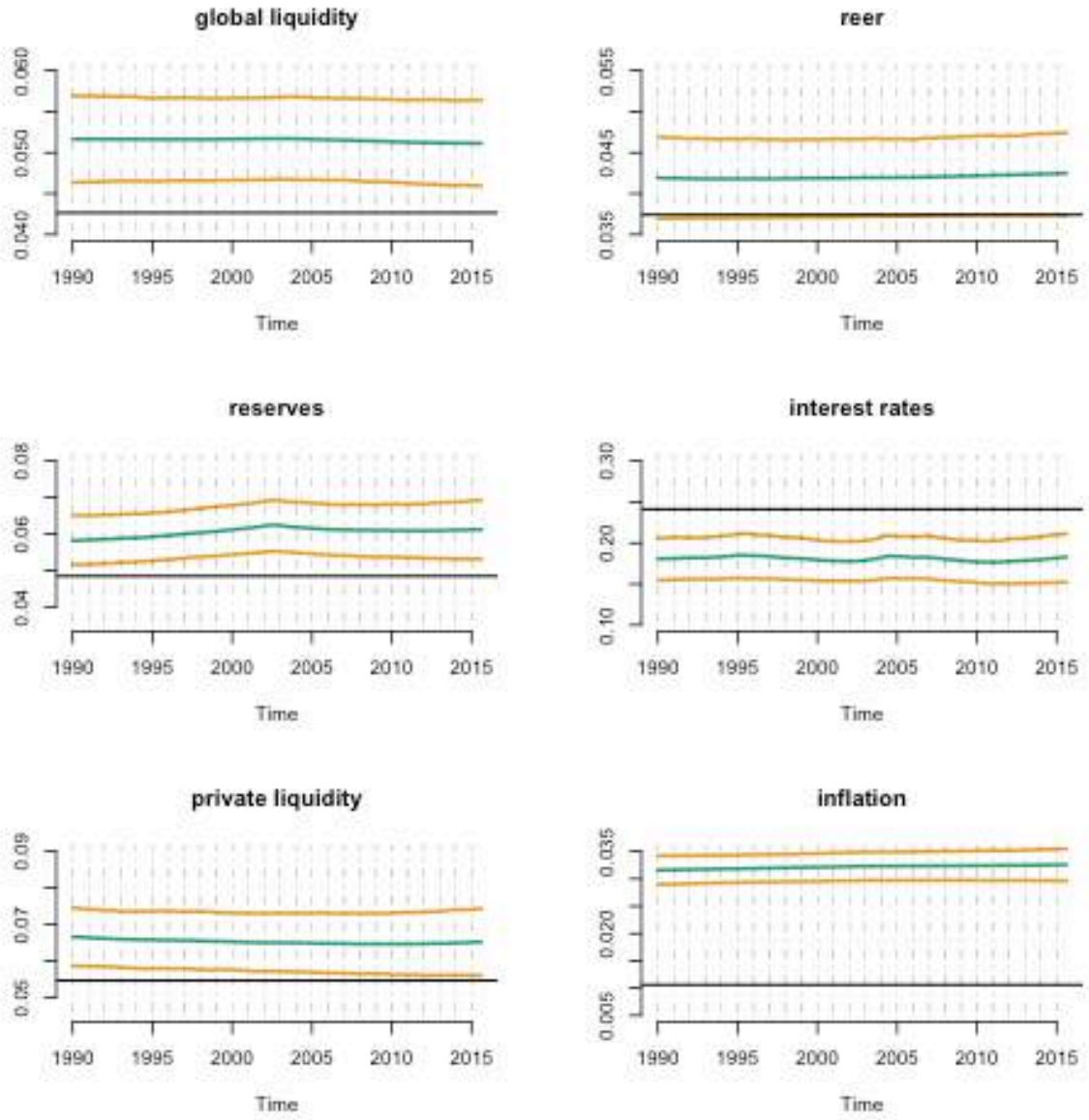

Figure 3.18: Time-varying residuals standard deviations

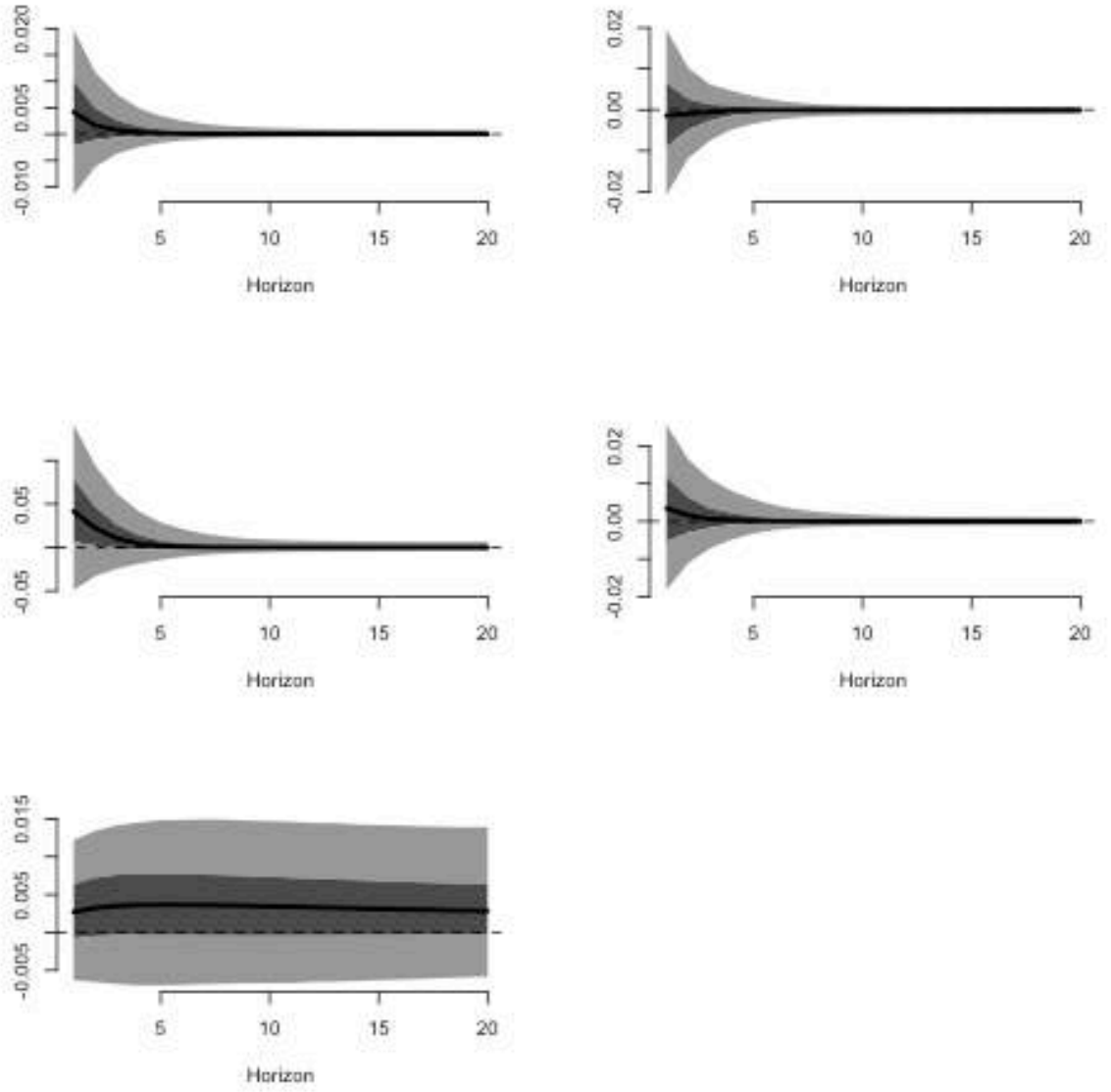

Figure 3.19: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

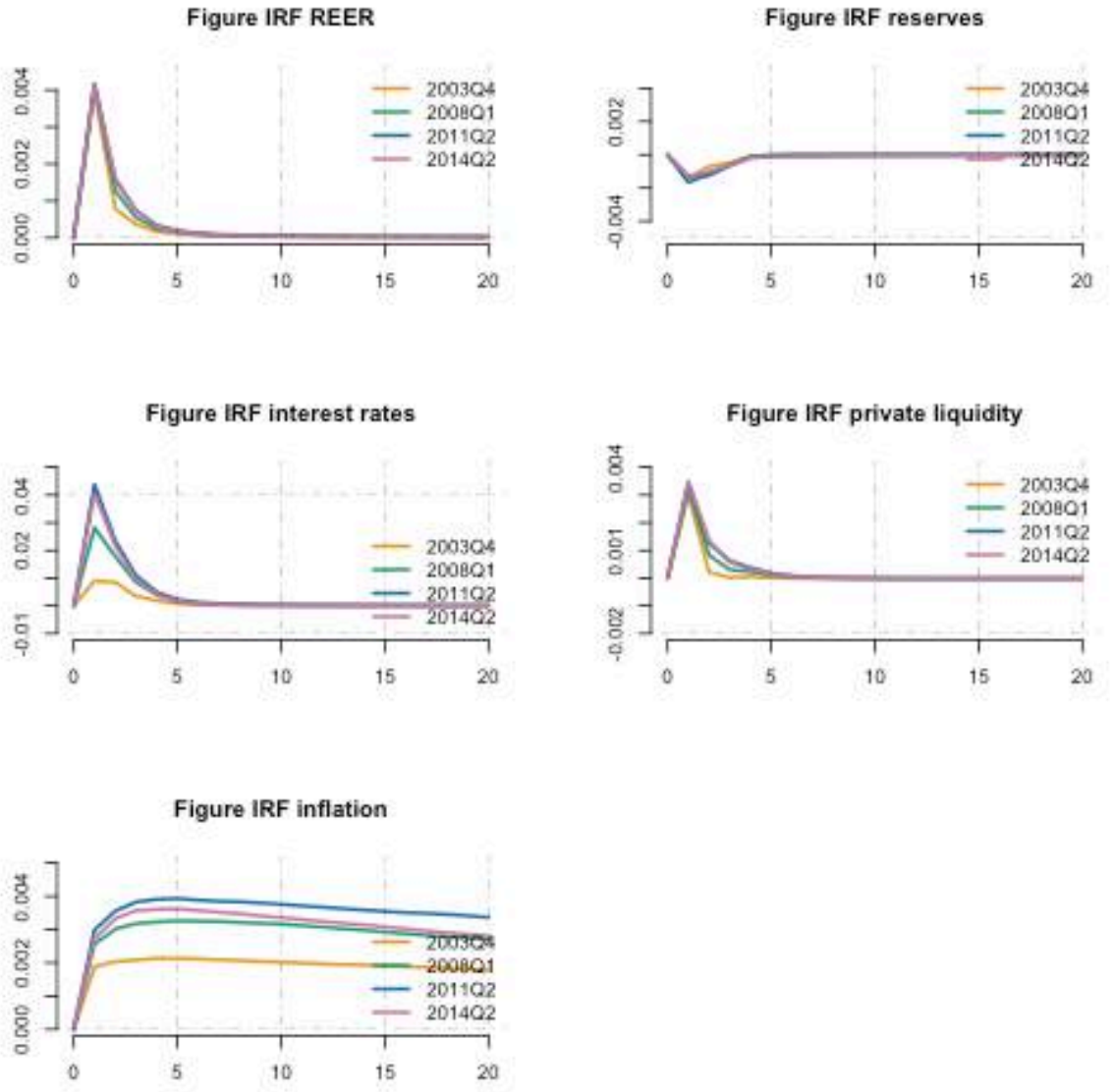

Figure 3.20: IRFs according to selected dates

C.3. TVPVAR Malaysia models

Model 1

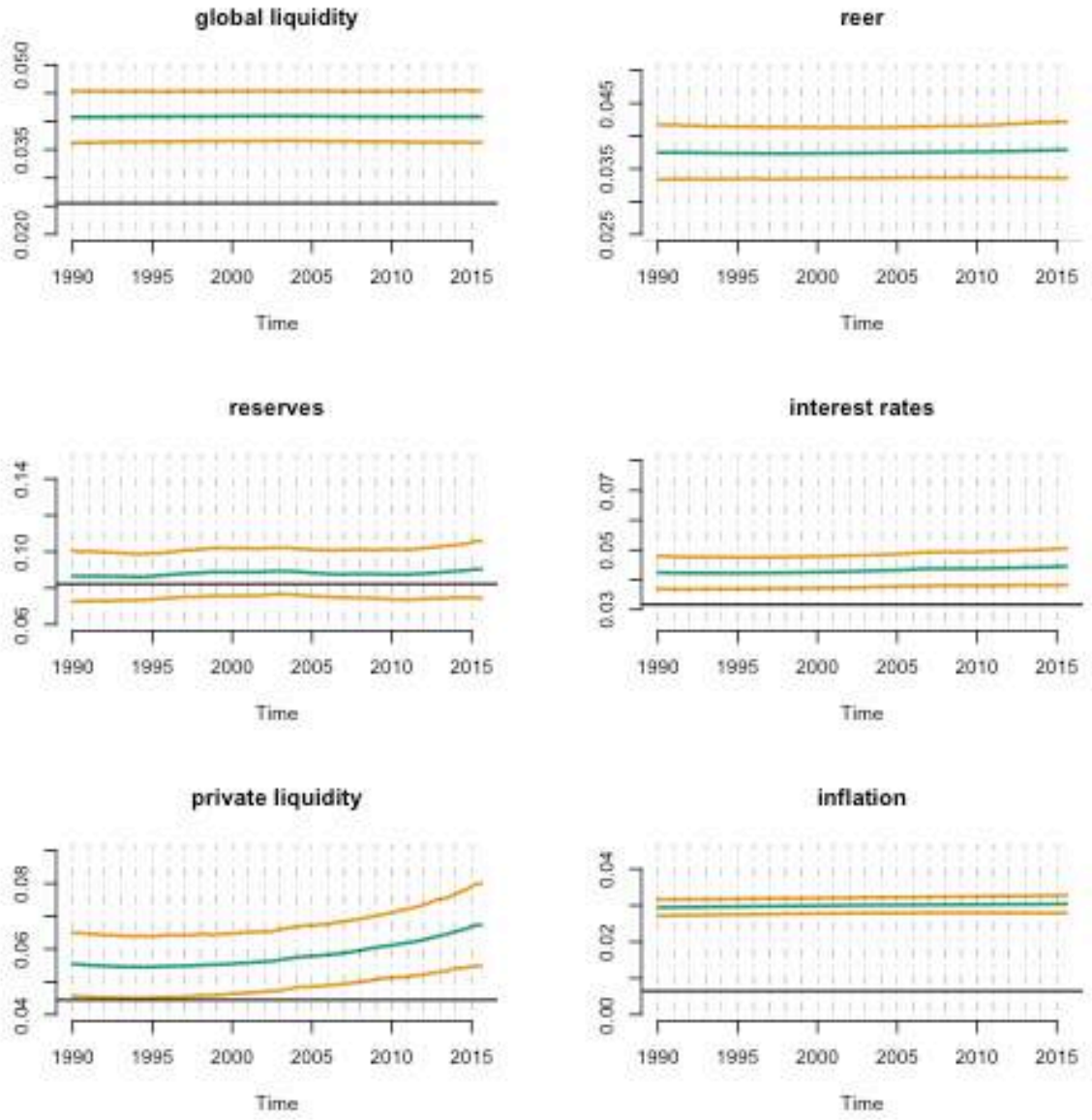

figure 3.21 : Time-varying residuals standard deviations

