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Monetary and Banking Policy Transmission through Interest rates: An Empirical Application to the USA, Canada, U.K. and European Union

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CENTRE OF PLANNING AND ECONOMIC RESEARCH

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Η νομισματική και τραπεζική μετακύλιση των επιτοκίων : Μια εμπειρική προσέγγιση σε Η.Π.Α., Ευρωζώνη, Καναδά και Βρετανία

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ΠΕΡΙΛΗΨΗ

Το συγκεκριμένο άρθρο έχει ως σκοπό να αναζητήσει το εάν και κατά πόσο οι μεταβολές των επιτοκίων της Κεντρικής Τράπεζας ή/και οι μεταβολές των επιτοκίων της Διατραπεζικής αγοράς μετακυλίονται στα «προϊόντα» των εμπορικών τραπεζών (π.χ. τα επιτόκια καταθετών αλλά και τα επιτόκια χορηγήσεων). Με αυτό τον τρόπο γίνεται μια προσπάθεια να διερευνηθεί ο τρόπος που διαμορφώνεται η προερχόμενη από το δανειακό χαρτοφυλάκιο (banking book) κερδοφορία του τραπεζικού συστήματος (στην περίπτωσή μας η κερδοφορία στο τραπεζικό σύστημα των Η.Π.Α., της Ευρωζώνης, του Καναδά και της Βρετανίας). Επιπροσθέτως, μέσα από σχέσεις αιτιότητας, διερευνάται εάν και κατά πόσο τα επιτόκια της Κεντρικής Τράπεζας (π.χ. τα επιτόκια προεξόφλησης τίτλων) ή τα επιτόκια της Διατραπεζικής αγοράς (π.χ. τα Overnight) μετακυλίονται στον τελικό πελάτη μιας τράπεζας. Η εν λόγω διευκρίνιση είναι ιδιαίτερα σημαντική διότι φωτίζει, σε κάποιο βαθμό, τον ρόλο και την δυνατότητα της Κεντρικής Τράπεζας –μέσω των επιτοκίων- να επηρεάζει τόσο την διατραπεζική αγορά όσο και εν γένει στο χρηματοπιστωτικό σύστημα.

Κατ' αρχήν γίνεται μια θεωρητική (και αλγεβρική) παρουσίαση του τρόπου που τα επιτόκια «χονδρικής» (δηλαδή τα επιτόκια της Κεντρικής Τράπεζας ή/και τα επιτόκια της Διατραπεζικής αγοράς) μετακυλίονται στα επιτόκια «λιανικής» των τραπεζών (δηλαδή τα επιτόκια καταθετών αλλά και τα επιτόκια χορηγήσεων). Εν συνεχεία, μέσω της αιτιώδους σχέσεως μεταξύ των επιτοκίων «χονδρικής» (πριν προχωρήσουμε στο ζήτημα της μετακύλισης), αναλύεται η ενδογένεση (endogeneity) ή μη του χρήματος στην διατραπεζική αγορά. Το αποτέλεσμα της εν λόγω αιτιώδους σχέσεως μας επιτρέπει να προσδιορίσουμε τις δυνατότητες της Κεντρικής Τράπεζας να επιλέγει και να υλοποιεί, μέσω των επιτοκίων «χονδρικής», τους νομισματικούς της στόχους. Για την εκτίμηση της αιτιώδους σχέσεως μεταξύ των επιτοκίων «χονδρικής» που προαναφέραμε χρησιμοποιούμε την Johansen co-integration error-correction μεθοδολογία (ECM-GE).

Ακολουθεί μια συνοπτική παρουσίαση της πρόσφατης εμπειρίας (βιβλιογραφίας) σε μοντέλα μετακύλισης (price transmission models). Εν συνεχεία παρουσιάζεται η οικονομετρική μέθοδος που εμείς εφαρμόζουμε στο ζήτημα της μετακύλισης των επιτοκίων «χονδρικής» στα «λιανικά» επιτόκια των τραπεζών και αυτή είναι η LSE-Hendry general to specific (GETS). Η μέθοδος αυτή μας επιτρέπει την ταυτόχρονη εκτίμηση τόσο των βραχυχρόνιων όσο και των μακροχρόνιων ελαστικοτήτων μετακύλισης των επιτοκιακών μεταβολών από την «χονδρική» στην «λιανική» αγορά. Επίσης η συγκεκριμένη μεθοδολογία επιτρέπει την εξέταση συμμετρικής ή μη συμπεριφοράς στην μετακύλιση των προαναφερθέντων επιτοκιακών μεταβολών «χονδρικής» στο εξεταζόμενο τραπεζικό σύστημα.

Με βάση τα εμπειρικά αποτελέσματα που προέκυψαν μακροχρονίως δεν υπάρχει ξεκάθαρη αιτιώδης σχέση μεταξύ επιτοκίων της Κεντρικής Τράπεζας και της Διατραπεζικής αγοράς σε καμία από τις εξεταζόμενες οικονομίες (Η.Π.Α., Ευρωζώνη, Καναδάς και Βρετανία). Βραχυχρονίως όμως τα οικονομετρικά αποτελέσματα μπορούν να συνοψισθούν ως εξής : Στις Η.Π.Α. και στην Ευρωζώνη οι Κεντρικές Τράπεζες ακολουθούν μια «Μετα-Κεϋνσιανή Συναινετική» (Accommodating) επιτοκιακή πολιτική, στον Καναδά μια Μικτή (Mixed) πολιτική ενώ στην Βρετανία μια αμιγώς Αντι-πληθωριστική (Strictly Anti-inflationary) πολιτική.

Σε ότι αφορά τις επιπτώσεις των επιτοκίων «χονδρικής» στην κερδοφορία του τραπεζικού συστήματος των εξεταζόμενων χωρών, θα μπορούσαμε να αναφέρουμε ότι οι Η.Π.Α. παρουσιάζουν την μεγαλύτερη δυνατότητα μετακύλισης των όποιων επιτοκιακών μεταβολών «χονδρικής» (είτε από την Κεντρική Τράπεζα είτε από την της Διατραπεζική αγορά) στην «λιανική» (και πιο συγκεκριμένα στην διαφορά επιτοκίων χορηγήσεων από τα επιτόκια καταθέσεων) ενώ η Βρετανία έχει την μικρότερη μετακύλιση.

Τέλος σε ότι αφορά την ύπαρξη Συμμετρίας (Symmetry hypothesis) στην μετακύλιση των επιτοκίων «χονδρικής» στην «λιανική» τραπεζική αγορά, θα μπορούσαμε να αναφέρουμε ότι μόνο σε ορισμένες περιπτώσεις, όπως π.χ. υπό προϋποθέσεις στην δανειακή αγορά των Η.Π.Α., κρίνεται απορριπτέα.

CONTENTS

ABSTRACT

The main issue of this paper is the examination of the pass-through (PT) mark-up [the long run difference between deposit and lending rates] behavior in the banking systems of the USA, Canada, U.K. and European Union. The selection of the wholesale interest rate is also an important part of this PT transmission framework because it is related to the money supply process and therefore the central bank (C.B.)'s policy capabilities. In the empirical part, a Johansen co-integration based error-correction procedure (ECM-GE) is implemented for the wholesale interest rate selection. Then an LSE-Hendry general to specific model (GETS) is applied, for the revelation of the banking sector PT interest rate behavior. In the empirical part, on the issue of the wholesale interest rate selection, the USA, Canada and European Union show a short-run favor of the money market (M-M) rates (a rather Post-Keynesian [PK] transmission behavior) while the U.K. shows a short-run favor of the C.B. policy rates (a rather New Consensus [NC] transmission behavior). On the issue of the interest rate PT behavior, the results indicate that Canada and the USA appear to have the highest mark-up effect, while the U.K. has the smallest.

J.E.L. Classification : E52, E43.

Keywords: Interest rate PT behavior, monetary policy transmission, asymmetries.

1.Introduction

The main aim of this paper is to unveil the existence of an interest rate pass-through (PT) mark-up[1] behavior in the USA, European Union, U.K. and Canada and, through the wholesale interest rate selection (either *M-M* rates or C.B. rates), the interest rate target and/or vehicle policy variable, which is related to the C.B.'s choices and effectiveness.

The structure of this paper is the following: in Section 2, we examine the way the wholesale rates (either *M-M* rates or C.B. rates) transmit their changes to the retail (the lending and the deposit) rates. Actually we briefly present a typical banking PT interest rate model and the theoretical explanations about the way rigidities and asymmetries are transmitted from the wholesale policy rates to the retail rates. Then, in Section 3, we present the wholesale selection process between the interbank *M-M* rates (e.g. the Overnight rate) and the *C.B*. rates (e.g. the Discount rates). The result of such selection approach is – to some extent – linked with the C.B.'s attitude towards the money supply process (e.g. the PK and the NC views).

