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Léonore Raguideau-Hannotin

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Membre de l'université Paris Lumières

# Léonore Raguideau-Hannotin

## **Pays d'Europe Centrale et du Sud-Est : Analyse de l'intégration financière, monétaire et bancaire avec l'Union Européenne et la zone Euro**

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en vue de l'obtention du doctorat de Sciences économiques de  
l'Université Paris Nanterre  
sous la direction de M. Jean-Pierre ALLEGRET (Université Côte d'Azur)

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# Introduction



La thèse porte sur les problématiques d'intégration financière, monétaire et bancaire des pays Membres de l'Union Européenne (UE) situés géographiquement en Europe Centrale et du Sud-Est (pays CESEE), à savoir la Bulgarie, la Croatie, la Hongrie, la Pologne, la République Tchèque et la Roumanie, dans le contexte institutionnel spécifique de l'UE. Ces six pays partagent une histoire commune suite à leurs adhésions successives à l'UE dans les années 2000, après avoir précédemment partagé l'expérience socialiste comme pays membres du Bloc de l'Est entre la fin des années 1940 jusqu'en 1991, puis une période de transition vers l'économie de marché durant la décennie 1990. Ils partagent enfin une histoire plus ancienne avec leurs voisins de l'Europe du milieu situés entre l'Allemagne et la Russie : nombre de ces pays ont été annexés ou vassalisés par les Empires hasbourgeois et ottomans entre les XIV<sup>ème</sup> et XIX<sup>ème</sup> siècles, parfois pendant cinq siècles.

De par la richesse de leur histoire récente, différents processus économiques sont à l'oeuvre au sein de ces pays de façon concomitante, processus qui font l'objet de recherches en économie. En premier lieu, la transition vers l'économie de marché (processus proche de l'achèvement en 2015 tel que mesuré par les indicateurs de transition de la Banque Européenne pour la Reconstruction et le Développement) ; en deuxième lieu, l'intégration au commerce et aux flux de capitaux internationaux et plus particulièrement, intra-européens ; en troisième lieu, la convergence nominale comme condition nécessaire à l'adhésion à la zone Euro et telle que mesurée par les critères de Maastricht ; enfin, la convergence réelle au sein de l'Union Economique et Monétaire (UEM), favorisée par les transferts transnationaux via les fonds structurels et mesurée par le niveau de revenu par habitant.

Les processus d'intégration financière, monétaire et bancaire de ces économies au sein de l'Union Européenne sont particulièrement intéressants pour trois raisons principales que nous développerons dans la section suivante. Tout d'abord, un certain nombre de caractéristiques de cette intégration sont spécifiques aux pays CESEE par rapport à d'autres pays émergents, comme par exemple la détention de leurs actifs bancaires par de grands groupes bancaires européens. Par ailleurs, la récurrence de crises financières depuis trois décennies et leurs coûts macroéconomiques et financiers nous amènent à réfléchir aux effets de cette intégration sur les mécanismes d'ajustement aux chocs. Ceci paraît d'autant plus important que les pays CESEE présentent une grande variété de régimes monétaires et de change, ce qui peut induire des réponses différentes de politique économique en cas de choc. Enfin, bien que leur statut actuel vis-à-vis de l'Union Economique et Monétaire soit assez varié, l'analyse de leur intégration monétaire et bancaire permet d'apporter des éléments de réponse aux débats sur l'adhésion à la monnaie unique et sur la participation anticipée à l'Union Bancaire. Ces débats ont de l'importance à un moment où la convergence des niveaux de développement des pays CESEE avec les pays de la zone Euro, mesurée par l'évolution du revenu réel par habitant en parité de pouvoir d'achat, se ralentit depuis la crise financière globale de 2008, pour

les pays du Sud-est particulièrement (graphique 1). Les PIB réels par habitant se situent en 2019 entre 60 et 70% de la moyenne de la zone Euro (à l'exception de la République Tchèque, autour de 90% et de la Bulgarie à 50%).

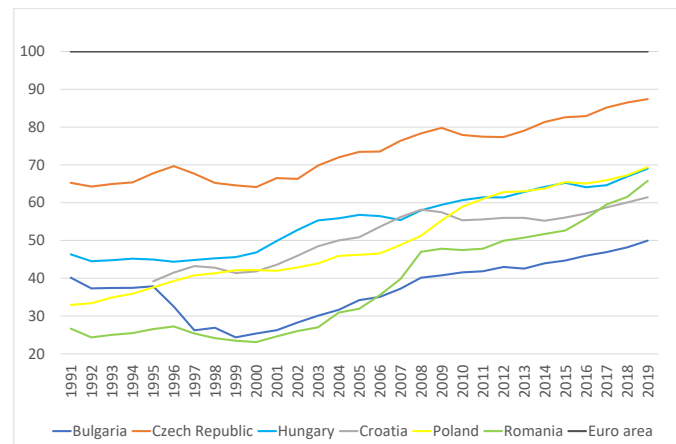


FIGURE 1 – Revenu réel par habitant (PPA)