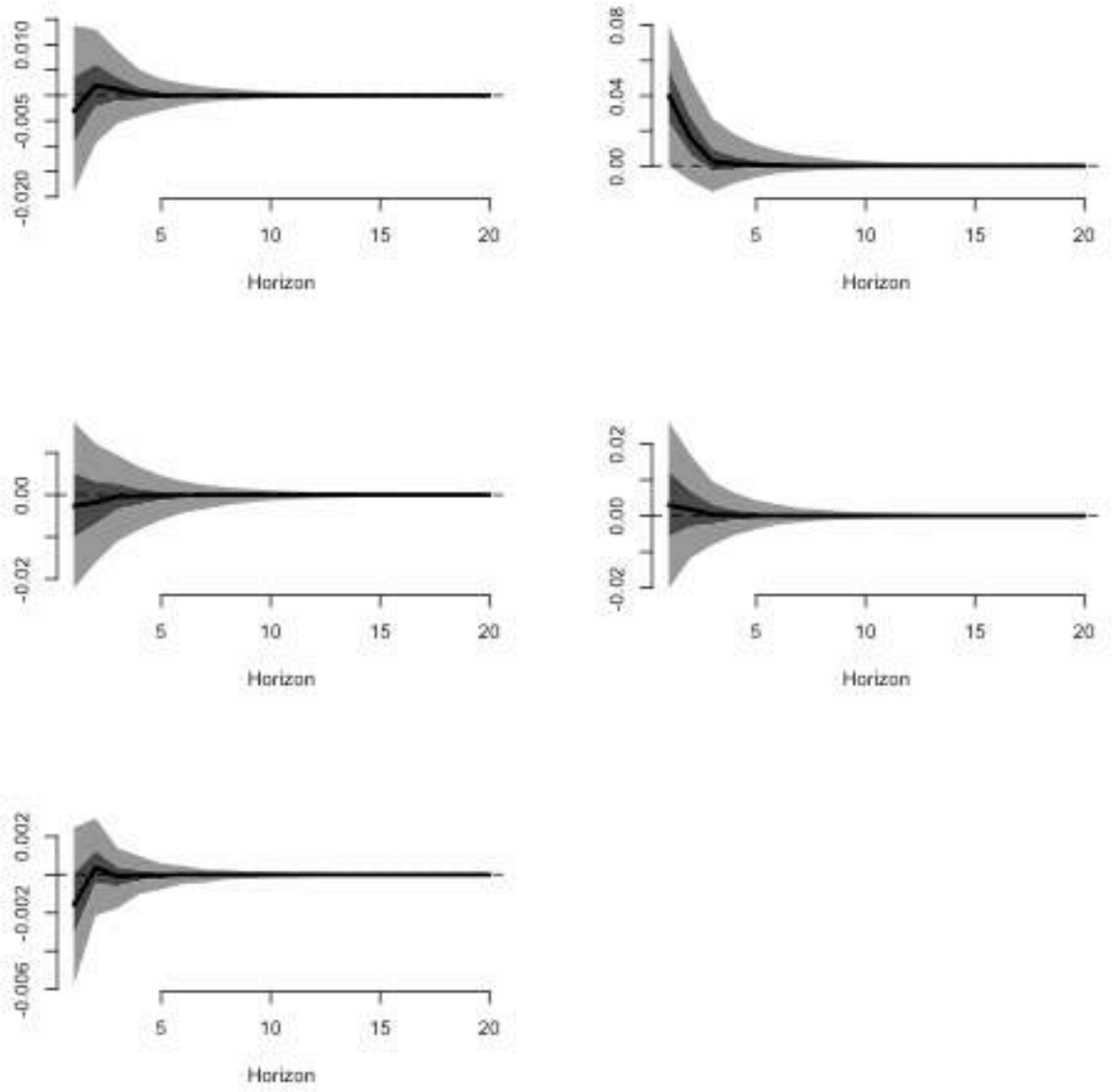

Figure 3.22: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

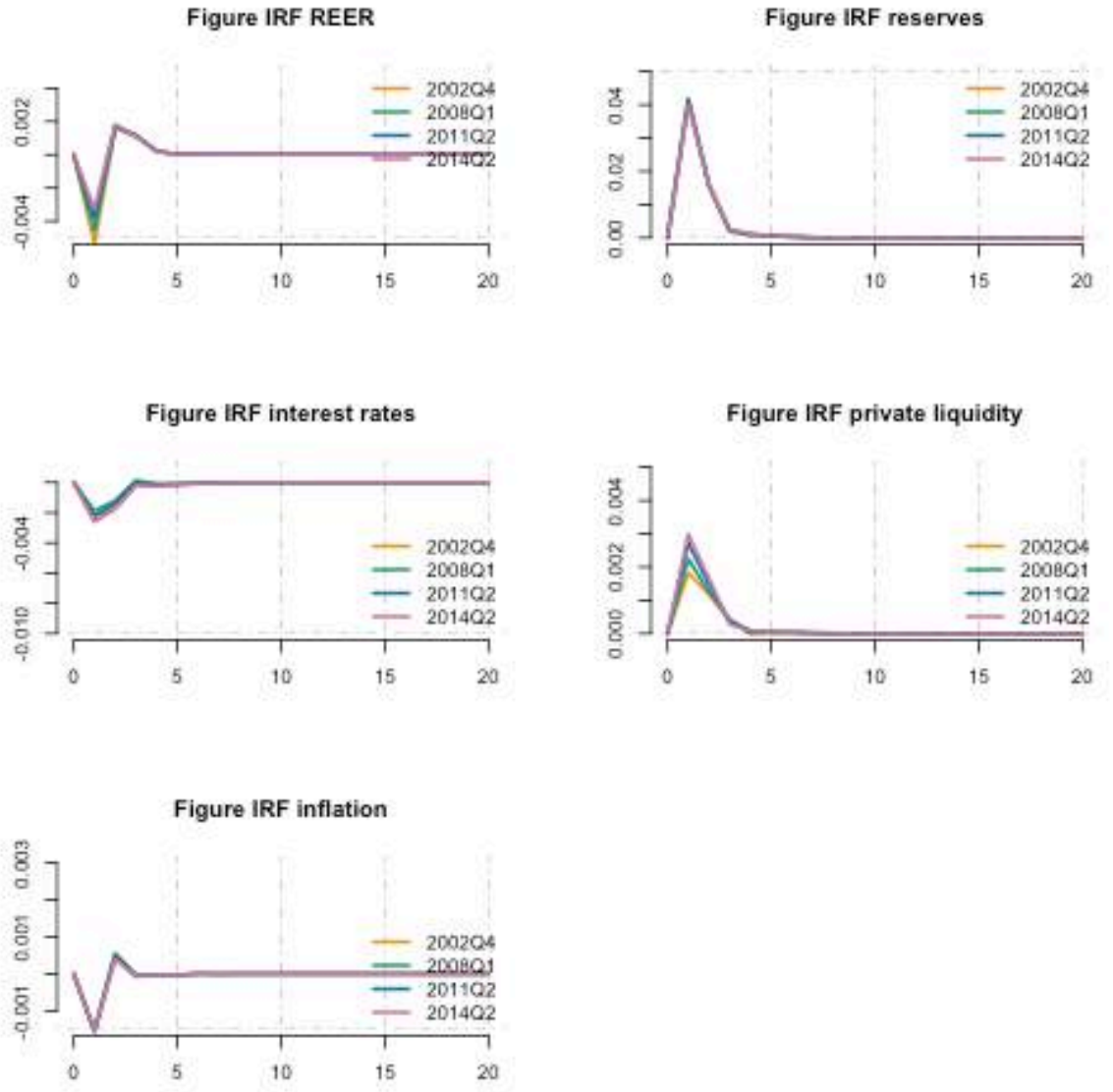

Figure 3.23: IRFs according to selected dates

Model 2

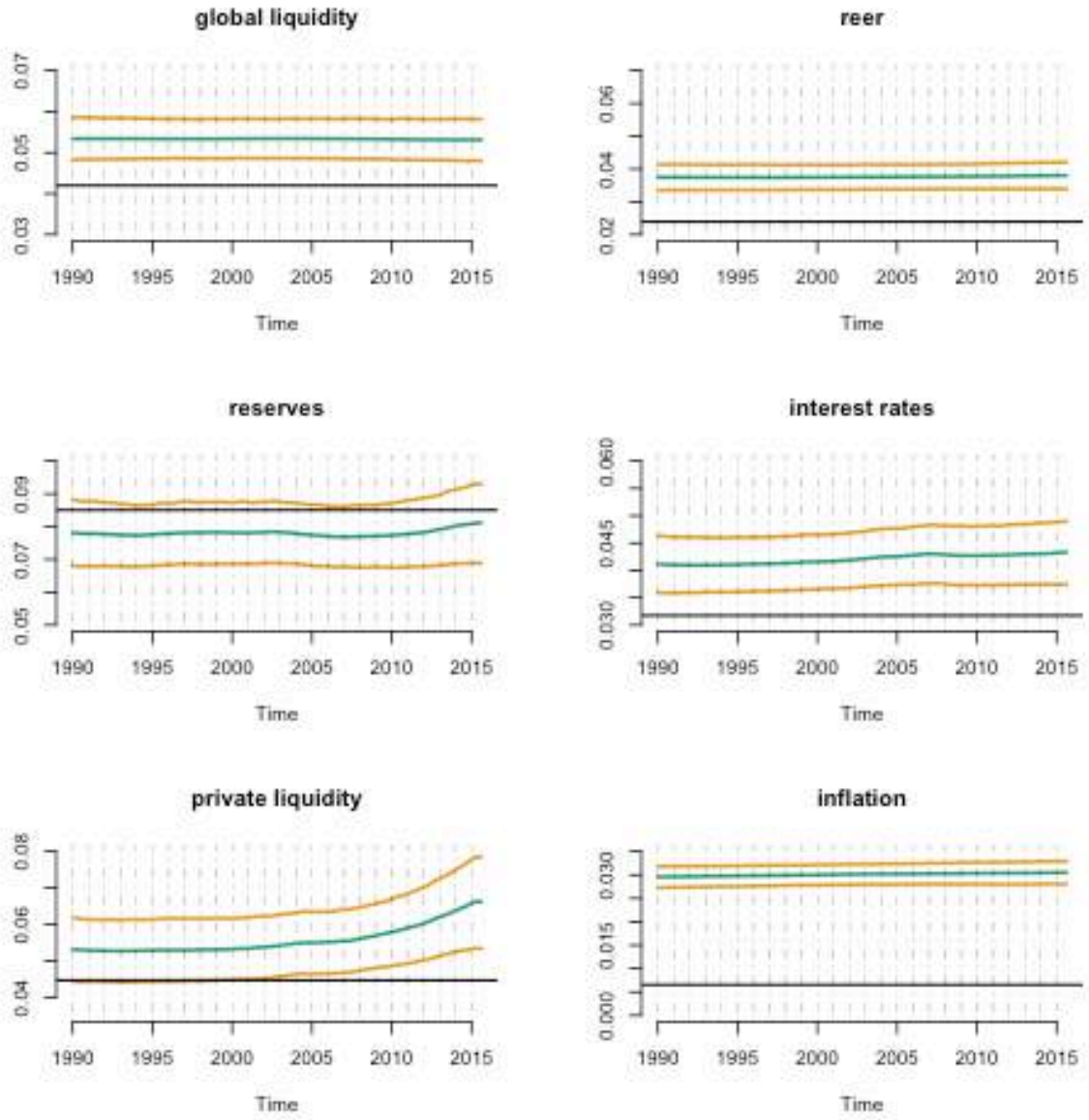

Figure 3.24: Time-varying residuals standard deviations

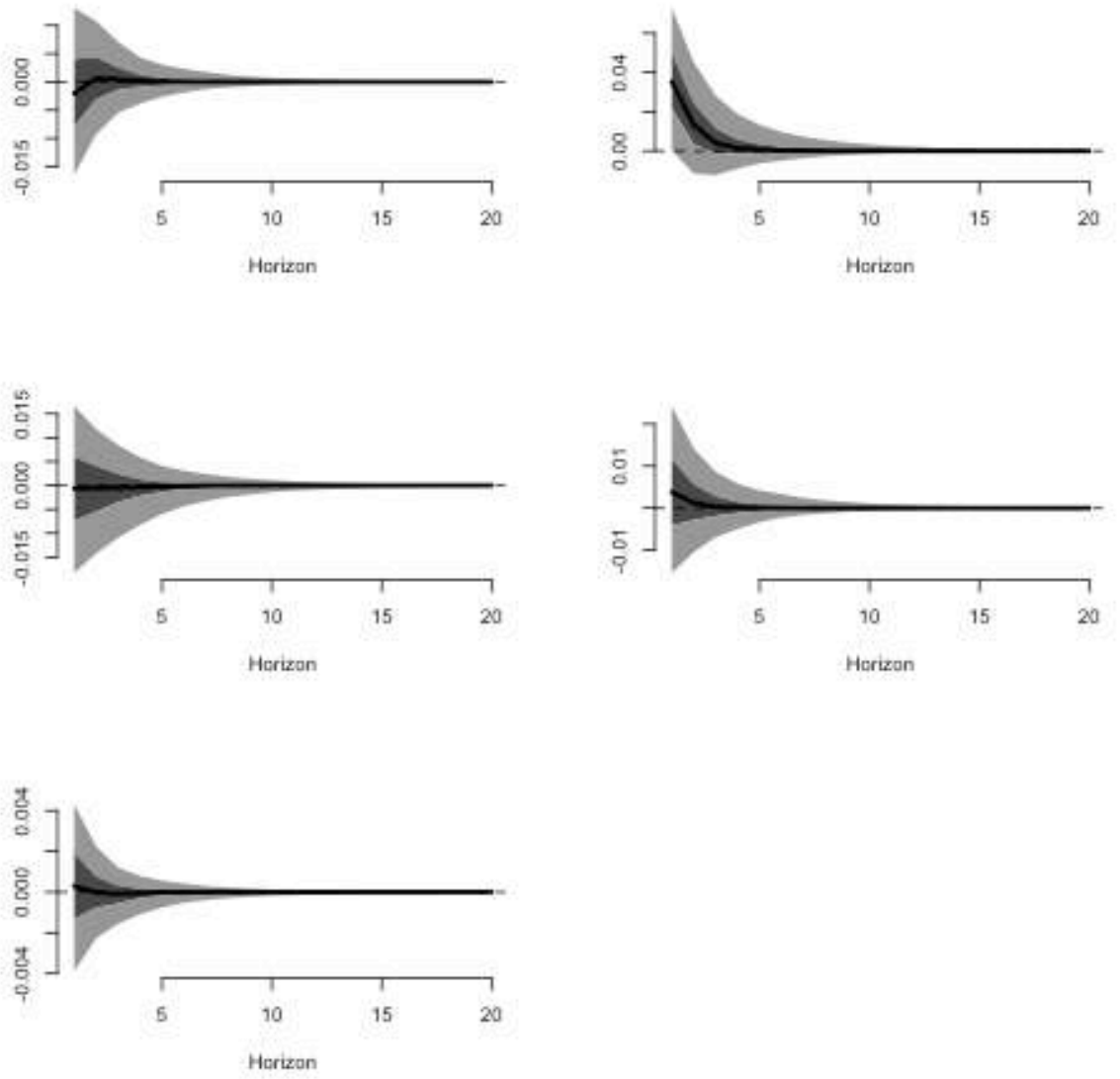

Figure 3.25: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