In Section 4, a brief literature review of the most updated price transmission models is presented. Then, in section 5, we analytically present the econometric method which we have engaged in our study [the LSE-Hendry general to specific model (*GETS*)]. This innovative method will help us in defining the possible long run and the short run PT interest rates rigidities and asymmetries in the examined banking system. Section 6 presents the available dataset for the examined economies and section 7 discusses the empirical results on a country by country basis. Finally, in section 8, we give our conclusion for the examined banking systems.

Overall, from the empirical results, is obvious that only short run interest rate target and/or vehicle policy variables exist in all the examined countries. However, even in the short run, these C.B. policy variables differ from monetary to monetary system. As a consequence, C.B. appears with an *Accommodating* role in U.S. and European Union, a *Mixed* role in Canada and an *Anti-inflationary* role in U.K. As for the banking sector PT interest rate behaviour, in banks' retail markets where their profitability is determined, Canada and USA appear to have the highest mark up effect, while U.K. the

[1] Mark-up: the existing long run spread (difference) between deposit and lending rates.

smallest. Finally, the long-run Symmetry hypothesis is actually rejected only in sporadic [loan market] cases.

2. The banking system interest rate PT behavior

The interest rates PT literature is mainly concerned with the way wholesale rates [C.B. and/or intebank M-M] are transmitted to the retail [deposit and lending] rates. Such PT interest rates equations usually take the following simple algebraic form:

$$i_{\mathrm{Re}tail,t} = c + \sum_{j=1}^{k} \kappa * i_{\mathrm{Re}tail,t-j} + \sum_{i=1}^{n} \mu * i_{Wholesale,t-i} + e_t \qquad (1a)$$

where :

$i_{\mathrm{Re}tail}$, stands for the different loan and deposit rates (e.g. the prime loan rates, the time deposit rates, the Certificate of Deposits rates etc) and

$i_{Wholesale}$, stands for the C.B. or M-M rates (e.g. the Overnight rate, the 3-month M-M rates, the discount rates, the treasury bill rates etc).

and :

$$\Delta i_{\mathrm{Re}tail,t} = c + \sum_{j=1}^{k} \rho * \Delta i_{\mathrm{Re}tail,t-j} + \sum_{i=1}^{n} \lambda * \Delta i_{Wholesale,t-i} - \theta * e_{t-1} + u_t \qquad (1b)$$

which is its simple dynamic error correction model (ECM).

Two main points should be examined here: First, the long-run and short-run sluggishness or interest rate rigidities (the μ 's and the $\lambda's$ coefficients in equations 1a and 1b respectively) from the wholesale to the retail market rates; and second, the speed of [e.g. symmetric or asymmetric] retail rates adjustment initiated from the wholesale interest rate changes (the θ coefficient of the error correction term, in equation 1b).

The existence of any price rigidity ["price-setting" retail decisions] is related to the decision taken by the bank's managers regarding the retail [deposits and loans] interest rates choices, which in the long run are considered as profit maximising. According to Lowe and Rohling (1992), the existence of any price (or interest rate) rigidity or sluggishness in the financial markets can be explained by a number of theories. More analytically, either by the *Agency costs* theory (see Stiglitz-Weiss, 1981) or by the *Adjustment costs* theory (see Cottarelli and Kourelis, 1994), or by the *Switching costs* theory (see Klemperer, 1987), and finally by the *Risk sharing* one (see

Fried and Howitt, 1980). However, we could additionally argue that the interest rate rigidity or sluggishness depends on the concentration level of the retail market (degree of oligopoly) as well as on the temporal or non-temporal nature of wholesale interest rate changes. So the more concentrated the retail market is, the more the *Costs* theories will weaken. On the other hand, a competitive retail market, accomplished with some stable wholesale interest rates changes, is expected to reinforce its *sluggish or rigid* behavior according to some of the aforementioned *Costs* theories.[2]

On the issue of the speed of retail rates adjustment, the [symmetric or asymmetric] θ coefficient in model (1b), is actually represented by the bank's managers speed of transmitting to their clients any wholesale rate changes. Such speed is possibly affected by the degree of banks' retail market competitiveness. For example, in a competitive banking environment, the deposit rates are expected to be reluctantly raised by the banks, responding this way to the wholesale rates increase. At least a similar speed of deposit rates adjustment is expected, regarding the decrease of the deposit rates, when the wholesale rates are falling (e.g. $\theta^- \approx \theta^+$, in model (1b), when perfect competition exists[3]). Consequently, the less competitive the deposit market is, the higher the inequality in the size of the two speeds of deposit rates adjustment is expected to be (e.g. actually $\theta^- > \theta^+$). Almost the same size of the positive and negative speed of adjustment is expected in a competitive loans market (e.g. $\theta^- \approx \theta^+$). As in the previous case, in a less competitive loans market, the two speeds of adjustments are expected to differ but this time with an opposite size. More specifically, any wholesale rate fall will be followed with a reluctant and sluggish decrease in the loan rates and any wholesale rate raise with a quick loan rate increase (e.g. $\theta^+ > \theta^-$).

This differentiation of the banks' speed of upward and downward adjustment behavior is considered as *asymmetric* in both retail markets [loans and deposits]. Moreover, such behavior is theoretically consistent, regarding the deposit market, with the Hannan and Berger (1991) adverse *Customer Reaction Hypothesis*, and with their *Bank's Collusive Hypothesis,* regarding the loan market.

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[2] For a brief summary of these theories see Toolsema, Sturm and Haan (2001).

[3] As Neuwark and Sharpe (1992) indicate, asymmetry in a market is less pronounced when competition is fierce.

3. The selection of the wholesale rate

In the previous section we presented the existing literature on the interest rate PT behavior between the wholesale or market rates and the commercial banks' retail (deposit and lending) rates. This way, however, the literature neglects the crucial question of whether C.B. policy rates (e.g. the Discount rate) or the interbank M-M rates (e.g. the Overnight rate) should be the selected as the PT one to the retail rates. The wholesale rate selection is indirectly linked with the monetary policy implementation aspects (Orthodox or Heterodox). So, before we proceed to the empirical part of the interest rate PT behavior – between the wholesale and the retail rates – we can briefly clarify which wholesale rate will be selected to be "spillovered" to the retail rates. C.B. and interbank M-M can be considered as two important financial entities. However, it is in the hands of the former [C.B.] to decide which is the most appropriate (fits better the data) means in order to be used as the PT target/vehicle from wholesale to retail rates. More analytically:

Case 1: When C.B. policy rates dictate the M-M rates

In this case we accept that C.B. rates cause the M-M rates. The economic interpretation of such an equation is that the C.B. ranks first the fulfilment of its *ex-ante* determined anti-inflationary target. The interbank M-M liquidity needs are considered as (exogenous) means for achieving such an aim. In other words, for this *ex-ante* anti-inflationary target objective a non-accommodative stand against the interbank M-M is often engaged. So although the M-M rate (e.g. the Overnight rate) is the reaction variable to the C.B. policy rate (e.g. the Discount rate) we can additionally claim that C.B. policy rate is the reaction variable to the predetermined level of inflation as well.

For instance, if the economic environment is inflationary (higher than expected), C.B. priority is to increase its policy rate (e.g. the Discount rate) in order to push, as an incentive, the (large) banks to invest their existing excess liquidity into Treasury Bills and other Government Bonds instead of the interbank M-M. This way, the C.B. tries to drain the interbank M-M from the supply, on behalf of large banks, of balance settlements regardless of the financial system's (notably, small and medium banks) excess liquidity needs. This consequently will produce – as a reaction – an increase in the M-M rates. Such C.B. interest rate policy will be sustained up to the point where the (small and medium) banks' credit expansion "conforms" to some predetermined [by the C.B.] anti-inflationary target. The reverse policy will be pursued, by the C.B., when an anti-inflationary environment is being realised. Overall the C.B.'s policy rates will always react up to the point the resulting M-M rates are in line with some *ex-ante* determined Wicksellian anti-inflationary aim. This C.B. behavior could be considered as a rather *NC* one (see Taylor, 2000).

Case 2: When C.B. policy rates follows carefully the M-M rates

In this case we assume that M-M rates cause the C.B. rates. This implies that in the examined financial sector we face an increasing demand for interbank M-M liquidity which is expressed through an upward pressure on the M-M rate (e.g. by an increasing Overnight rate). If now the C.B. wants to "accommodate" such interbank M-M request then it will change its policy rate (e.g. the Discount rate) in a way that will not provoke any adverse market conditions regarding its [C.B.] "*Lender of the Last Resort* (*L.L.R.*)" mission in the system [see Moore (1988), Goodhart (1994), Lavoie (1984) etc]. More accurately, the accompanied C.B.'s policy rate change [which affects the trading book of the banks which operates as a substitution effect to the interbank M-M] should carefully move for the satisfaction of the interbank M-M liquidity request. This means that the C.B.'s policy rate change should not provoke insolvency risk problems for some (small) banks and simultaneously should not engineer the creation of inflationary excess M-M liquidity. Overall, such a C.B. interest rate reaction policy could be characterized as a carefully "accommodating" policy.