Notes : Volume indices % Euro area; Source : WB World Development Indicators

Nous allons dans un premier temps définir les processus d'intégration financière, monétaire et bancaire à l'oeuvre dans les pays CESEE, en s'appuyant sur des indices synthétiques ou agrégés. Puis dans un deuxième temps, nous analyserons les vulnérabilités financières communes ainsi que l'état d'avancement du processus d'intégration européenne vers l'UEM. Etant donné ce contexte, nous développerons enfin l'état de la littérature ainsi que les motivations, stratégies empiriques et résultats des trois chapitres.

## 0.1 Définition et mesures de l'intégration financière, monétaire et bancaire des pays CESEE

Si l'on souhaite caractériser le niveau global d'intégration financière de ces économies en utilisant des mesures synthétiques, il existe des indices de jure et de facto de la même manière que pour la classification des taux de change. Quand on utilise une mesure de facto comme l'indice d'ouverture financière en volume de Lane and Milesi-Ferretti (2018) en graphique 2, les pays CESEE ont un degré d'ouverture deux fois moindre que la zone Euro, à l'exception notable de la Hongrie. Quand on considère une mesure de jure comme l'indice d'ouverture financière de Chinn and Ito (2006), qui reflète le degré de libéralisation des flux de capitaux, il apparaît que la majorité des pays CESEE ont atteint au début des années 2000 un degré d'intégration financière comparable à ceux des pays Membres de la zone Euro (graphique 3a). Les pays présentant actuellement le degré d'ouverture financière le plus faible sont la Pologne et la Croatie. Quel que soit l'indice d'intégration financière retenu, il apparaît néanmoins que ce phénomène est commun à tous les pays.

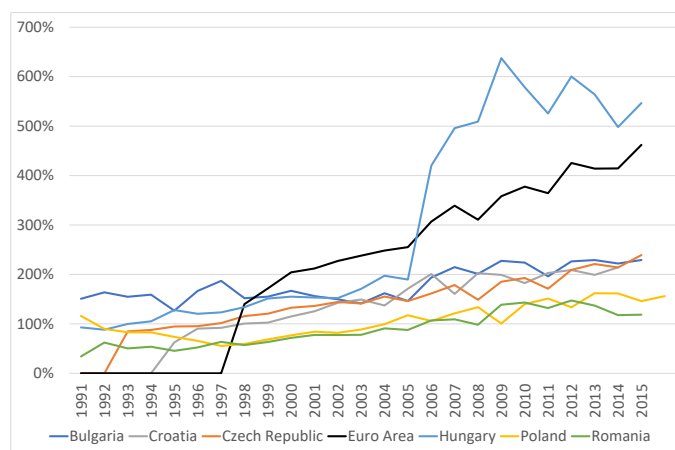
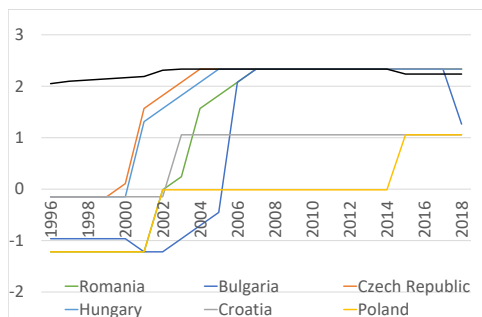


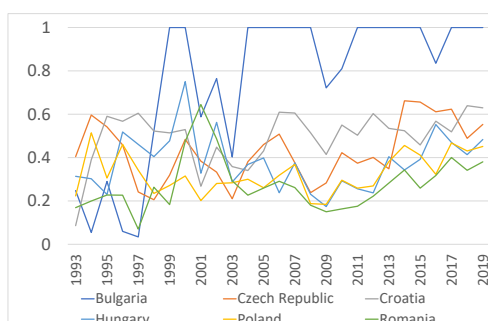
FIGURE 2 – Indice d'intégration financière en volume

Notes : Ratio de la somme des actifs et passifs sur le PIB, exprimé en dollar courants. Source : EWN database