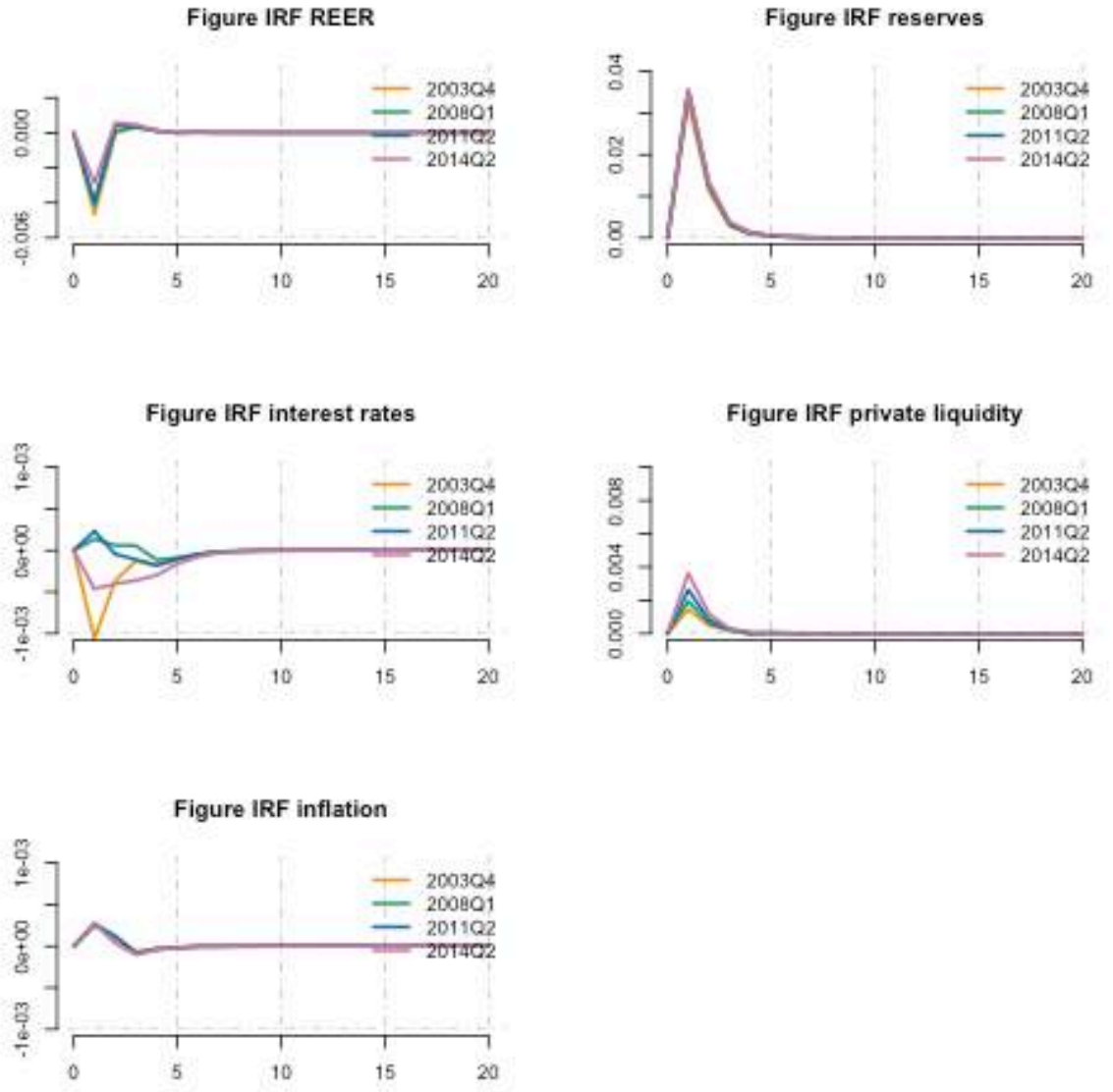

Figure 3.26: IRFs according to selected dates

C.4. TVPVAR India models

Model 1

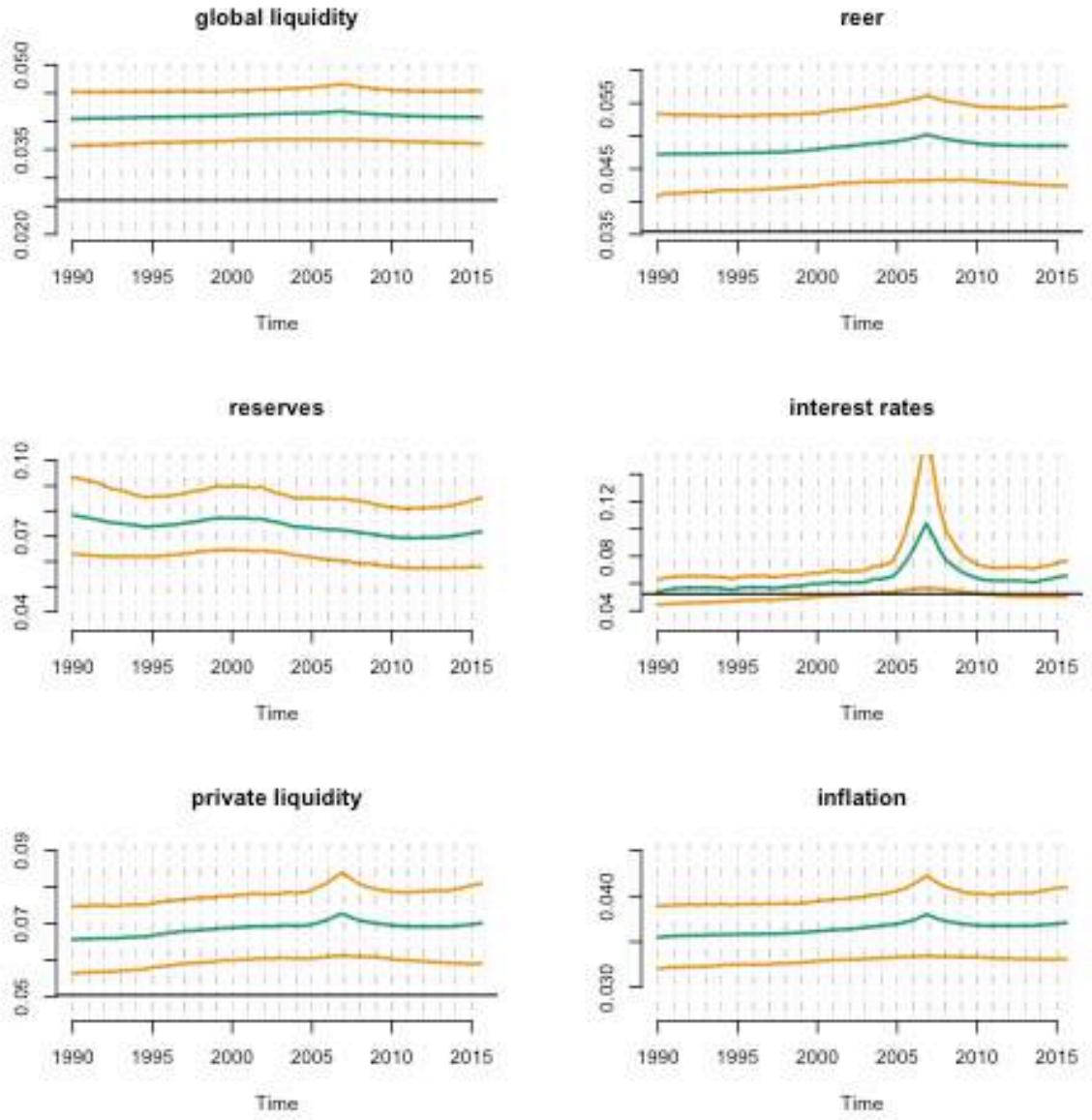

figure 3.27: Time-varying residuals standard deviations

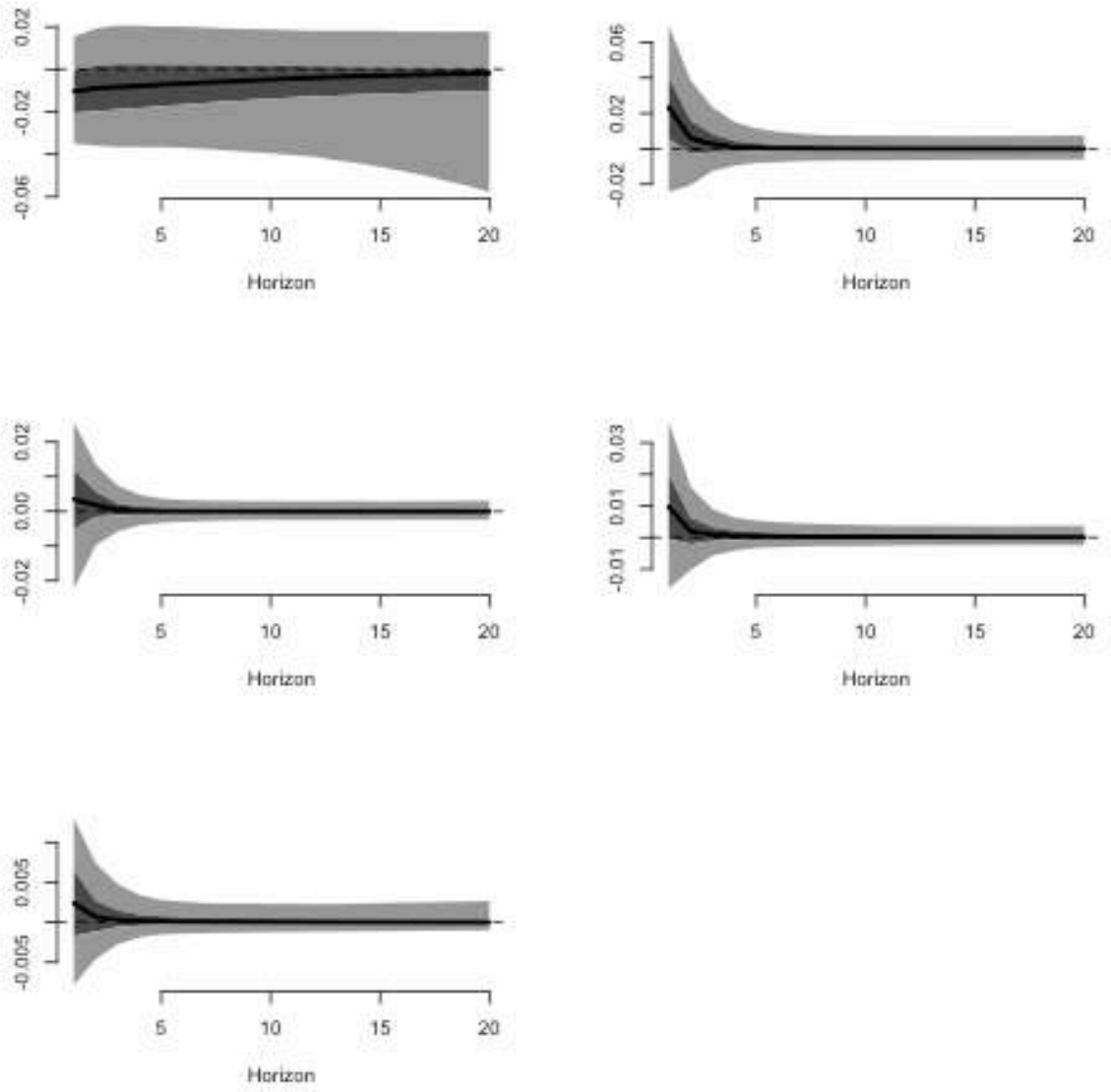

Figure 3.28: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

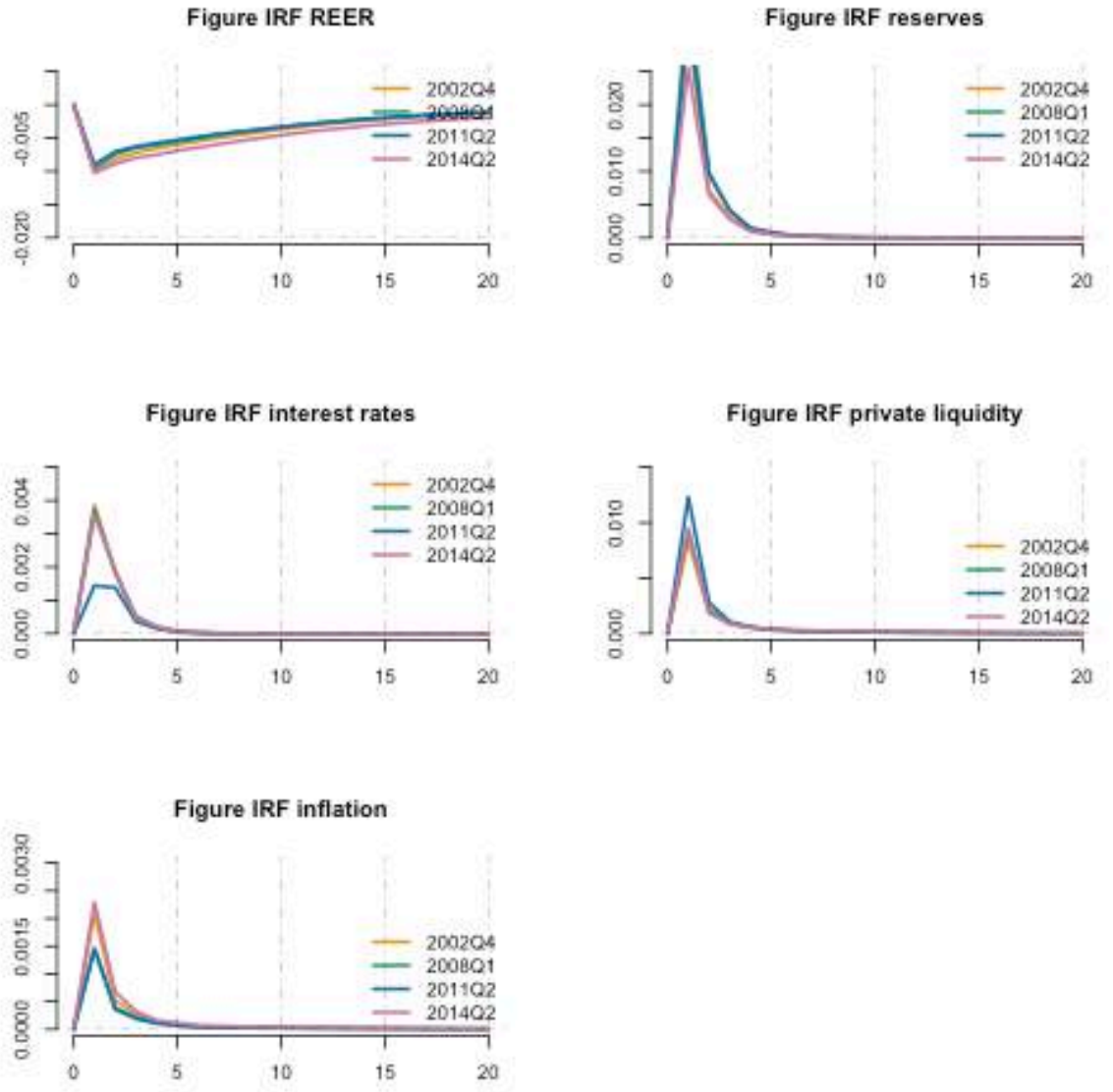

Figure 3.29: IRFs according to selected dates

Model 2