Case 3: When C.B. policy rates feedback with the M-M rates

There is also the alternative case when C.B. policy rates *feedback* with M-M rates. In such a case, although the C.B. accepts the importance of the M-M needs satisfaction, for the solvency of the banking system, at the same time it ranks highly its *ex-ante* determined anti-inflationary objectives. In this case a feedback policy rule appears in accordance with the Atesoglu (2003-4) definition of *Structuralism,* regarding the PT interest rate policies [a feedback relationship between federal fund (F-F) rate and 30-year Treasury Note (policy) rate].

All the aforementioned C.B. dilemmas can be now summarized in the following algebraic causal formula :

$$i_{C.B.,t} = c + \sum_{j=1}^{k} a * i_{C.B.,t-j} + \sum_{i=1}^{n} b * i_{mm,t-i} + e_t \tag{2a}$$

vs.

$$i_{mmt} = c + \sum_{j=1}^{k} d * i_{mm,t-j} + \sum_{i=1}^{n} \beta * i_{C.B.,t-i} + u_t \tag{2b}$$

where :

$i_{C.B.}$, stands for the C.B. policy rate (e.g. a Discount rate) and

i_{mm}, stands for the M-M rates (e.g. the Overnight rate or the 3-month M-M rate etc).

Table 1 also summarizes the alternative monetary policy interpretation originating from the C.B. and M-M interest rates causal behavior.

Table 1

The interest rate causal results between C.B. & M.-M. rates

Causality Results	***C.B. Objective (mission)***
Case 1 : $i_{mm} \Leftarrow i_{C.B.}$	*Strictly Anti-inflationary (New Consensus)*
Case 2 : $i_{mm} \Rightarrow i_{C.B.}$	*Accommodating policy (L.L.R.)*
Case 3 : $i_{mm} \Leftrightarrow i_{C.B.}$	*Mixed approach (Structuralism)*

Before we proceed to the empirical part of this study we will present α brief literature review of the existing bi-variate PT transmission processes.[4]

4. A brief literature review of price transmission models [tests]

Numerous studies have utilized the PT transmission models not only in the interest rates market but in other markets as well (e.g. the agri-food market, the oil market, etc). There are different ways we can approach this kind of price transmission literature review (e.g. following the time of presentation or the category of models etc). We choose here to

[4] The econometric process implemented in the second part of our study (the causal relationship between M-M and C.B. rates) is a typical *Johansen* co-integration based error-correction procedures (ECM-GE). This method is well-known and we do not consider that it is necessary to be further explained here (see for example Lutkepohl and Reimers, 1992).

present this brief review by the type of model (e.g. the Threshold Autoregressive [TAR] vs. the Error Correction Model [ECM] models).

Commencing with the TAR *adjustment speed* models, Blacke and Fomby (1997) and Enders and Granger (1998) show that tests for unit roots and cointegration, in the standard ECM models, have low power in the presence of asymmetric adjustment. This happens because such tests implicitly assume symmetric and linear adjustment processes.[5] Therefore, Enders and Siklos (2001) propose an extension to the standard ECM strategy which appears in the literature as TAR models (see Sander and Kleimeier, 2002). However, TAR models have computational difficulties and often impose *ex-ante* non-theoretical restrictions. Additionally, TAR models are aimed at testing for the presence of non-linear transaction costs, and in general for the existence of price bands where there is no transmission. Finally the above mentioned models do not incorporate the positive and negative disagreggation of the Data Generation Process (DGP).

As regards the simple *ECM* case, it was Von Cramon-Taubadel and Loy (1997) and von Cramon-Taubadel (1998) who actually introduced the symmetric/asymmetric EC approach through an *ex-ante* disagreggation of the data. Into this framework, Bachmeier and Griffin (2003) and Rao and Rao (2005) presented an alternative dynamic approach originating from the LSE-Hendry general to specific (*GETS*) methodology. There are two main advantages of this last approach: First that through a GETS model we have the comparative advantage (as will be explained in the next section) that we can jointly and simultaneously test the short-run and long–run effects [rigidities] in the same dynamic model [see Rao and Singh (2006)]. Second, with the same model we can test the existence of any symmetric or asymmetric [speed of adjustment] transmission behavior between the examined variables [see Rao and Rao (2005), Panagopoulos and Reziti (2007)].[6] These variables in our case are the wholesale and the retail interest rates.

In the following section we will briefly present the way GETS methodology can be implemented.

[5] See Goodwin and Harper (2000) for the advantages of the TAR model over the simple ECM proposed by von Cramon-Taubadel (1998).

[6] Meyer and von Cramon-Taubabel (2004) provide a comprehensive discussion of the possible types and causes of asymmetric price adjustments together with a brief review of the relevant empirical results.

5. The *LSE-Hendry* general to specific (*GETS*) model

We know from the literature that a simple aggregate dynamic Granger–Engle Vector Error Correction [*VECM (n)*] model has the following form:

$$\Delta i_{R,t} = \mu + \sum_{i=1}^{n1} \beta_{R,t-i} \Delta i_{R,t-i} + \sum_{i=0}^{n2} \beta_{W,t-i} \Delta i_{W,t-i} + \pi_1 Z_{t-1} + e_t \qquad (3)$$

where : $i_{W,t}$ and $i_{R,t}$ are two variables, say two different interest rates and in particular the $i_{W,t}$ stands for the wholesale interest rates while the $i_{R,t}$ for the retail one. The Z_{t-1} term stands for the error correction term (or the long run relationship) between them.

Moreover, in its data decomposed *VECM (n)* version, the above model (equation 3) can be presented in the following form:

$$\Delta i_{Rt} = \mu + \sum_{i=0}^{n1} \beta_{Rt}^{-} \Delta i_{R,t-i}^{-} \sum_{i=1}^{n2} \beta_{Wt}^{-} \Delta i_{W,t-i}^{-} + \pi_1^{-} Z_{t-1} + + \sum_{i=0}^{n3} \beta_{Rt}^{+} \Delta i_{R,t-1}^{+} +$$
$$\sum_{i=1}^{n4} \beta_{Wt}^{+} \Delta i^{+}{}_{W,t-i} + \pi_2^{+} Z_{t-1} + \varepsilon_t \qquad (4)$$

As Rao and Rao (2005) indicate, the (+) superscript on the coefficients and the variables is relevant when changes in the variables are positive while the (–) superscript is relevant when changes in the variables are negative. More analytically, for any positive change ($\Delta i_{W,t}$>0) in the independent variable of equation (4), we expect a corresponding reaction of all positive coefficients (β^{+}) plus the coefficient of the speed of adjustment (π^{+}). On the other hand the corresponding negative coefficients ($\Delta i_{W,t}$<0) will be "engaged" in any negative change of the dependent variable of equation (4).[7]

Moving a step forward, the *GETS* asymmetric model could be presented in the following form:[8]

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[7] In econometric terms the corresponding "activation" will be triggered in equation 4 with the help of dummy variables (e.g. DUM). More specifically, all positive coefficients will take the value of 1 when a positive change in the dependent variable occurs and will be zero otherwise (1-DUM).

[8] This model is tested according to the Non-Linear Least Squares (N.L.L.S.) methodology.

$$\Delta i_{R,t} = \sum_{i=1}^{j1} \beta_{R,t}^{-} \Delta i_{R,t-i}^{-} + \sum_{i=0}^{j2} \beta_{W,t}^{-} \Delta i_{W,t-i}^{-} + \theta^{-} (i_{W,t} - \varphi_0 - \varphi_1 i_{R,t} - \varphi_2 T)_{t-1} +$$

$$+ \sum_{i=0}^{j3} \beta_{W,t}^{+} \Delta i_{W,t-i}^{+} + \sum_{i=1}^{j4} \beta_{R,t}^{+} \Delta i_{R,t-i}^{+} + \theta^{+} (i_{W,t} - \varphi_0 - \varphi_1 i_{R,t} - \varphi_2 T)_{t-1} + \xi_t \qquad (5)$$

where: θ^{-} and θ^{+} are the speed of adjustment coefficients in the *GETS* asymmetric model in the positive and negative case respectively and T the time trend.

In addition, the EC term (Z_{t-1}) of the simple decomposed OLS estimation (4) has been substituted by an equation at the levels. Moreover, as Rao & Rao (2005) say, model 4 can be tested by rearranging the *GETS* asymmetric model in the following way :

$$\Delta i_{R,t} = \gamma_o + \gamma_1 T + \sum_{i=1}^{j1} \beta_{R,t}^{-} \Delta i_{R,t-i}^{-} + \sum_{i=0}^{j2} \beta_{W,t}^{-} \Delta i_{W,t-i}^{-} + \theta^{-} (i_{W,t} - \varphi_1 i_{R,t})_{t-1} +$$

$$+ \sum_{i=0}^{j3} \beta_{W,t}^{+} \Delta i_{W,t-i}^{+} + \sum_{i=1}^{j4} \beta_{R,t}^{+} \Delta i_{R,t-i}^{+} + \theta^{+} (i_{W,t} - \varphi_1 i_{R,t})_{t-1} + \xi_t \qquad (5a)$$

The choice between the two GETS models (5) and (5a) will depend on the performance and plausibility of the estimations. Finally, the existence of *Asymmetry* (in the speed of adjustment), will be tested by the implementation of the Wald χ^2 - test for the hypothesis that $\theta^{+} = \theta^{-}$ in either equation (5) or (5a).