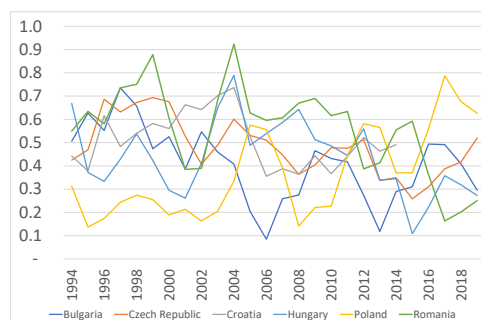
L'intégration monétaire des pays CESEE au niveau international peut elle aussi se mesurer grâce aux deux autres indices du trilemme de politique monétaire de [Aizenman et al. \(2008\)](#), relatifs à la stabilité du taux de change et à l'indépendance monétaire (graphiques 3b et 3c). Il apparaît ainsi que le degré d'indépendance monétaire s'est tendanciellement réduit depuis 2004. La Hongrie, la Roumanie et la Bulgarie ont en 2018 l'indépendance monétaire la plus faible (indices autour de 0,3), tandis que la Pologne est la plus indépendante monétairement (indice égal à 0,65).



(a) Ouverture financière



(b) Stabilité du taux de change



(c) Indépendance monétaire

FIGURE 3 – Les indices du trilemme monétaire

Notes : Plus l'indice est élevé, plus le taux de change est stable, l'indépendance monétaire est forte ou l'ouverture financière élevée ; Source : [Aizenman et al. \(2008\)](#)

Pour autant, l'intégration monétaire à la zone Euro recouvre une réalité différente car elle est encadrée et officiellement mesurée par des critères de convergence de Maastricht, qui donnent des niveaux de référence des variables monétaires (taux d'inflation, taux d'intérêt et taux de change) et de finance publique (dette et déficit public).

Ces critères de convergence ne donnent néanmoins pas d'information sur l'intégration monétaire effective, qui elle ne fait pas l'objet d'une mesure synthétique comme ses équivalents commerciaux ou financiers qui reposent sur des flux (ratio d'ouverture commerciale, indice d'intégration financière en volume). La question de la mesure de l'intégration monétaire des pays CESEE avec la zone Euro sera ainsi au coeur de notre deuxième chapitre.

Si l'on s'intéresse enfin au processus d'intégration bancaire des pays CESEE avec la zone Euro, on peut le caractériser comme précédemment en utilisant des indicateurs agrégés en volume, et en comparant dans un premier temps la dynamique des prêts des pays CESEE en fonction du type d'emprunteur (interbancaires d'une part et au secteur privé et gouvernement d'autre part) avec celles de la zone Euro. Cette analyse permet de déterminer si l'horizon d'intégration par les flux est de court terme ou long terme.

Pour ce faire, nous précisons tout d'abord le contexte global d'intégration bancaire au niveau intra zone Euro. Celle-ci devrait à priori être soutenue par la mise en place de l'Union Bancaire depuis 2012 : pour autant, l'évolution récente des indicateurs en volumes depuis la crise financière de 2008 vont dans le sens d'une décroissance puis d'un redémarrage très lent du niveau global des prêts bancaires.

Le graphique 4, qui s'intéresse aux prêts interbancaires (qui constituent le marché professionnel des prêts entre institutions financières), montre que la proportion de ceux-ci a diminué en proportion de la totalité des prêts accordés pour les douze pays coeur de la zone Euro, particulièrement en Autriche, Belgique, Allemagne, Grèce et Chypre (avec des niveaux initiaux moyens de 30% des prêts totaux dans la période de forte croissance du crédit précédant la crise financière de 2008, qui ont été divisés par deux depuis). Par ailleurs, tel qu'indiqué dans le graphique 5, le volume global de prêts transfrontières aux secteurs privé et public hors institutions financières, n'a retrouvé son niveau de 2011 qu'en 2019. Ce phénomène de retranchement des flux bancaires en zone Euro post crise financière de 2008, voire de désintégration financière, a été identifié par la littérature ([Bouvatier and Delatte, 2015](#)).

Il n'en va pas de même pour les pays CESEE pour lesquels il apparaît en graphique 4 que la proportion de prêts interbancaires a faiblement décliné seulement sur la même période (sur une base initiale moyenne de 5% des prêts totaux). Comme nous le verrons dans notre analyse des vulnérabilités financières communes, l'intégration bancaire par les flux des pays CESEE au niveau européen ne s'est pas faite par les prêts interbancaires transfrontières comme intra zone Euro mais par une explosion des créances bancaires locales en devises locales (graphique 13), portées par des filiales de banques européennes.