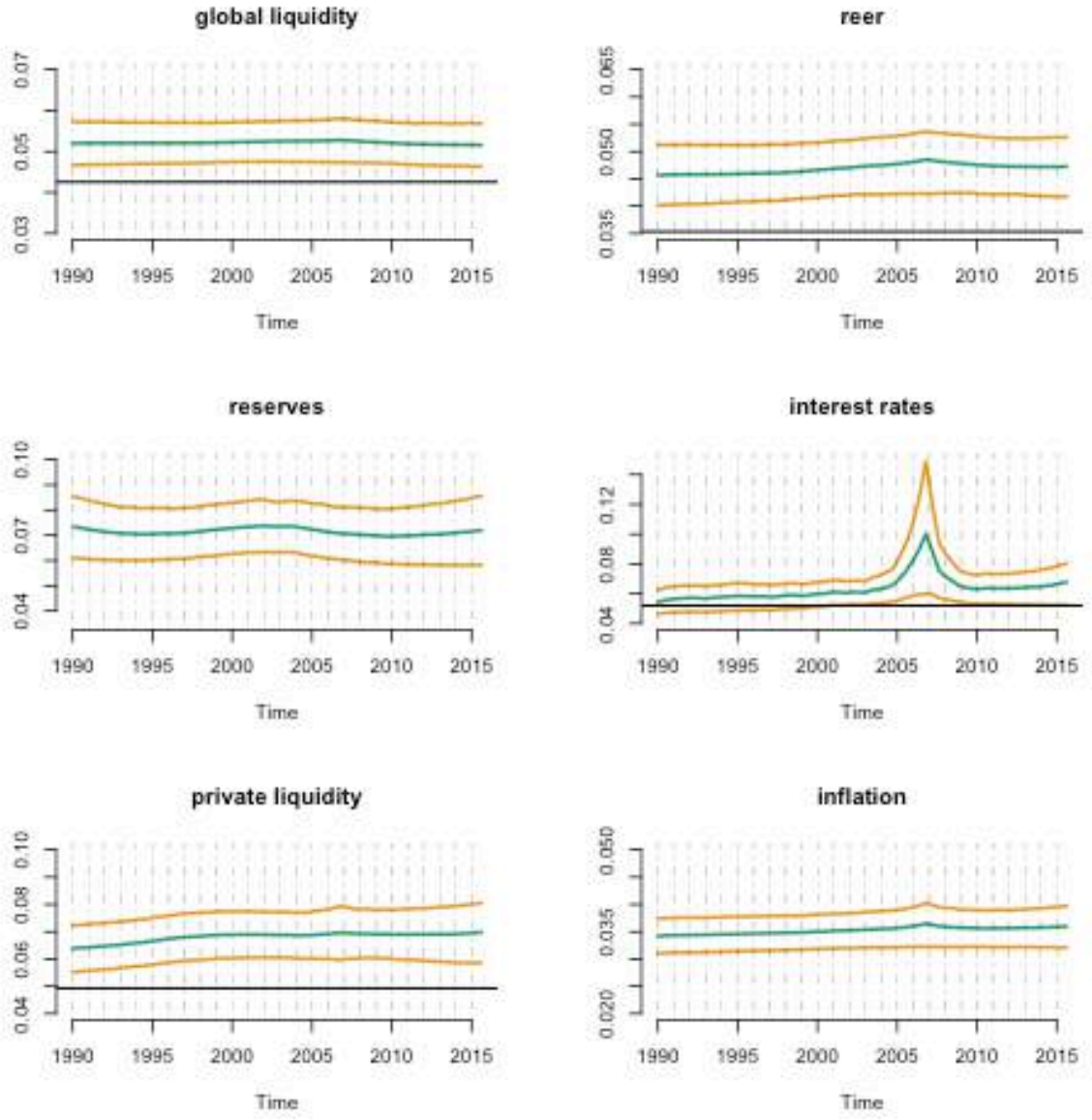

Figure 3.30: Time-varying residuals standard deviations

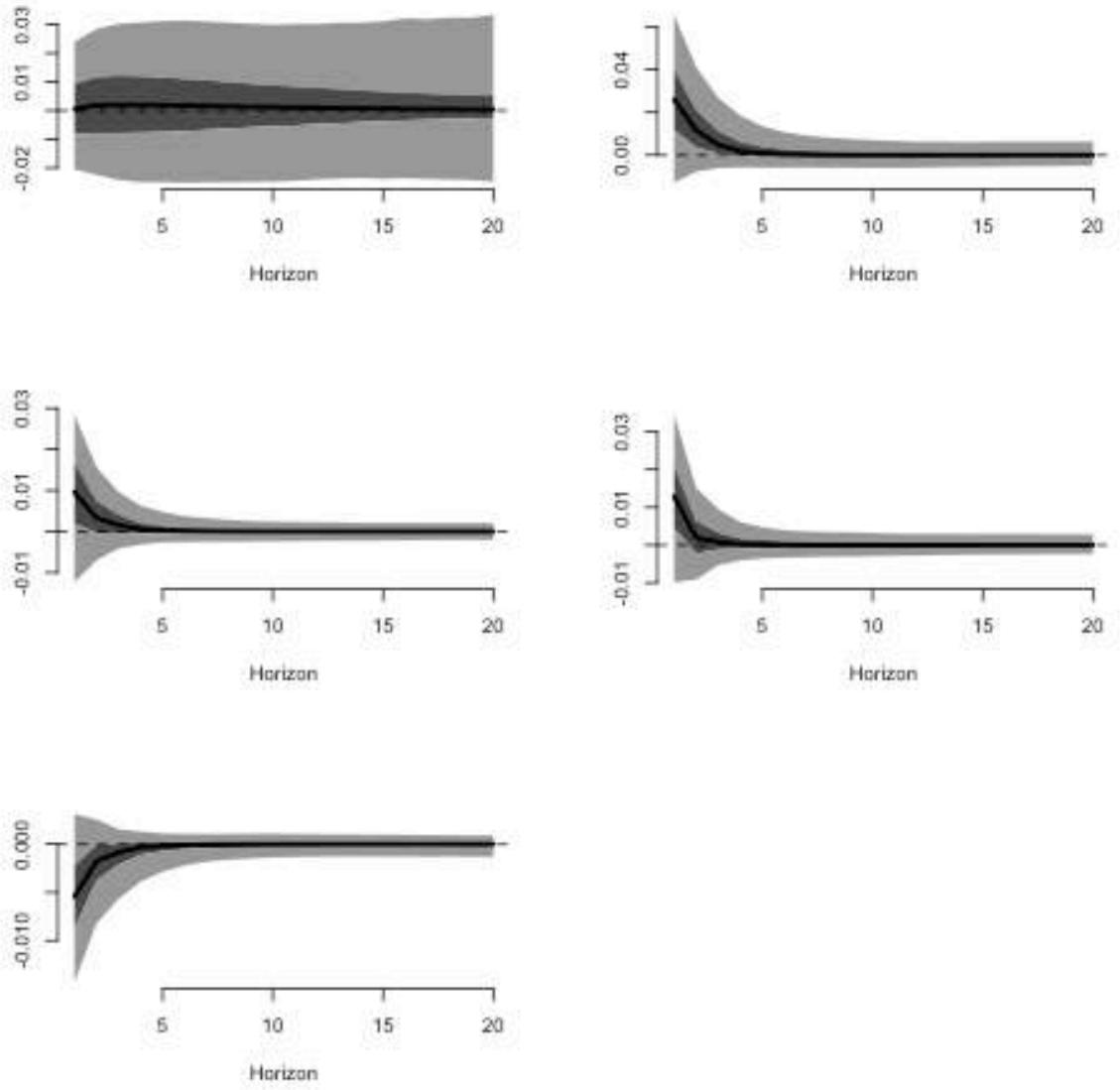

Figure 3.31: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

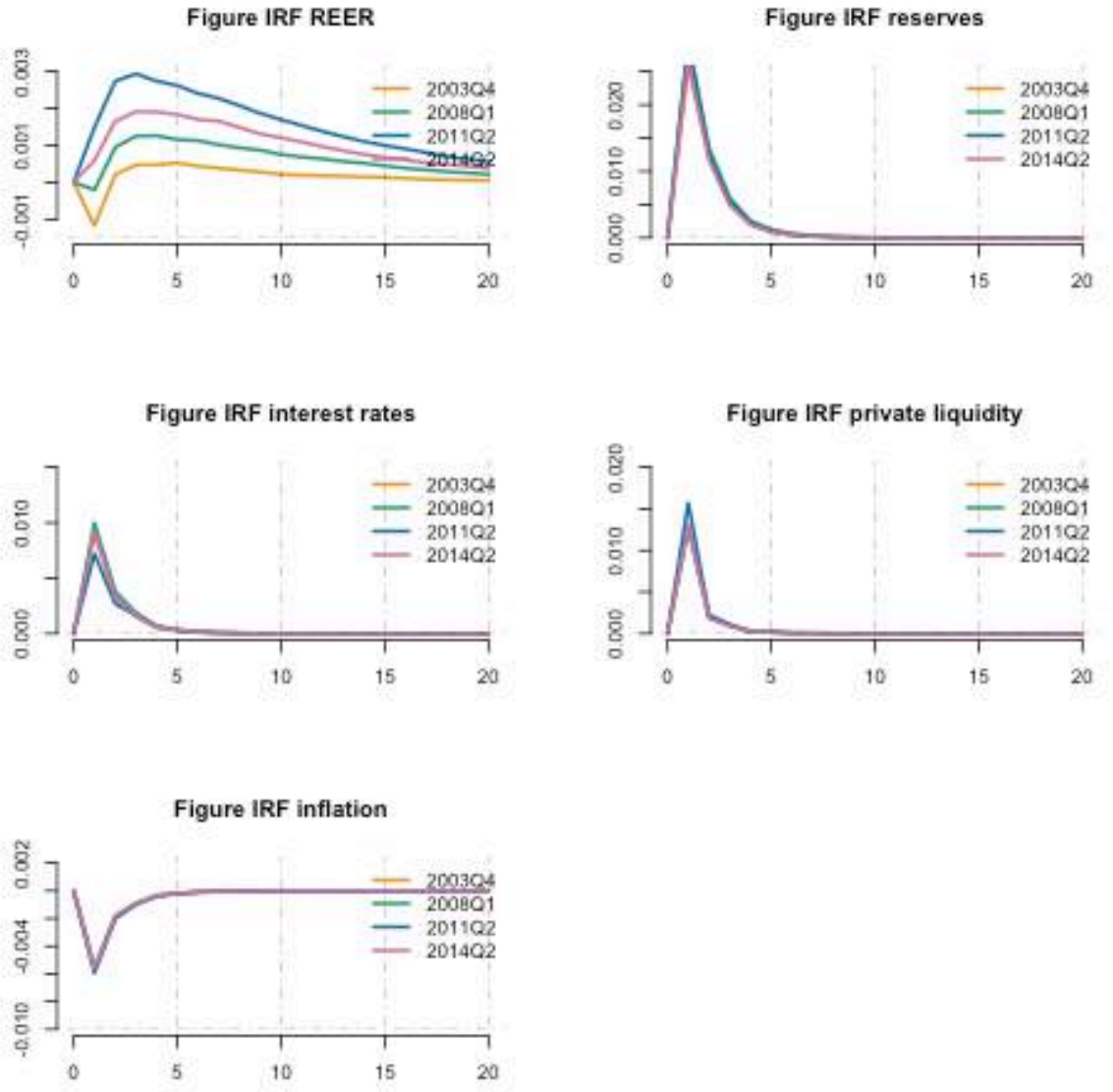

Figure 3.32: IRFs according to selected dates

C.5. TVPVAR Brazil models

Model 1

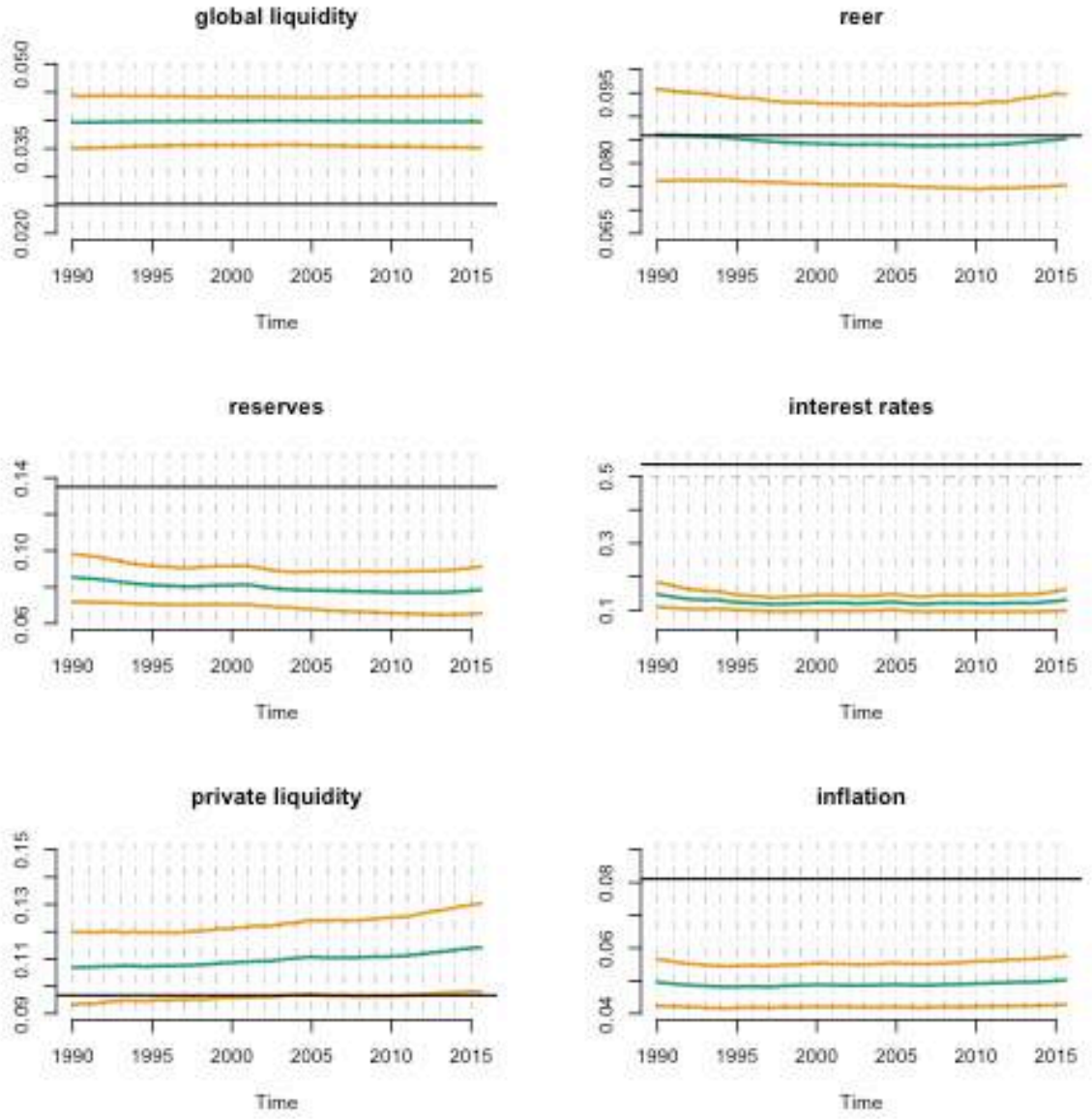

figure 3.34: Time-varying residuals standard deviations