Therefore in contrast with other ECM models (e.g. Von Craumon-Taubadel and Meyer (2000)) and TAR models (e.g. Sander and Kleimeier (2006) and Fuertes, Heffernan and Kalotychou (2006)), possibly the strongest benefits from equations (5) and (5a) are:

1. the capability of estimating the negative and positive short-run elasticities (e.g. the $\beta_{W,t}^{-}$ *and* $\beta_{W,t}^{+}$)[9] in the dynamic model and

[9] The ability of testing both negative and positive short-run pass through elasticities ($\beta_{W,t}^{-}$ *and* $\beta_{W,t}^{+}$) in the same model is actually enriching the Cottarelli and Kourelis (1994) pass through interest rates *multipliers* – and especially their EC form [see Toolsema, Sturm and Haan

2. the direct and simultaneous estimation of the long-run (φ_1 or alternatively $\varphi_0 + \varphi_1$) and the short-run price transmission elasticities (rigidities) in the same model.

Summarizing, the empirical part of our study is organized as follows: The C.B. vs. M-M causal relationship – equations (2a) and (2b) – will be examined with the implementation of the *Johansen*'s co-integration based VAR error-correction methodology *(ECM-GE)*. Then, for the banking sector PT interest rates behavior – equations (1a) and (1b) – the *GETS* methodology will be implemented. This approach will help us in defining the short-run and long–run effects (rigidities) plus the speed of adjustments (the symmetry issue) between the wholesale and retail interest rates of the examined economies.

6. The Dataset

We are testing the PT interest rate behavior in some of the biggest and more mature economies of the world. More specifically, in the USA, Canada, U.K. and E.U. monetary systems. We use monthly data and the examined time period is from 1990 up to the most recent available from the International Monetary Fund *(I.M.F.)* Financial Statistics data set (middle 2006).

More analytically, starting with the *U.S.A.*, the Discount rate and the Federal Fund rate are used for proxying the central bank (i_{CB}) and the money market (i_{mm}) interest rates respectively. In addition, the 3-month Certificate of Deposits (CD) and the Prime Loan rate are used for proxying the retail rates (deposit and loans) in this banking market (i_{Loan} and $i_{Deposit}$ accordingly).

Regarding *Canada*, the Bank rate and the Overnight rate are used for the central bank (i_{CB}) and the money market (i_{mm}) interest rates accordingly. The 90 days fixed Deposit rate and the Prime Loan rate are proxying the corresponding retail rates.

Turning to the *U.K.* case, for the central bank interest rates proxy (i_{CB}) we use the interest rate provided by the Bank of England[10] while for the M-M interest rates

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(2001)] – with positive and negative values. More analytically, due to the GETS model we are in a position now to estimate two different *impact multipliers* (a negative and a positive one) plus two *interim multipliers* (not to mention the two different *speed of adjustments*).

[10] This is the Minimum Band 1 dealing rate (1988-1996) and as a continuation to this a Discount rate (1997-2005) and finally its Official Bank rate (2006 onwards).

proxy the (I.M.F.'s) Overnight rate (i_{mm}) is applied. Regarding now the retail rates, both the deposit[11] and the loan (bank clearing) rates are provided by the I.M.F. International Financial Statistics.

Finally, in the case of the *E.U.,* the Discount rate[12] is used for proxying the central bank interest rate (i_{CB}) and the interbank 3-month maturity rate is used for proxying the money market (i_{mm}) rate. Both rates are provided by the I.M.F. International Financial Statistics data set. Regarding now the E.U. retail rates, unfortunately we do not have corresponding unified rates in the Eurozone. In order to bypass this problem we decided to proxy the "missing" retail rates with corresponding rates of the two biggest (and perhaps most representative) E.U. (Eurozone) countries i.e. Germany and France. Data for Deposit and Loan rates[13] for these two countries are taken from I.M.F. International Financial Statistics.[14]

7. Empirical Results

The empirical results are presented, on a country by country basis, commencing with the U.S.A.

The USA banking system [Table 1]

The empirical part begins with the selection of the wholesale rate. From the *Johansen*'s Co-integration tests, is obvious that there is no long run relationship between the examined M-M and C.B. rates in U.S. (C.V.(r) = 0). Only short run C.B. objectives exist – according to the VAR block [short-run] *Exogeneity* tests results – in the examined period (1990-2006), and favor a transmission policy which obeys the *Accommodative (L.L.R.)* monetary policy principles (e.g. $\Delta i_{mm} \Rightarrow \Delta\, i_{CB}$). So the C.B. rate, in the short run, carefully satisfies the interbank needs for liquidity in the financial system.

[11] Note that the U.K. deposit rate variable, which is provided by the *I.M.F.* International Financial Statistics, is terminated at 1999m1.

[12] The data set availability for this variable commences from 1999m1.

[13] Actually for the Loan rate we used Germany's and France's *Mortgage* rates while for the Deposit rate we used the *simple Deposit* rate in the case of France, and the *3-month Deposit* rate in the case of Germany. All these rates are available from the I.M.F. International Financial Statistics data set.

[14] It is important to report here that, due to the existing I.M.F. data availability, the E.U. M-M

The second stage of our analysis deals with the PT banking retail interest rates behavior. First it should be noticed that due to the derived short run results, regarding the C.B. transmission policy, we use both rates – C.B. and M-M rate – as the PT variable/vehicle. Commencing with the M-M rates, as the PT variable, we estimate the GETS long run coefficients (the sum of $\phi_1 + \gamma$ coefficients in equation 5a) for the loan and the deposit market rates separately. From the two different long run PT coefficients is obvious that the US banks spillover to their borrowers (loans) a much bigger part of the M-M rate change than to the depositors [1.73-1.06=0.67]. This actually is the produced US banks' profitability range, from its main economic activity (borrowing and lending money), derived from the PT variable change (per unit of loan). The US banks' profitability is getting bigger if we treat C.B. rate, as the PT variable, in our analysis. More specifically, the aforementioned spread of the two long run PT coefficients is getting wider [1.37-0.15=1.22].

Concerning now the long run *Symmetry* hypothesis we can observe that it is only rejected in the loans market when the M-M rate is the PT variable. More analytically, in the USA loan market the upward speed of adjustment (the θ^+ coefficient in equation 5a) is greater than the downward one (the θ^- coefficient). This implies that it accepts the *Bank's Collusive* hypothesis.

We now proceed to the short run rigidities estimation as theoretically formulated by Cottarelli and Kourelis (1994) and Toolsema, Sturm and Haan (2001). These rigidities became known in the literature as PT interest rates *multipliers* (e.g. the *impact effect and* the two *interim effects – dependent and independent).* But now, due to the GETS decomposed data approach, as we already mentioned in *Footnote* 9, we can estimate and then sum up two different (negative and positive) *impact multipliers* plus two different *independent interim*[15] *multipliers*. In economic terms, this allows us to test for a short run Symmetry in the examined markets. In both the US retail markets (loan and deposit) the separately (negative and positive) estimated and then added *interim and independent impact effects* reject the short run Symmetry hypothesis. More analytically, only short run negative asymmetry results were derived, regardless of the PT variable

pass through behavior to the retail rates is examined commencing from 1997m1.

[15] All the presented *interim* multipliers for all countries are the sum of their statistically significant coefficients.

implemented [see also Table 5a and 5b].

Canada's banking system [Table 2]

As in the previous case the empirical part begins with the selection of the wholesale rate. From the *Johansen*'s Co-integration tests it is obvious that there is no long run relationship between the examined M-M and C.B. rates (C.V.(r) = 2). However, the existing C.B. short run objectives – according to the VAR [short-run] block *Exogeneity* tests results – in Canada's financial system are in favor of a transmission policy which follows the *Mixed* monetary policy ideas (e.g. $i_{mm} \Leftrightarrow i_{CB}$). So, in the short run, the C.B. satisfies the interbank needs for liquidity and at the same time tries to keep some of its anti-inflationary objective.

In the second stage, we estimate the GETS long run coefficients for the loan and the deposit market separately. From the two long run PT results, it is obvious that the Canadian banks spillover to their borrowers (loans) a much bigger part of the M-M rate change than to the depositors [1.46-0.31=1.15].[16] The actual PT spread [the two different transmission long run coefficients from the PT variable to the two retail rates] is bigger than the corresponding US spread. On the other hand, the PT spread narrows when the C.B. rate is used as the PT variable (1.35-0.66=0.69). In other words, the Canadian banks' profitability range, derived from their main economic activity (borrowing and lending money), looks bigger when M-M rate is implemented as the PT variable, than when the C.B. rate plays this role.

Regarding now the long run *Symmetry* hypothesis we can observe that – as in the USA case – it is only rejected in the loans market when the M-M rate is the PT variable. But, in contrast to the *Bank's Collusive* hypothesis, in Canada's loan market the downward speed of adjustment (the θ^- coefficient in equation 5a) is greater than the upward speed of adjustment (the θ^+ coefficient). A possible explanation for such behavior can be sought in the assumption that Canada's entrepreneurs have easy access to the relatively huge USA banking and financial system for borrowing. This looks as if it compels the Canadian banks to adjust their lending rate more quickly to the M-M rate fall than to the M-M rate rise.[17]

[16] Note also here that the 0.31 coefficient is statistically insignificant

[17] In addition it is not accidental at the same time in Canada the long run M-M transmission to the deposit rate coefficient is very small (0.31) and statistically insignificant as well. This implies that apart from the entrepreneurs the Canadian banks themselves are based on the USA interbank M-M for liquidity rather than being dependent on domestic depositors.

We now move to the short run rigidities or PT-originated interest rates *multipliers* (the *impact* and the two *interim effects – dependent and independent).* As we already mentioned we estimate and then sum up the two different (the negative and the positive) *impact multipliers* plus two different *independent interim multipliers,* in order to test the existence of a short run Symmetry in the examined retail (loan and deposit) markets. The separately (negative and positive) *independent interim and impact effects* are estimated. However, as they are next added they reject the short run Symmetry hypothesis. Actually we only have short run negative *Asymmetry* results, regardless of the PT variable implemented. The only exception with positive *Asymmetry* results estimated is Canada's deposit market with the M-M rate as the PT variable [see also Tables 5a and 5b].

The U.K. banking system [Table 3]

The empirical part in UK begins with the selection of the wholesale rate. As in the previous two countries, the *Johansen*'s Co-integration tests reject the existence of any long run relationship between the examined M-M and C.B. rates (C.V.(r) = 2). However, according to the VAR [short-run] block *Exogeneity* tests results, the C.B. favors a rather *Anti-inflationary* transmission monetary policy, in the short run (e.g. $i_{CB} \Rightarrow i_{mm}$). In other words, through its policy rate, the C.B. dictates its anti-inflationary objectives to the U.K. interbank M-M.

In the second stage, we observe that the GETS long run coefficients for both retail rates (the loan and the deposit one) are identical. This implies that in the long run the U.K. banks spillover to their borrowers (loans) and to their depositors the same size of the PT variable change (0.88). So the U.K. banks' profitability range, from their main economic activity (borrowing and lending money), looks to be almost zero.[18] But as was reported from the monetary policy causality tests, the C.B. policy rate is more important PT rate than the M-M one. Therefore, it is more crucial to present here the banking system interest rates behavior when C.B. rate is the PT variable. More specifically, the actual PT spread [the two different transmission long run coefficients from the PT variable to the two retail rates] in this case is equal to 0.15 (0.99-0.84). This transmission difference defines the produced banks' profitability from every C.B. rate change in the U.K.

Regarding now the long run *Symmetry* hypothesis we can observe that it is only rejected in the loans market and in particular when the C.B. rate is the PT variable. Moreover, as in the case of Canada, the derived speed of adjustment results (the θ^{-} and θ^{+} coefficients in equation 5a) are in contrast to the *Bank's Collusive* hypothesis. In other words, the downward speed of adjustment (the θ^{-} coefficient) is greater than the upward speed of adjustment (the θ^{+} coefficient). A possible economic explanation analogous to the Canada's loan market asymmetry case cannot be excluded here (considering the E.U. interbank M-M analogously to the way Canada's banking system we assume that it considers the US interbank M-M).

[18] Note that the banks' profitability can also be derived from other activities reported in their trading book (e.g. the stocks, bonds and derivatives trading) plus other financial activities.

We now move to the short run rigidities or short run PT interest rates *multipliers.* As we already mentioned, we estimate the two different (negative and positive) *impact multipliers* and then we correspondingly add the two different *independent interim multipliers.* The derived results help us to infer the existence of a short run Symmetry in the examined retail (loan and deposit) markets. The separately (negative and positive) *independent interim and impact effects* are estimated. However, as they are next added they reject the short run Symmetry hypothesis. Actually we have only short run negative Asymmetry results, regardless of the PT variable implemented. The only exception is the UK loans market, where Symmetry results are derived, and the C.B. rate is the PT variable implemented [see also Tables 5a and 5b].

The E.U. banking system [Table 4]

The empirical part begins with the selection of the wholesale rate. From the *Johansen*'s Co-integration tests, it is obvious that there is no long run relationship between the examined European M-M and C.B. rates (C.V.(r) = 2). However, according to the VAR [short-run] block *Exogeneity* tests results, we can trace the existence of short run C.B. objectives in the examined period (1999-2006). As in the US monetary system, E.U. testing favors an interest rates transmission policy, between C.B. and M-M rates, which obeys the *Accommodative (L.L.R.)* monetary policy principles ($i_{mm} \Rightarrow i_{CB}$). So in the short run, the C.B. policy rate satisfies the E.U. interbank M-M needs for liquidity.

In the second stage, we use French and German deposit and loan rates as proxies for the European banking system retail rates. Commencing now with the M-M rates, as the PT variable, we estimate the GETS long run coefficients for retail rates (loan and deposit rates) in both countries. Only the results of the French PT-derived retail rates spread [the difference between the estimated long run GETS coefficients of the deposit and lending rates] are analyzed. This is because the PT-derived retail rates spread is not calculable for the German banking system because the long run loan rates coefficient is negatively signed (-1.44). In the French banking system this PT-derived retail rates spread is equal to 0.15 (0.74-0.59).[19] This signifies the size of the French banks' profitability range – during the examined period – from its main economic activity (borrowing and lending money), initiated from the M-M rate change.

We now move our discussion to the case when the C.B. rate is the PT-originated variable. Fortunately, in this case, both countries' PT-derived retail rates spread can be calculated. More analytically, in the German banking system, the PT-derived retail rates spread is equal to 0.27 (0.90-0.63). On the other hand, the analogous French PT-derived spread is equal to 0.58 (1.22-0.64).[20] The aforementioned results signify that the French banks' profitability range is bigger than the German one, when the C.B. rate is the PT variable. Moreover, the PT-derived French retail rates spread is bigger with the C.B. rate, as the PT variable, than with the M-M rate. As for the issue of the long run *Symmetry* hypothesis, from Table 4's reported results, we can observe that it is rejected in both banking systems, regardless of the PT variable.

We now move our analysis to the short run rigidities or short run PT interest rates multipliers. The derived, by country, results can be summarized accordingly [see also Tables 5a and 5b]: In the case of the French banking system, results are derived only when M-M is the PT variable. In both French retail markets (loans and deposits) we observe the existence of a positive short run Asymmetry. On the other hand, in the case of the German banking system, both retail markets signify the existence of a negative short run Asymmetry, when the C.B. rate is used as the PT variable. On the other hand, the German banking system retail results deviate when the M-M rate is used as the PT variable (positive short run Asymmetry, in the loans market, and negative short run Asymmetry in the deposits market).

8. Conclusions

The main aim of this paper is the examination of the PT interest rates mark-up [the difference between the estimated long run GETS coefficients of the deposit and lending rates] behavior in the banking systems of the USA, Canada, U.K. and E.U. The selection of the wholesale (PT) interest rate in the PT transmission process is an important part of our discussion because it is related to the C.B. monetary policy objectives and/or vehicle policy variable which reflects the C.B. choices and effectiveness.

The empirical evidence exclusively qualifies the existence of short run dynamics. More specifically, in the USA and E.U., C.Bs seem to follow, in the short run,

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[19] The estimated long run coefficient of the French lending rates is statistically insignificant.

[20] As in the previous French PT case (when M-M is the PT variable) the estimated long run

Accommodating behavior as a "*Lender of the Last Resort*" against their interbank M-M. On the other hand, the Bank of England looks like following an *Anti-inflationary* objective [NC] while the Canadian C.B. has a rather *Mixed* objective (Structuralism).

On the issue of the banking sector interest rates PT behavior, in both banks' retail markets, we have to remind the reader that the result is linked with banks' long run profitability process. According now to the derived, on a country by country basis, results we can make the following comments: the Canadian and the US banking systems appear with the highest long run profitability range, regardless of the PT interest rate variable implemented. The E.U. banking system (in particular the French system), on the other hand, follows next with a smaller long run mark-up (or profitability range) while the U.K. banking system looks essentially without any serious long run profitability range, especially when the M-M rate is used as the PT variable. The situation in the U.K. banking system looks better when the C.B. rate is used as the PT variable.