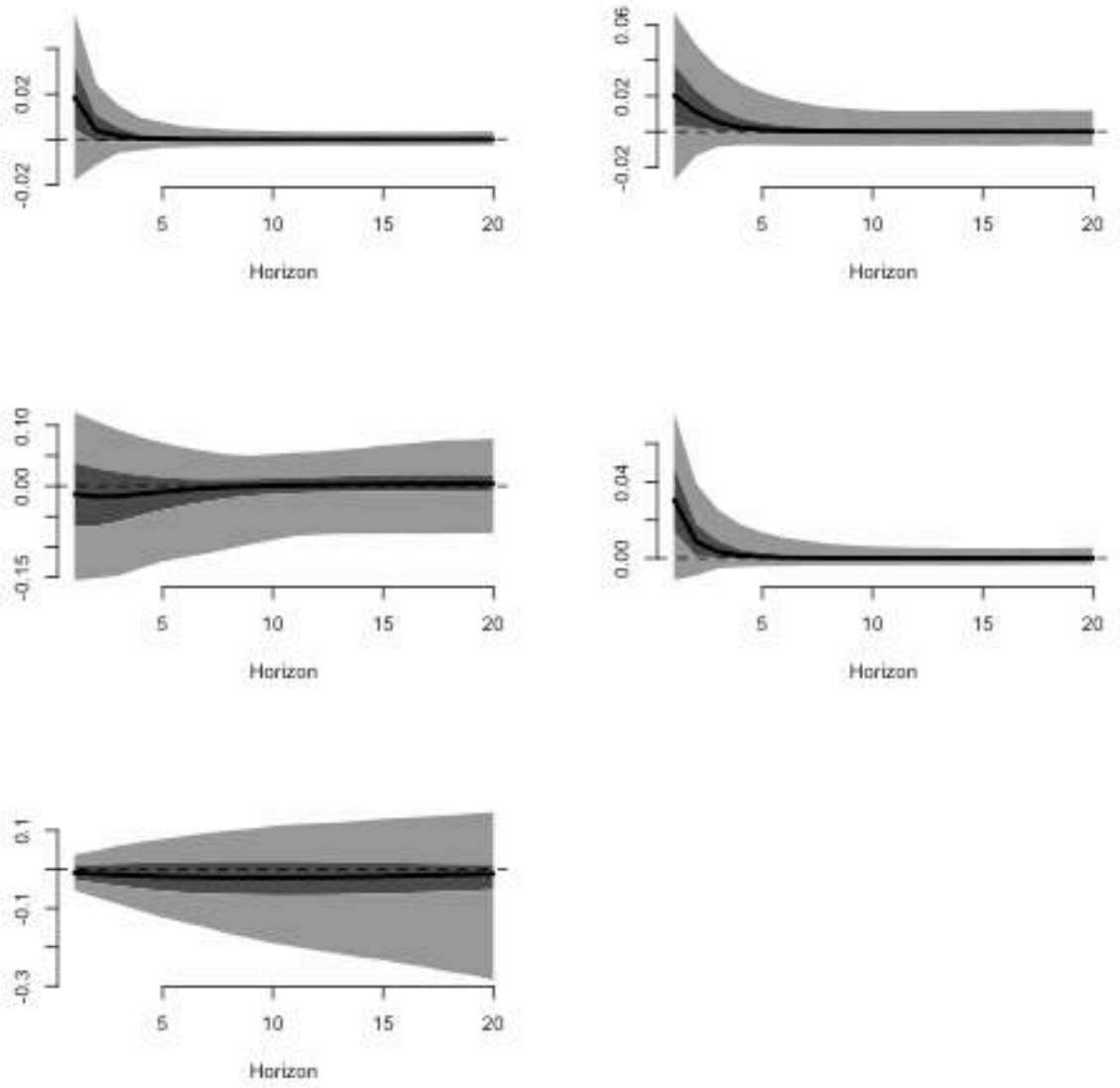

Figure 3.35: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

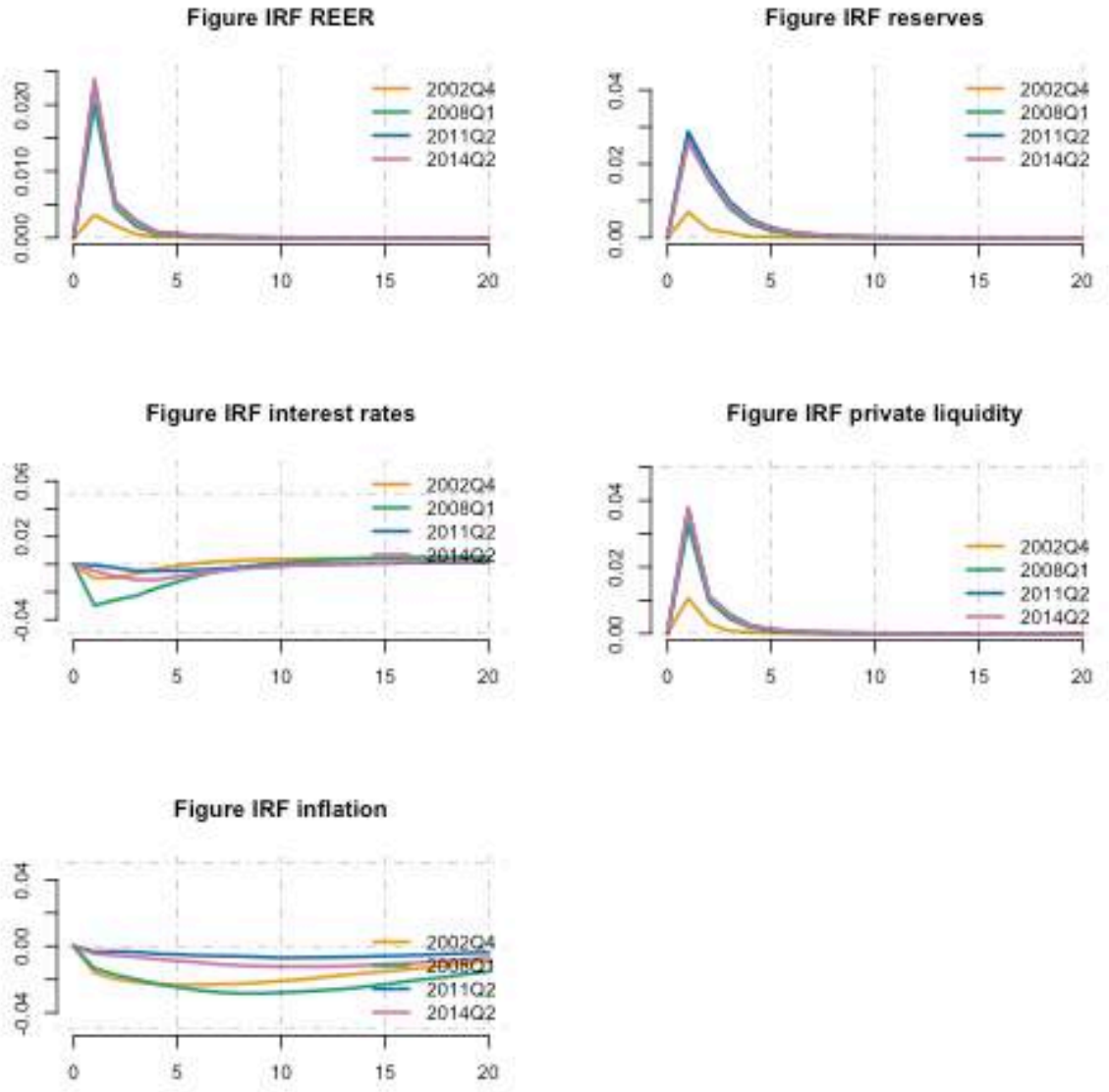

Figure 3.36: IRFs according to selected dates

Model 2

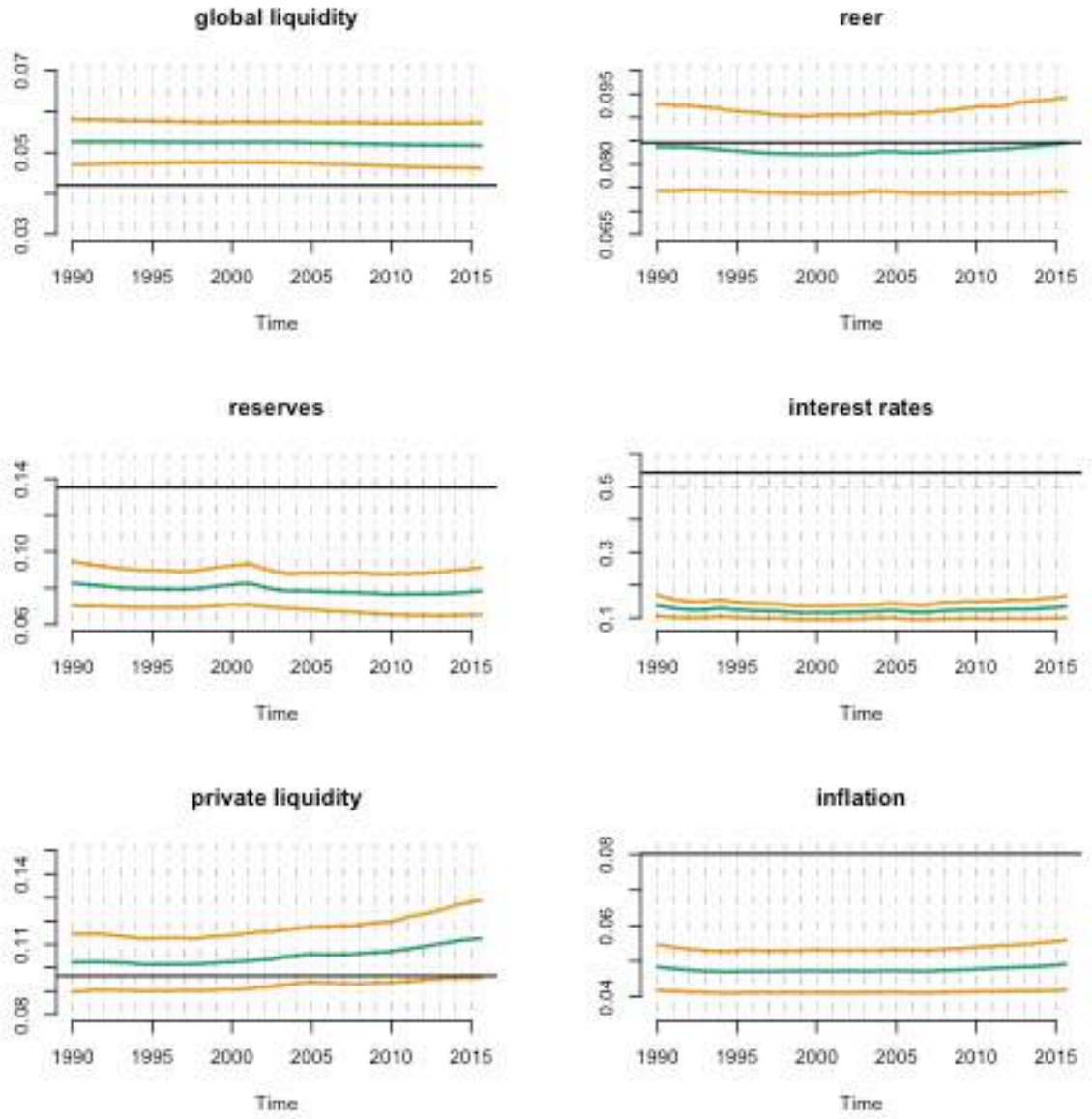

Figure 3.37: Time-varying residuals standard deviations

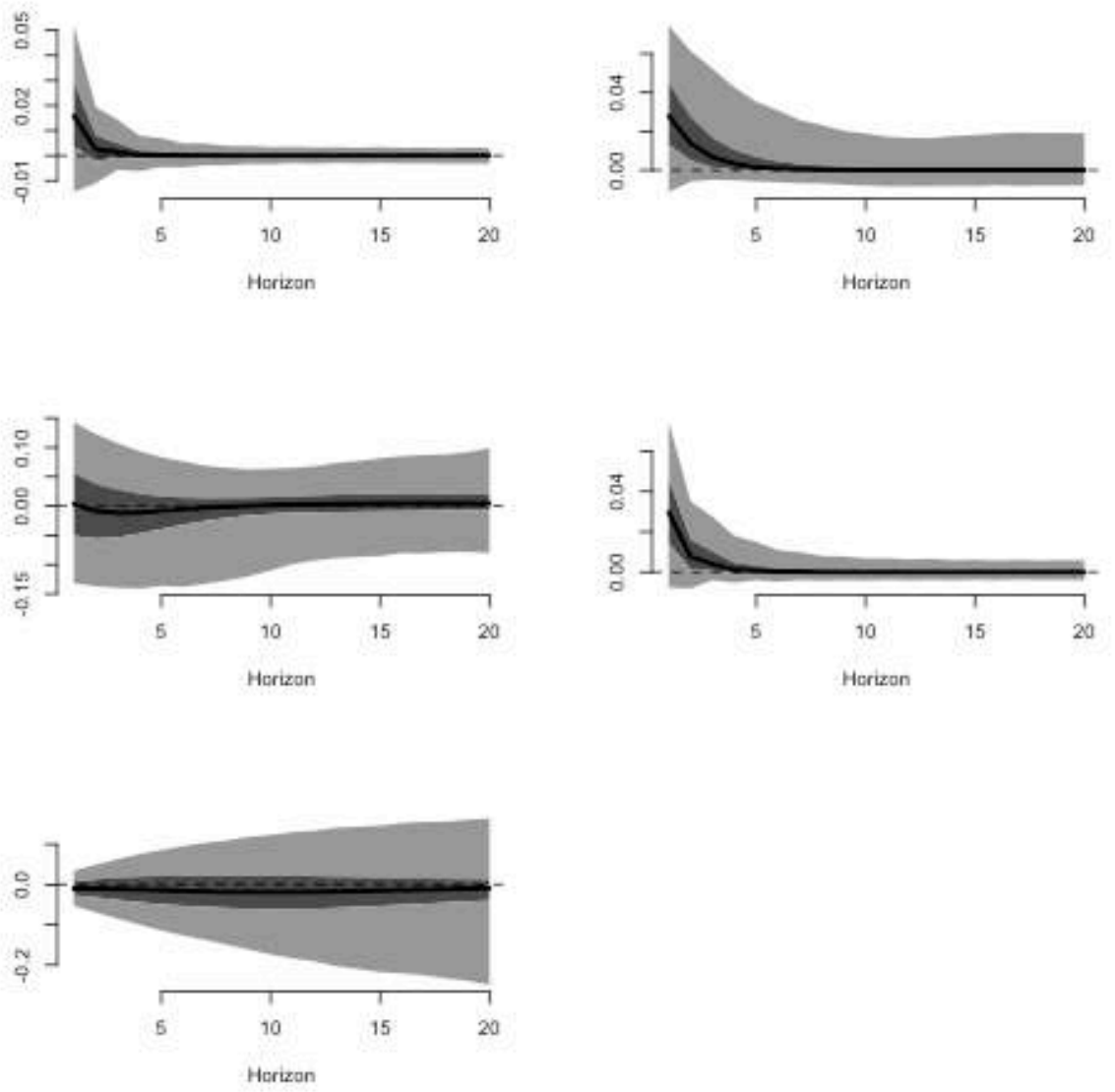

Figure 3.38: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