On the issue of the long run *Symmetry* hypothesis, in the examined banking systems, we can underline the following: it was actually rejected only in three cases and all of them are related to the loan markets (US, Canada and U.K.). Nevertheless only in the US loan market is the result theoretically in accordance with the *Bank's Collusive* hypothesis. This theoretical distortion of the asymmetry results in the Canadian and British loan markets is possibly related to their firms "easy" access to the nearby huge financial and M-M systems (US and E.U. markets respectively).

Finally, on the issue of short run aggregate rigidities or *Joint* multipliers *effect,* in the banks' retail markets, we can say the following: in most of the estimated *Joint* multipliers cases [the separate sum of the negative and positive *independent interim* and *impact* multipliers], the total negative effect is bigger than the total positive one. This is observed regardless of the implemented PT variable and can be interpreted as a kind of negative short run asymmetry in most of the examined banking markets (especially for the loan markets).

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coefficient of the French lending rates is statistically insignificant.

Diagram 1 : USA interest rates (1990-2006)

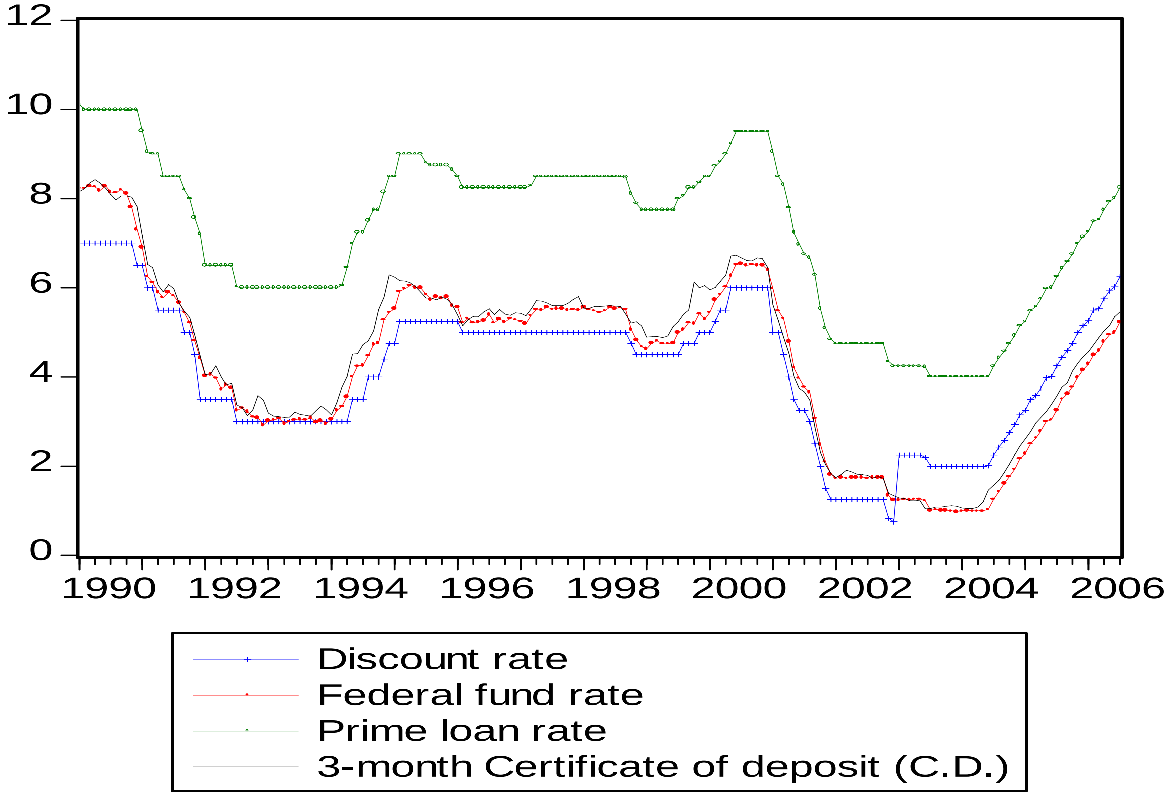

Diagram 2 : UK interest rates (1990-2006)

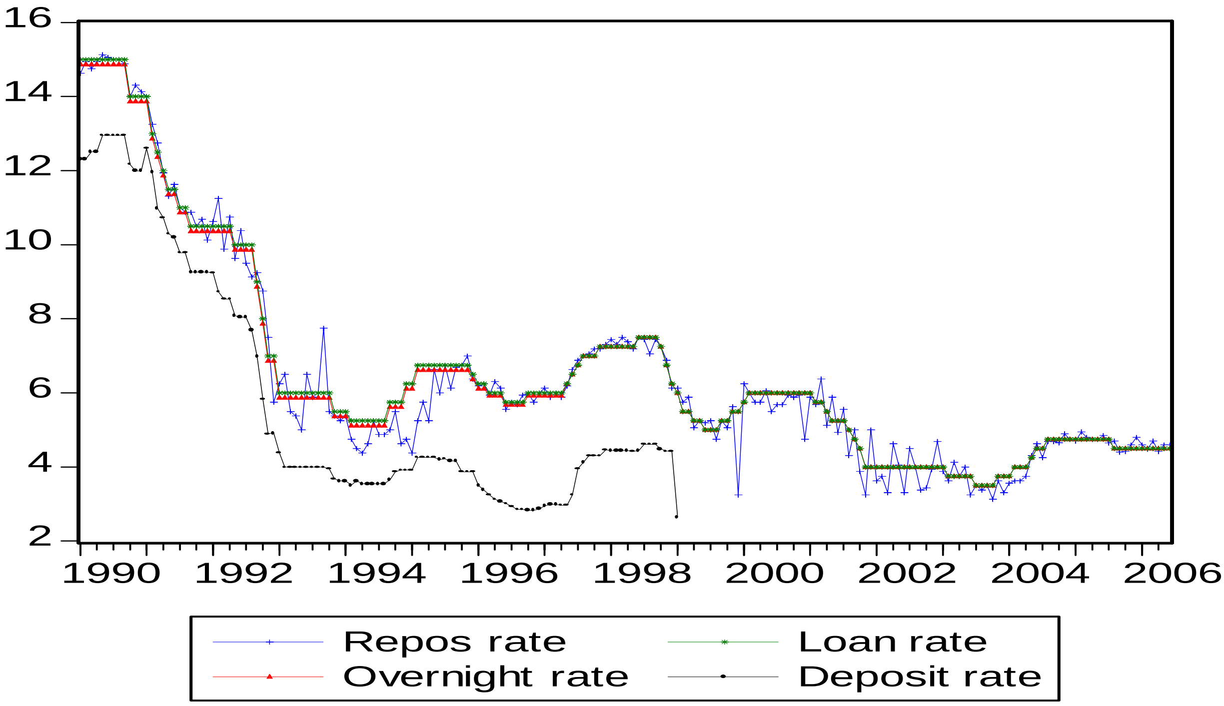

Diagram 3 : Canadian interest rates (1990-2006)

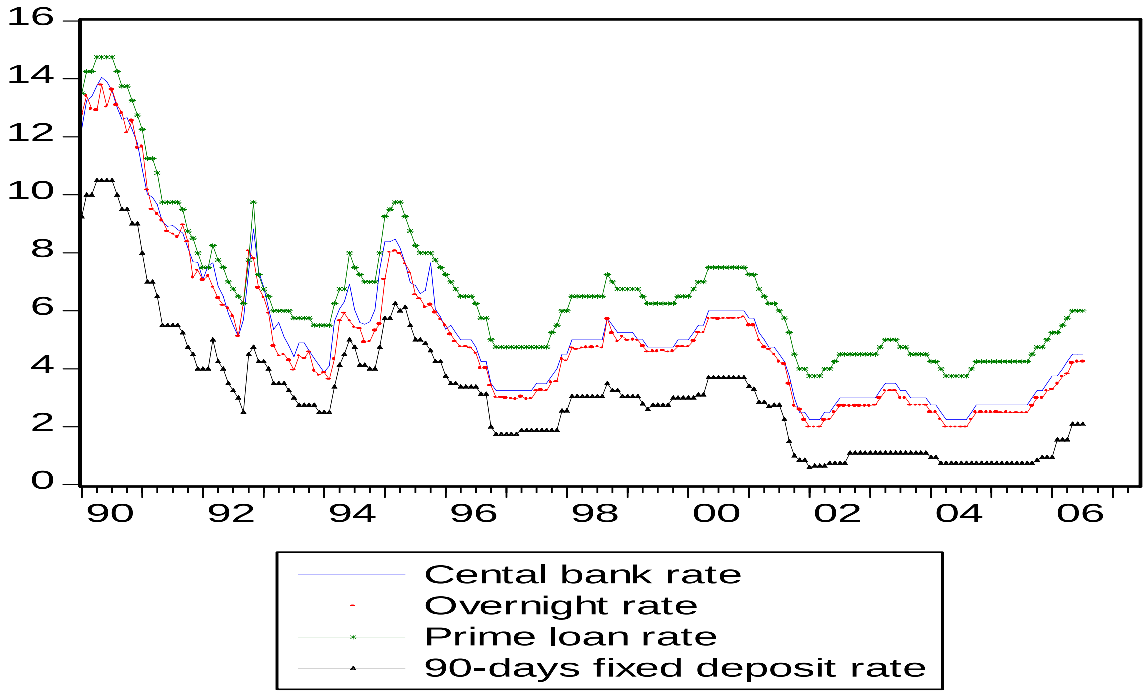

Diagram 4a : E.U. [Wholesale] interest rates (1997-2006)

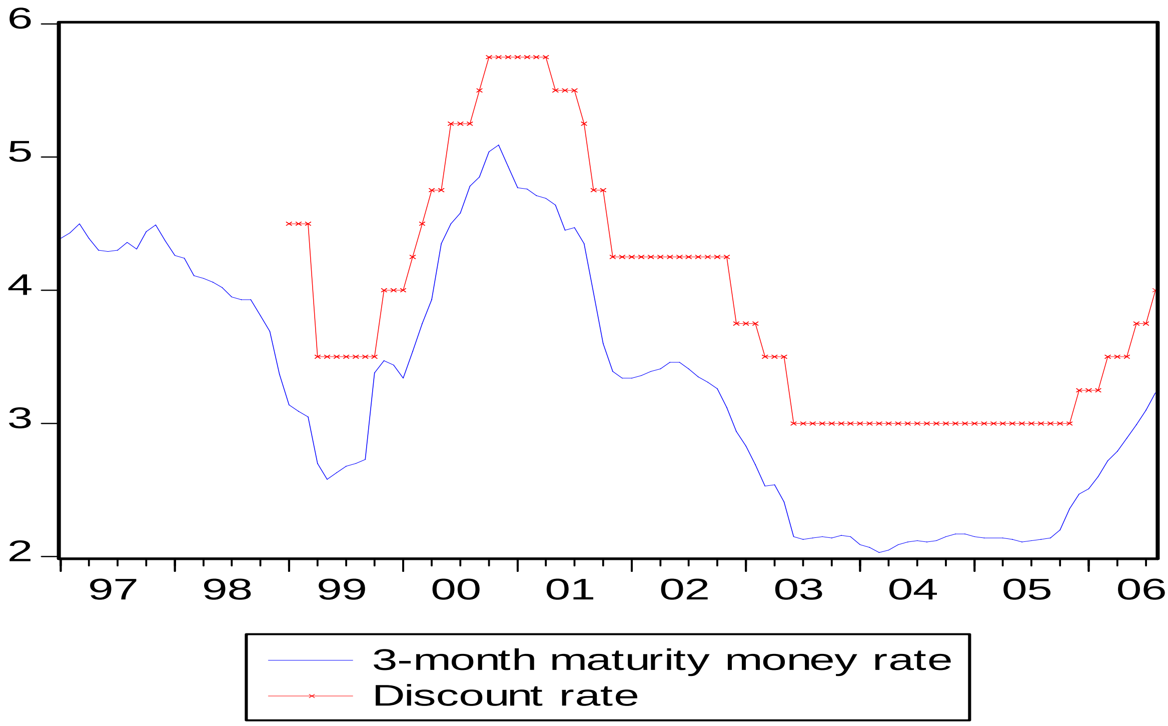

Diagram 4b : Germany's [retail] interest rates (1997-2003)

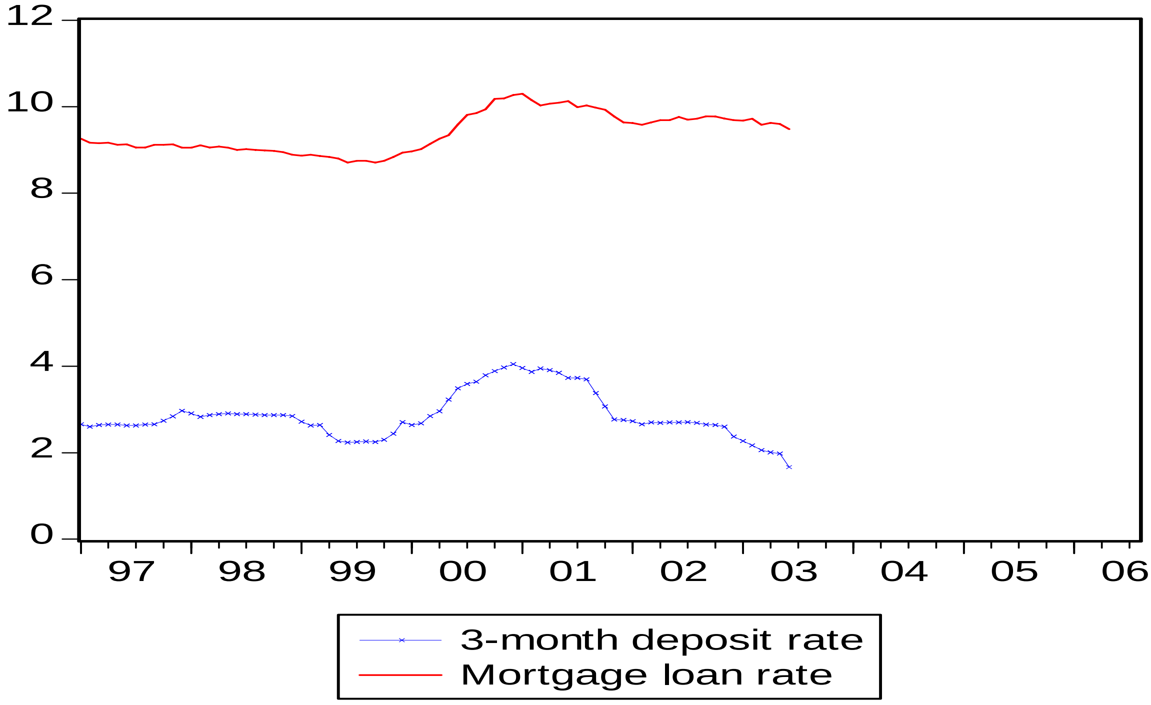

Diagram 4c : France's [retail] interest rates (1997-2006)

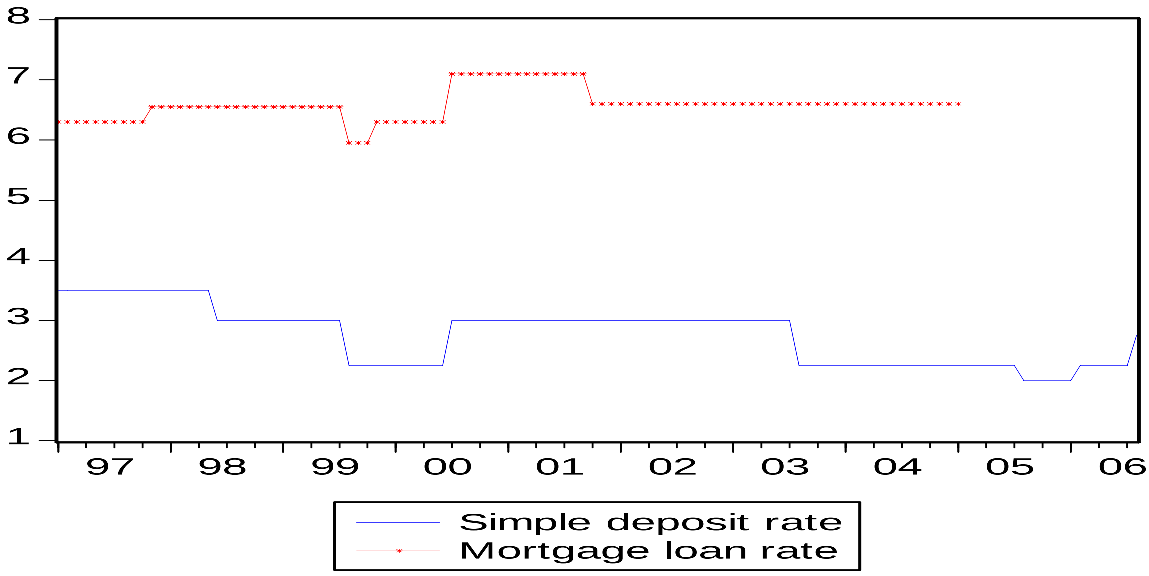

Table 1 : The U.S.A. case

The C.B. vs. M-M rate hypothesis

1. The Johansen's Co-integration tests

lag selection[f] [k]	λ Max-eigenvalue	λ - trace	C.V.(s)[∂]
4	3.85	3.85	0

2. The VAR block [short-run] Exogeneity tests

Hypothesis test[϶]	*Wald test* [$X^2(k)$]	κ (lag selection)[f]	the short run causality result
Δi_{CB} *causes* Δi_{mm}	8.31	4	
Δi_{mm} *causes* Δi_{CB}	23.43	4	$i_{mm} \Rightarrow i_{CB}$