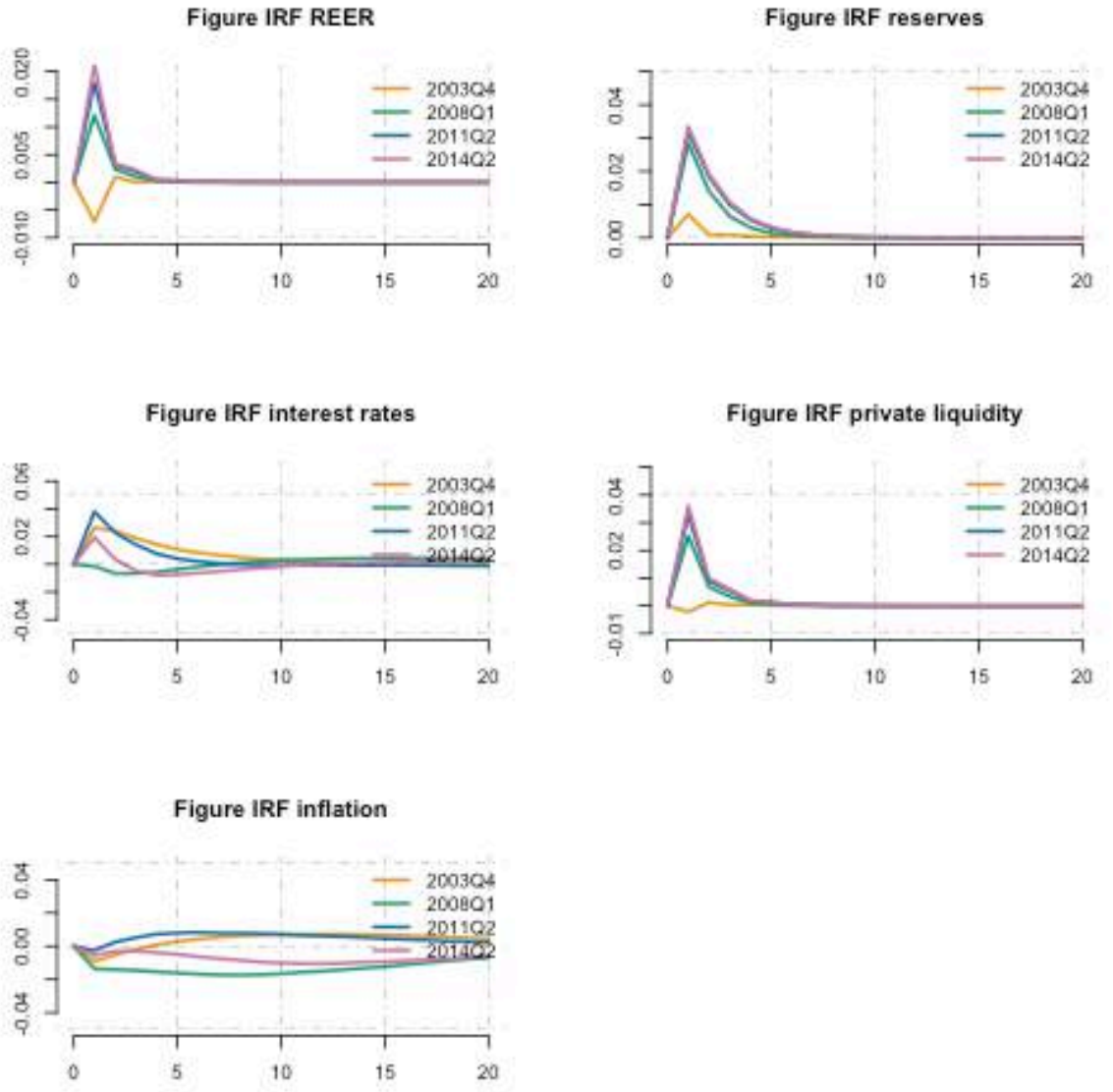

Figure 3.39: IRFs according to selected dates

C.6.TVPVAR Chile models

Model 1

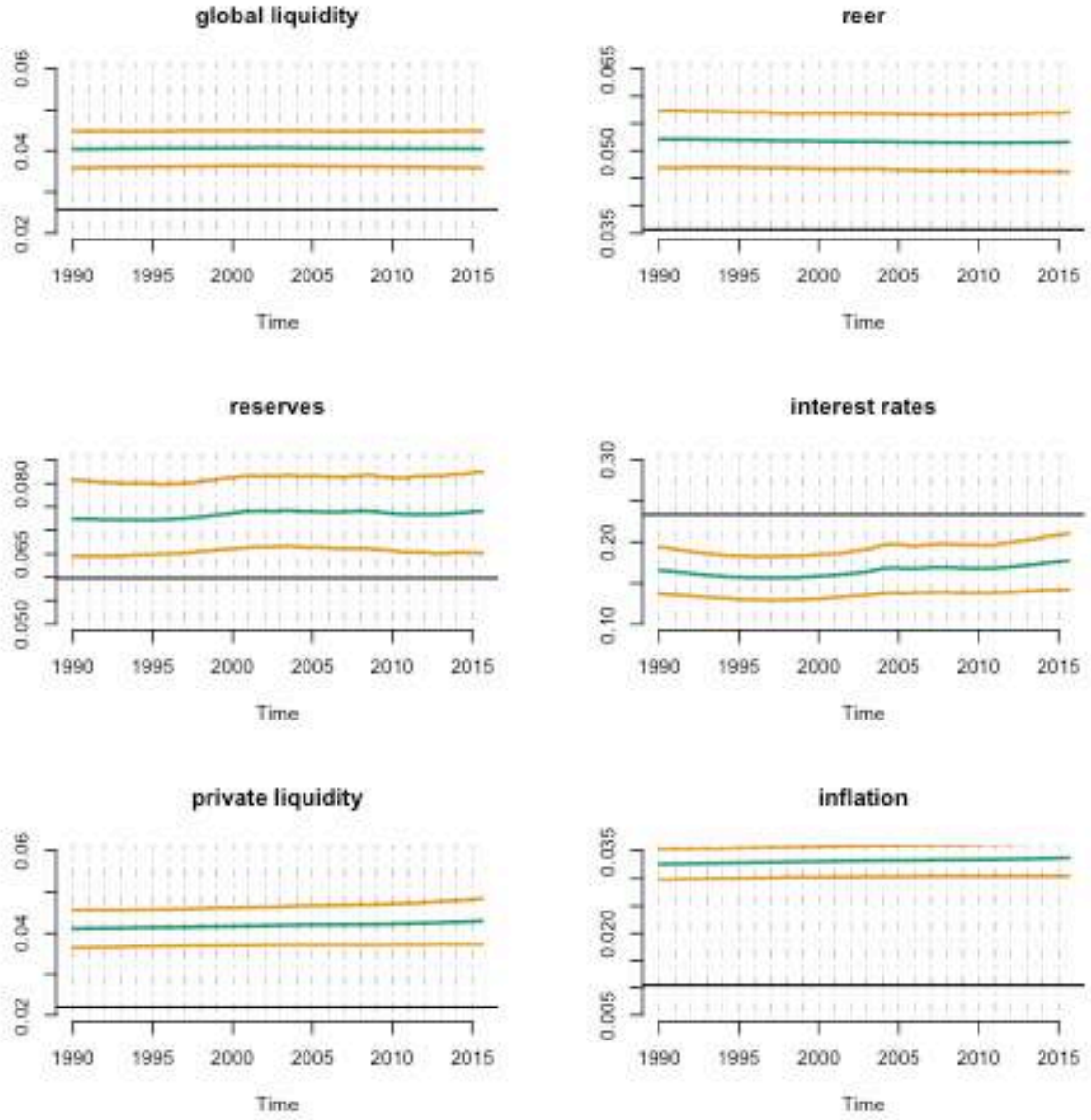

figure 3.40: Time-varying residuals standard deviations

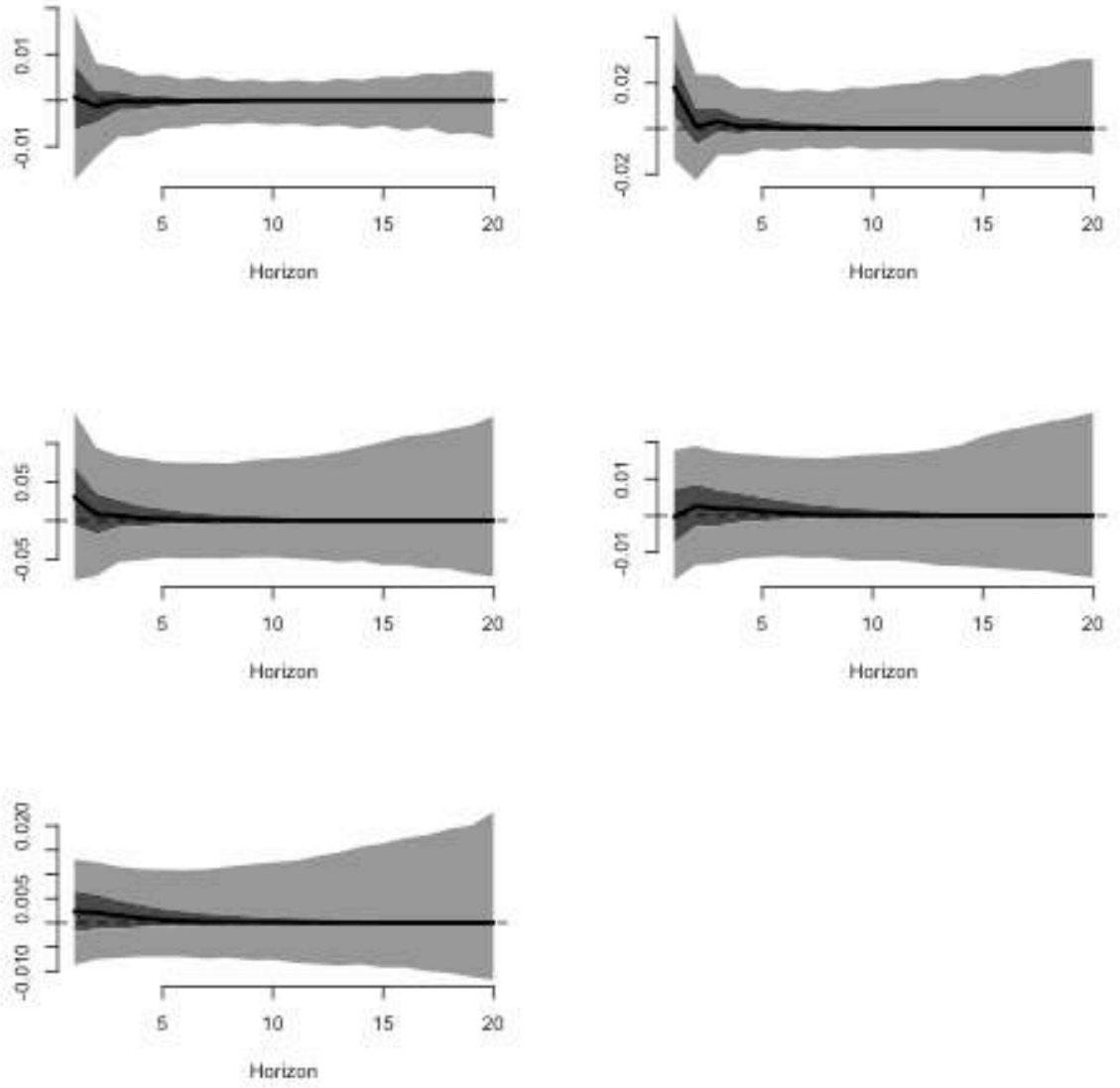

Figure 3.41: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

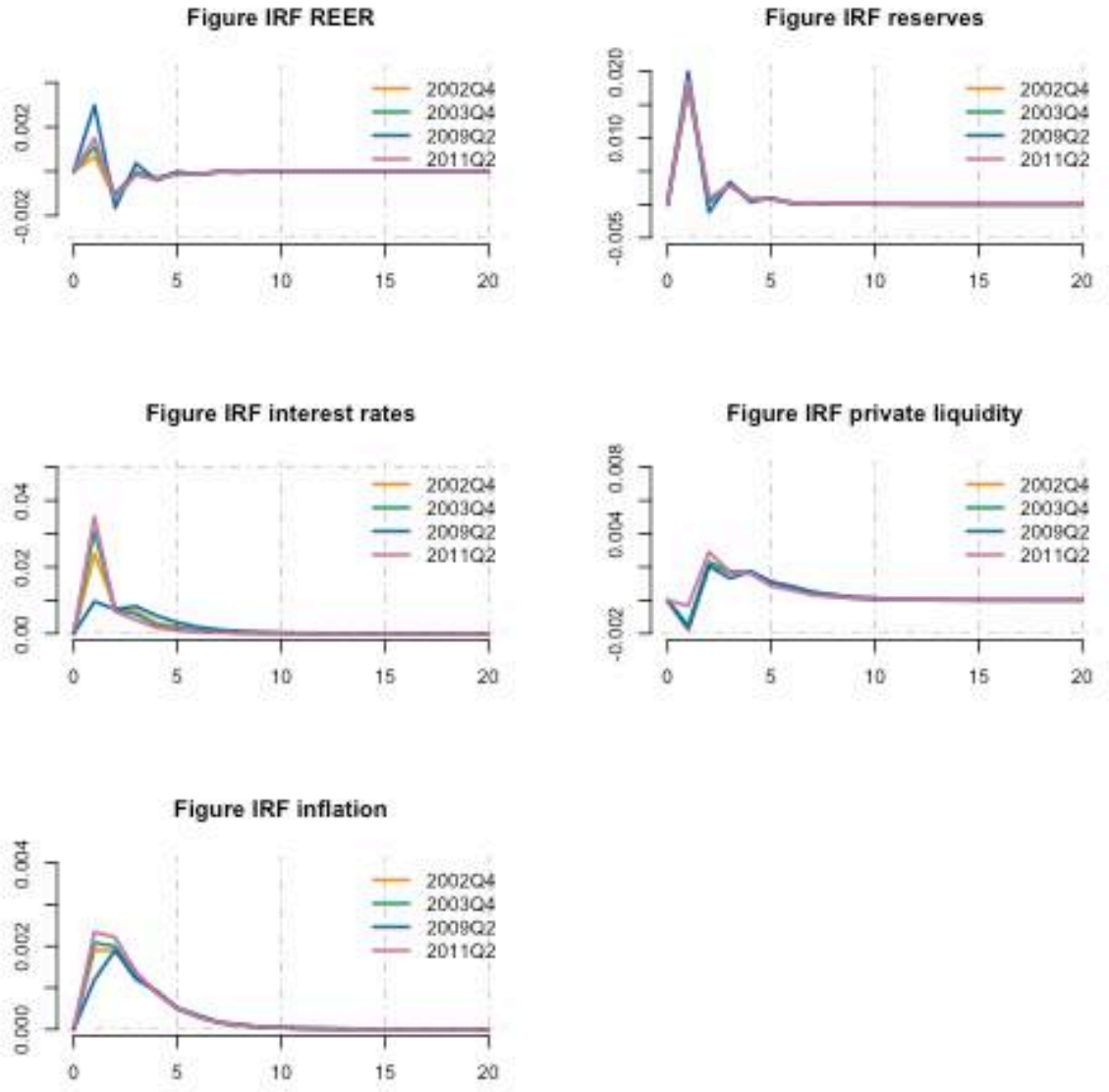

Figure 3.42: IRFs according to selected dates

Model 2

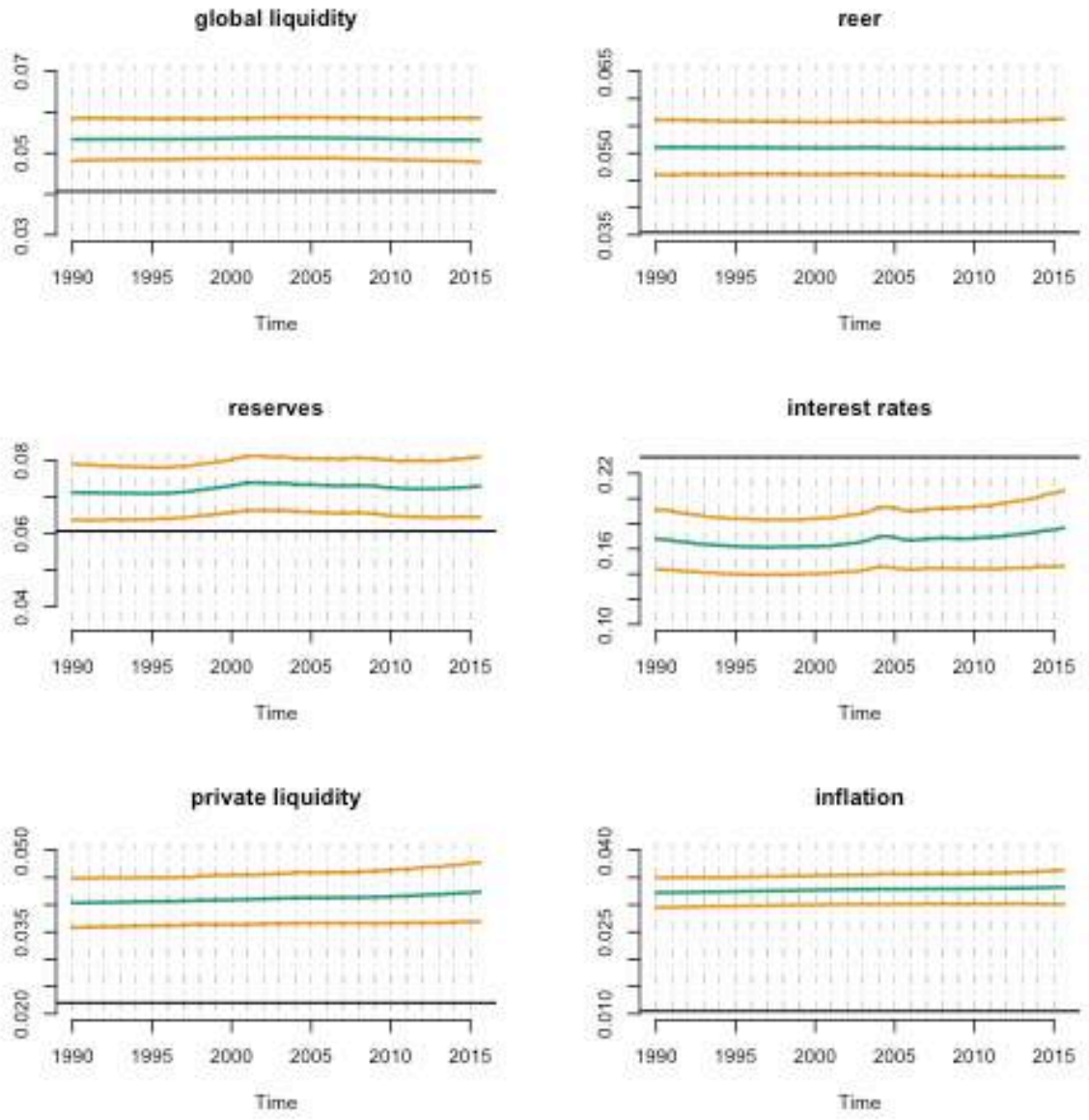

figure 3.43: Time-varying residuals standard deviations

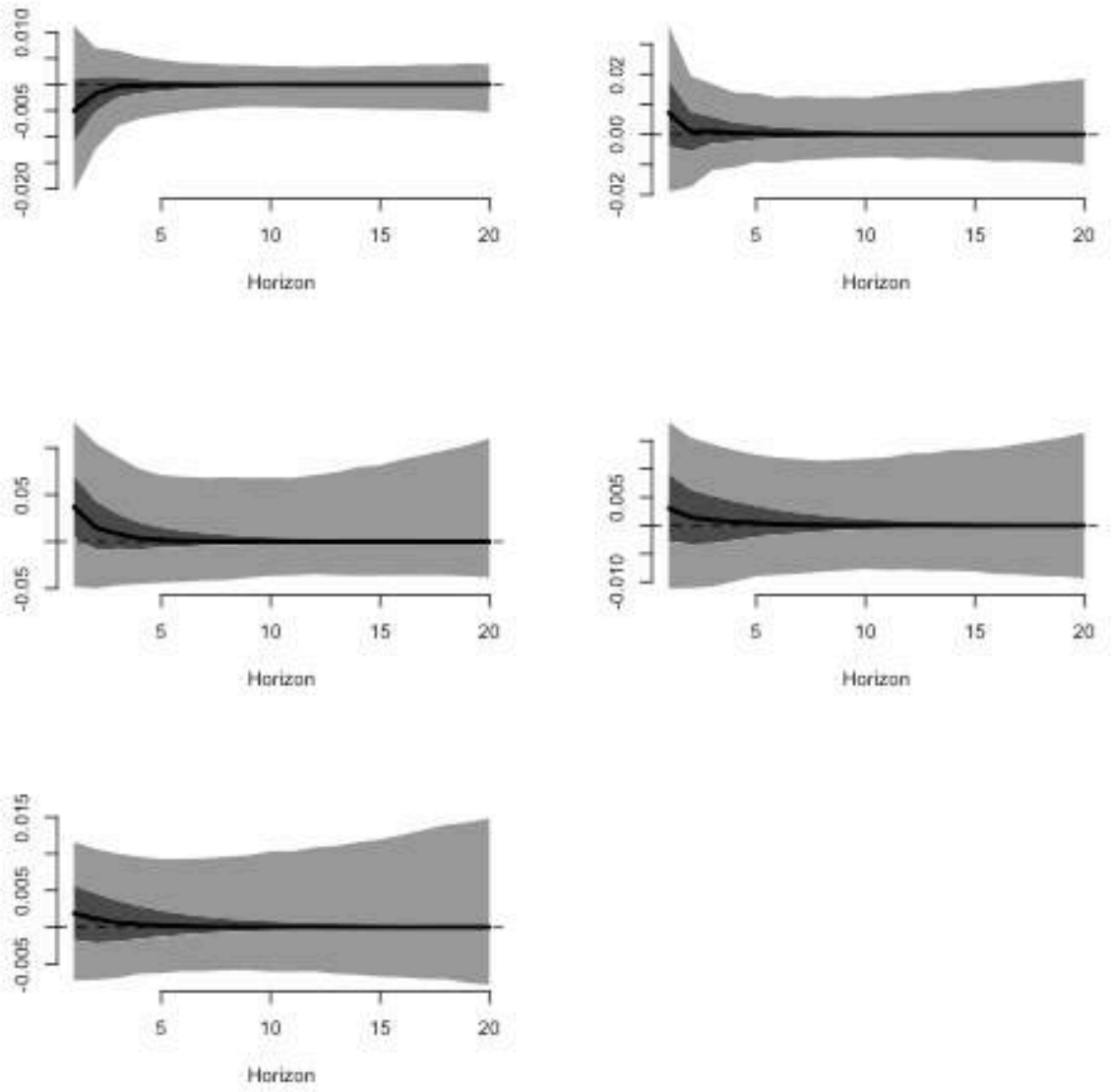

Figure 3.44: Responses of exchange rates (top left panel), reserves (top right panel), interest rates (middle left panel), domestic credit (middle right panel) and inflation (down panel) to a contemporaneous shock of global liquidity with respectively 5 and 95 percent quantiles