The GETS model : the long run rigidity and the Symmetry hypotheses

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[§]	Symmetry results
(0.99) 1.06	Yes

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[§]	Symmetry results
(0.99) 1.73	No ($\theta^- < \theta^+$)[ℜ]

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[§]	Symmetry results
(0.13) 0.15	Yes[∝]

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[§]	Symmetry results
(1.36) 1.37	Yes[∝]

The short run rigidity hypothesis: the impact and interim multipliers

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.50	0.96	-	-	0.34	-

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)

	0.97	0.92	-	-0.21	0.32	0.57

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect ϖ		indep. *interim* effect ϖ	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.07*	0.54	-	0.11	-	0.24

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect ϖ		indep. *interim* effect ϖ	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.19*	0.49	1.19	-	-	0.32

Table 2: The Canadian case

The C.B. vs. M-M rate hypothesis

1. The Johansen's Co-integration tests

	lag selection^f	λ Max-	λ - trace	C.V.(s)$^\partial$

[k]	eigenvalue		
2	6.85	6.85	2

2. The VAR block [short-run] Exogeneity tests

Hypothesis test[∍]	Wald test [$X^2(k)$]	κ (lag selection)[f]	the short run causality result
i_{CB} *causes* i_{mm}	38.35	2	
i_{mm} *causes* i_{CB}	16.11	2	$i_{mm} \Leftrightarrow i_{CB}$

The GETS model : the long run rigidity and the Symmetry hypotheses

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[ξ]	Symmetry results
(0.30)* 0.31*	Yes[∝]

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[ξ]	Symmetry results
(0.91) 1.46	No ($\theta^- > \theta^+$)[ℜ]

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[ξ]	Symmetry results
(0.80) 0.66	Yes

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[ξ]	Symmetry results
(0.92) 1.35	Yes

The short run rigidity hypothesis: the impact and interim multipliers

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.56	0.40	-0.47	-	0.53	0.35

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)

	0.45	0.84	-	-1.16	0.30	1.26

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.44	0.58	-0.86	-	0.80	0.29

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.58	0.89	-	-	-	-

Table 3 : The U.K. case

The C.B. vs. M-M rate hypothesis

1. The Johansen's Co-integration tests

	lag selection[f] [k]	λ Max-eigenvalue	λ - trace	C.V.(s)[∂]
	4	12.04	12.04	2

2. The VAR block [short-run] Exogeneity tests

Hypothesis test[϶]	Wald test [$X^2(k)$]	κ (lag selection)[f]	the short run causality result
i_{CB} *causes* i_{mm}	97.79	2	
i_{mm} *causes* i_{CB}	1.40	2	$i_{CB} \Rightarrow i_{mm}$

The GETS model : the long run rigidity and the Symmetry hypotheses

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[ξ]	Symmetry results
(1.00) 0.88	Yes

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[ξ]	Symmetry results
(0.78) 0.88	Yes[∝]

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

the Long run coefficients[ξ]	Symmetry results
(1.17) 0.84	Yes

-Retail rate variable : Loan rate (i_{Loan})

the Long run coefficients[ξ]	Symmetry results
(0.98) 0.99	No $(\theta^- > \theta^+)^{\Re}$

The short run rigidity hypothesis: The impact and interim multipliers

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect[ω]		indep. *interim* effect[ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
	0.08*	0.23	-	-	-	0.70

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect	dep. *interim* effect[ω]	indep. *interim* effect[ω]

	(+)	(-)	(+)	(-)	(+)	(-)
	0.08*	0.14	-	0.03	-	-

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect ω		indep. *interim* effect ω	
	(+)	(-)	(+)	(-)	(+)	(-)
	–0.79*	0.70	-	-	-	0.43

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect ω		indep. *interim* effect ω	
	(+)	(-)	(+)	(-)	(+)	(-)
	1.00	1.00	-	-	-	-

Table 4 : The E.U. case

The C.B. vs. M-M rate hypothesis

1. The Johansen's Co-integration tests

lag selection^{f} [k]	λ Max-eigenvalue	λ - trace	C.V.(s)$^{\partial}$
9	4.39	4.39	2

2. The VAR block [short-run] Exogeneity tests

Hypothesis test$^{\ni}$	Wald test [$X^2(k)$]	κ (lag selection)^{f}	the short run causality result
i_{CB} *causes* i_{mm}	18.28	9	
i_{mm} *causes* i_{CB}	119.69	9	$i_{mm} \Rightarrow i_{CB}$

The GETS model : the long run rigidity and the Symmetry hypotheses

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

	the Long run coefficients $^{\xi}$	Symmetry results
[Germany]	(1.20) 1.17	Yes$^{\propto}$
[France]	(0.43) 0.59	Yes

-Retail rate variable : Loan rate (i_{Loan})

	the Long run coefficients $^{\xi}$	Symmetry results
[Germany]	(-1.53) -1.44	Yes$^{\propto}$
[France]	(0.24)* 0.74*	Yes$^{\propto}$

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

	the Long run coefficients $^{\xi}$	Symmetry results
[Germany]	(0.60) 0.63	Yes$^{\propto}$
[France]	(0.39) 0.64	Yes$^{\propto}$

-Retail rate variable : Loan rate (i_{Loan})

	the Long run coefficients $^{\xi}$	Symmetry results
[Germany]	(0.58) 0.90	Yes$^{\propto}$
[France]	(0.23)*1.22*	Yes$^{\propto}$

The short run rigidity hypothesis: the impact and interim multipliers

1. Pass through policy variable : Interbank M-M rate (i_{mm})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect $^{\omega}$		indep. *interim* effect $^{\omega}$	
	(+)	(-)	(+)	(-)	(+)	(-)

[Germany]	0.20	0.56	-	-	0.21	0.54
[France]	-0.03*	0.03*	-	-	0.63	-

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
[Germany]	0.008*	0.06*	0.47	-	0.57	0.14
[France]	-0.51	0.21*	-0.66	-	1.01	-

2. Pass through policy variable : Central bank rate (i_{CB})

-Retail rate variable : Deposit rate (i_D)

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
[Germany]	0.29*	0.39	-	-	-	0.25
[France]	-0.42*	-0.06*	-	-	-	-

-Retail rate variable : Loan rate (i_{Loan})

Multipliers	*impact* effect		dep. *interim* effect [ω]		indep. *interim* effect [ω]	
	(+)	(-)	(+)	(-)	(+)	(-)
Germany]	0.26*	0.10	-	-	-	-
[France][ψ]	0.30[ψ]	0.006[ψ]	-	-	-	-

f. The lag selection criterion was based on five different tests (the LR statistic (*LR*), the Final Prediction error test (*FPE*), the Akaike Criterion (*AIC*), the Schwarz Criterion (*SC*), the Hannan-Quinn Criterion (*HQ*).

∂ . C.V. : number of Co-intergarting Vectors (at 5% level).

϶. Following Lutkepohl and Reimers (1992) comments, upon the number of C.V.'s in a bivariate VAR, the *block* [short-run] *Exogeneity test* will be contacted as follows*:* For *C.V.* = 1, the two variables -i_{CB} and i_{mm}- are considered as co-integrated in the sense of Granger and Engle (1987). On the other hand if *C.V.* = 0 then a bivariate VAR short run *Exogeneity* test will be applied at the first differences. Finally, for *C.V. = 2*, the bivariate VAR short run *Exogeneity* test can be applied at the levels (without taking differences).

⋛. The result in parenthesis is the long-run PT relationship without any constant term in the regression (the ϕ_1 coefficient in equation 5a). The alternative is the $\phi_1 + \gamma$ coefficients (see Heffernan, 1997).

∝. Indicates that one or both the speed of adjustment coefficients [θ^{-} *and* θ^{+} in equation 5a] are statistically insignificant.

*. Indicates that the t-coefficients are statistically insignificant.

ℜ. The $\theta^{-} < \theta^{+}$ are the negative and positive speed of adjustment coefficients in equation 5a.

ω. Only statistically significant coefficients are added.

ψ. These results are problematic because the singular covariance coefficients are not unique.

Table 5a: Summary of the short run rigidity (or asymmetry) results in the deposits market

Pass through

policy variable :	*M-M* rate	*C.B.* rate
USA	(-) asymmetry	(-) asymmetry
UK.	(-) asymmetry	(-) asymmetry
Canada	(+) asymmetry	(-) asymmetry
E.U.		
[Germany]	(-) asymmetry	(-) asymmetry
[France]	(+) asymmetry	?

(-) & (+): stands for negative and positive respectively

Table 5b: Summary of the short run rigidity (or asymmetry) results in the loans market

Pass through policy variable :	*M-M* rate	*C.B.* rate
USA	(-) asymmetry	(-) asymmetry
UK.	(-) asymmetry	symmetry
Canada	(-) asymmetry	(-) asymmetry
E.U.		
[Germany]	(+) asymmetry	(-) asymmetry
[France]	(+) asymmetry	?

(-) & (+): stands for negative and positive respectively

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