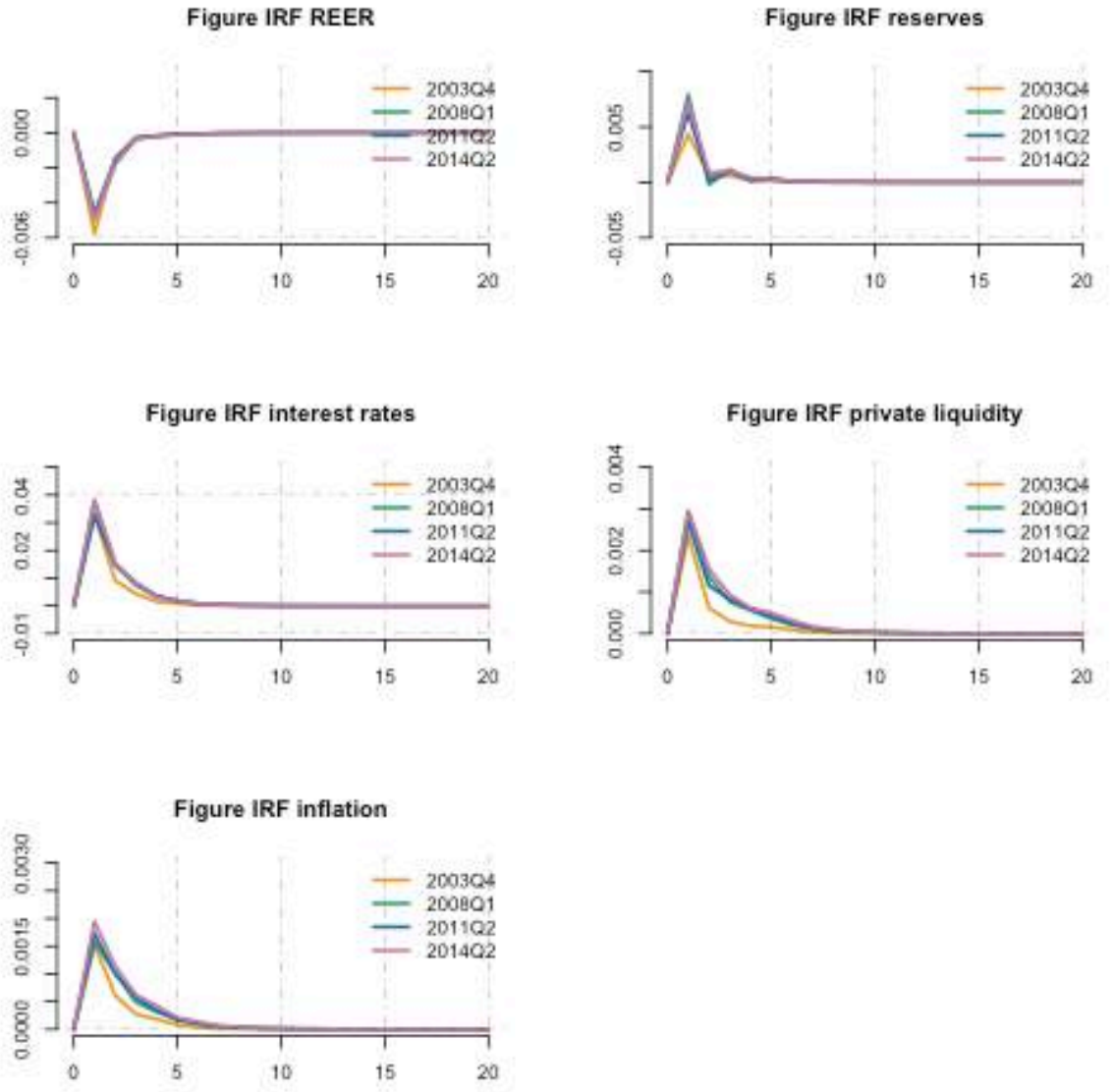

Figure 3.45: IRFs according to selected dates

C.7. Unit root tests: Global liquidity indicators

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
GL_t^1	No intercept and trend	4.54	1.00	No intercept and trend	4.45	1.00
ΔGL_t^1	Intercept	-9.53***	0.00	Intercept	-9.52***	0.03
GL_t^2	No intercept and trend	4.03	1.00	No intercept and trend	2.99	0.99
ΔGL_t^2	Intercept	-8.55***	0.00	Intercept	-8.90***	0.00

Note: The signs *** and ** means respectively the rejection of null hypothesis at 1% and 5% significance level GL_t^1andGL_t^2 represent respectively the aggregate monetary based global liquidity indicator and the aggregate cross-border credit based global liquidity indicator

Table 3.4: Global liquidity indicators Unit root results

C.8. Unit root tests: China

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	No intercept and trend	1.70	0.97	No intercept and trend	1.71	0.97
$\Delta reer_t$	No intercept and trend	-6.84***	0.00	No intercept and trend	-6.80***	0.00
$reserve_t$	No Intercept and trend	1.83	0.98	Intercept and trend	2.29	1.00
$\Delta reserve_t$	Intercept and trend	-3.92**	0.01	Intercept and trend	-3.72**	0.02
i_t	Intercept	-2.83	0.06	Intercept	-2.96**	0.04
Δi_t	No intercept and trend	-7.77***	0.00	No intercept and trend	-8.10***	0.00
$credit_t$	No intercept and trend	13.73	1.00	No intercept and trend	9.82	1.00
$\Delta credit_t$	Intercept	-6.20***	0.00	Intercept	-6.39***	0.00
$price_t$	No intercept and trend	1.04	0.92	Intercept	0.68	0.99
$\Delta price_t$	No intercept and trend	-2.94***	0.00	No intercept and trend	-2.92***	0.00

Note: The signs ***, ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.5: China Unit root results

C.9. Unit root tests: Thailand

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	No intercept and trend	-0.15	0.625	No intercept and trend	-0.32	0.56
$\Delta reer_t$	No intercept and trend	-9.06***	0.00	No intercept and trend	-8.97***	0.00
$reserve_t$	No intercept and trend	3.21	0.99	No intercept and trend	3.20	0.99
$\Delta reserve_t$	Intercept	-7.48***	0.00	Intercept	-7.88***	0.00
i_t	No intercept and trend	-1.75	0.07	No intercept and trend	-1.62	0.09
Δi_t	No intercept and trend	-8.02***	0.00	No intercept and trend	-8.05***	0.00
$credit_t$	No intercept and trend	2.19	0.99	No intercept and trend	2.19	0.99
$\Delta credit_t$	No intercept and trend	-7.09***	0.00	No intercept and trend	-7.34***	0.00
$price_t$	Intercept	-3.03**	0.03	Intercept	-3.06***	0.03

Note: The signs ***, ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.6: Thailand Unit root results

C.10. Unit root tests: Malaysia

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	No intercept and trend	-0.82	0.35	No intercept and trend	-0.94	0.30
$\Delta reer_t$	No intercept and trend	-7.78***	0.00	No intercept and trend	-7.83***	0.00
$reserve_t$	No intercept and trend	1.70	0.97	No intercept and trend	2.22	0.99
$\Delta reserve_t$	No intercept and trend	-6.84***	0.00	No intercept and trend	-6.83***	0.00
i_t	No intercept and trend	-3.34	0.06	No intercept and trend	-1.23	0.19
Δi_t	No intercept and trend	-5.73***	0.00	No intercept and trend	-5.73***	0.00
$credit_t$	Intercept	-2.42	0.13	Intercept	-2.11	0.23
$\Delta credit_t$	Intercept	-7.99***	0.00	Intercept	-8.01***	0.00
$price_t$	Intercept	-2.21	0.20	Intercept	-2.37	0.15
$\Delta price_t$	Intercept	-8.72***	0.03	Intercept	-8.73***	0.00

Note: The signs *** and ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.7: Malaysia Unit root results

C.11. Unit root tests: India

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	Intercept and trend	-3.90**	0.01	Intercept and trend	-3.98**	0.01
$reserve_t$	No intercept and trend	2.60	0.99	No intercept and trend	2.69	0.99
$\Delta reserve_t$	Intercept	-8.80***	0.00	Intercept	-8.77***	0.00
i_t	No intercept and trend	-1.09	0.24	No intercept and trend	-1.22	0.20
Δi_t	No intercept and trend	-9.53***	0.00	No intercept and trend	-9.52***	0.00
$credit_t$	Intercept and trend	-2.94	0.15	Intercept and trend	-2.86	0.17
$\Delta credit_t$	Intercept	-9.19***	0.00	Intercept	-9.50***	0.00
$price_t$	No intercept and trend	2.45	0.99	Intercept	-1.22	0.65
$\Delta price_t$	Intercept	-3.12**	0.02	Intercept	-8.13***	0.00

Note: The signs *** and ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.8: India Unit root results

C.12. Unit root tests: Brazil

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	No intercept and trend	-0.34	0.55	No intercept and trend	-0.35	0.55
$\Delta reer_t$	No intercept and trend	-10.96***	0.00	No intercept and trend	-11.04***	0.00
$reserve_t$	No intercept and trend	2.81	0.99	No intercept and trend	2.66	0.99
$\Delta reserve_t$	No intercept and trend	-9.15***	0.00	No intercept and trend	-9.17***	0.00
i_t	No intercept and trend	-1.99**	0.04	No intercept and trend	-2.04**	0.03
$credit_t$	No intercept and trend	1.61	0.97	No intercept and trend	1.49	0.96
$\Delta credit_t$	No intercept and trend	-8.56***	0.00	No intercept and trend	-8.72***	0.00
$price_t$	Intercept	-4.91***	0.00	Intercept	-5.79***	0.00

Note: The signs *** and ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.9: Brazil Unit root results

C.13. Unit root tests: Chile

Variable	ADF			Philippe Perron		
	Model	t-stat	p-value	Model	t-stat	p-value
$reer_t$	No intercept and trend	0.54	0.83	Intercept	-2.75	0.06
$\Delta reer_t$	No intercept and trend	-9.94***	0.00	No intercept and trend	-9.74***	0.00
$reserve_t$	No intercept and trend	2.04	0.99	Intercept	-2.79	0.06
$\Delta reserve_t$	No intercept and trend	-5.00***	0.00	Intercept	-10.54***	0.00
i_t	No intercept and trend	-1.43	0.14	No intercept and trend	-1.60	0.10
Δi_t	No intercept and trend	-12.81***	0.00	No intercept and trend	-12.84***	0.00
$credit_t$	Intercept	-3.76***	0.13	Intercept	-3.37**	0.01
$price_t$	Intercept and trend	-6.66	0.00	Intercept and trend	-9.34	0.00

Note: The signs *** and ** means respectively the rejection of null hypothesis at 1% and 5% significance level

Table 3.10: Chile Unit root results

C.14. TVPVAR Estimation procedures

Prior information

Our specifications of prior distributions follow the same principles as in Primiceri (2005). The initial values for the time-varying parameters and variance-covariance matrices are assumed to be mutually independent. An initial training sample of 40 observations is used to generate OLS point estimates of the parameters of interest. The following table provides an overview of the priors used in the TVP-VAR model. As to the priors on VCV matrices, note that a dimension A (and V) which follows an $IW(A, b)$ distribution has mean $\frac{A}{b-d-1}$, where d is the (row and column) dimension of A (and V). Moreover, the variance of any element $V_{i,j}$ goes to zero as $b \to \infty$. That is, choosing a large value of b essentialy fixes the matrix V at its mean. This can be used in practice to "shut off" some of the stochastic elements in the model.

Parameter	Description	Prior family	Coefficient
B_0	Initial betas	$N\left(\hat{B}_{ols}, k_B \times \hat{V}\left(\hat{B}_{ols}\right)\right)$	$k_B = 4$
A_0	Initial covariance	$N\left(\hat{A}_{ols}, k_A \times \hat{V}\left(\hat{A}_{ols}\right)\right)$	$k_A = 4$
$log\sigma_0$	Initial log volatility	$N(log\hat{\sigma}_{ols}, k_\sigma \times I_n)$	$k_\sigma = 1$
Q	VCV of shocks to B_t	$IW\left(k_Q^2 \times pQ \times \hat{V}\left(\hat{B}_{ols}\right), pQ\right)$	$k_Q = 0.01, pQ = 40$
W	VCV of shocks to $log\sigma_t$	$IW(k_W^2 \times pW \times I_n, pW)$	$k_W = 0.01, pW = n + 1$
$S_j, j = 1, \dots, n-1$	VCV of shocks to A_t	$IW\left(k_S^2 \times pS_j \times \hat{V}\left(\hat{A}_{ols}\right), pS\right)$	$k_S = 0.01, pS = j + 1$

Note: $N$and IW denote the normal and inverse Wishart distributions, $\hat{A}_{ols}$, $\hat{V}\left(\hat{A}_{ols}\right)$, $\hat{B}_{ols}$ and $\hat{V}\left(\hat{B}_{ols}\right)$ are obtained via training sample OLS (see Primiceri (2005) for details)

Table 3.11: TVP-VAR Prior informations

Markov Chain Monte Carlo (MCMC) algorithm

The algorithm we use on our estimations is based on Primiceri (2005), with the correction noted by Del Negro and Primiceri (2015). The corrected algorithm is called "Algorithm 2" in the corrigendum paper. The implementation procedure of the Markov Chain Monte Carlo (MCMC) algorithm can be sketches as: denote by B^T the entire path of parameters $\{B_t\}_{t=1}^T$(and similarly for Σ^T and A^T), let $\theta = [B^T, A^T, V]$ and let $V = [Q, S, W]$ collect the VCV matrices of the iid shock components $\{\nu_t, \zeta_t, \eta_t\}$. For clarity, we suppress dependence of the conditional posteriors on the observed data, and suppress variables wich affect a conditional posterior in principle but not in practice. Then the MCMC sampler can be summarized as follows.

1. Initialize A^T, Σ^T, $s^T$and V
2. Sample B^T from $p\left(B^T \middle| \theta^{-B^T}, \Sigma^T\right)$, using the Carter and Kohn (1994) algorithm (denoted CK)
3. Sample Q from $p(Q|B^T)$, which is an inverse Wishart (IW) distribution
4. Sample A^T from $p\left(A^T \middle| \theta^{-A^T}, \Sigma^T\right)$, again using CK algorithm
5. Sample S from $p(S|\theta^{-S}, \Sigma^T)$, which consists of several blocks that are IW
6. Sample the auxiliary discrete variables s^T from $p(s^T|\Sigma^T, \theta)$ for Kim, Shepharn and Chib (1998) algorithm
7. Draw Σ^T from $p(\Sigma^T|\theta, s^T)$, using CK
8. Sample W from $p(W|\Sigma^T)$, which is IW
9. Go to Step 2.