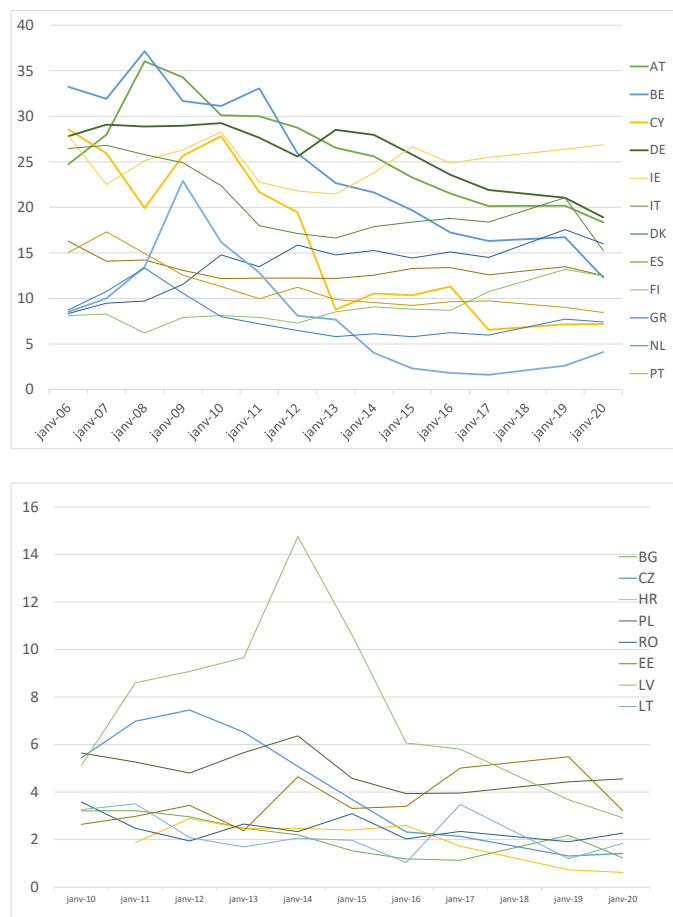


FIGURE 4 – Prêts interbancaires dans la zone Euro (12), dans les pays CESEE et les pays Baltes

Data source : ECB Risk Assessment Indicators ; % of total loans by country LHS

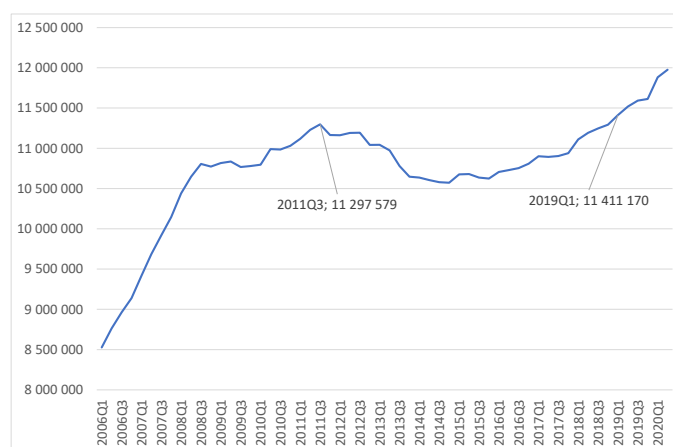


FIGURE 5 – Prêts bancaires aux ANF des institutions de crédit de la zone Euro, intra zone Euro : Evolution depuis 2006

Data source : ECB Balance Sheet Items, quarterly data ; LHS : millions of Euros

L’horizon d’intégration bancaire des pays CESEE est donc de long terme et soutenue par la demande de crédit des secteurs privé non financier et public. Il apparaît d’ailleurs que ce type de prêts a commencé à décroître plus tardivement qu’en zone Euro (en proportion du PIB, à partir de 2012, tel qu’indiqué par les statistiques agrégées du WDI de la Banque Mondiale), ce qui est en faveur d’un cycle de crédit différent entre pays CESEE et pays de la zone Euro.

## 0.2 Importance des vulnérabilités financières et de l’intégration européenne

Après avoir rappelé la succession de crises financières depuis le début des années 1990 et leurs impacts sur la volatilité de la croissance économique, nous allons préciser certains faits stylisés relatifs à l’intégration financière et bancaire des pays CESEE, à savoir l’accumulation de vulnérabilités financières, des caractéristiques structurelles des systèmes bancaires communes, avant de préciser leur statut actuel vis-à-vis de l’UEM.

L’histoire économique récente des pays CESEE a été marquée par une forte occurrence de chocs financiers, de type et de nature variés (structurels, conjoncturels, idiosynchroniques, globaux). Le tableau 1 en annexe récapitule les dates de ces crises telles qu’estimées par [Laeven and Valencia \(2008\)](#) et [Reinhart et al. \(2008\)](#) pour les crises bancaires et les crises de change, et par [Forbes and Warnock \(2012\)](#); [Eichengreen and Gupta \(2016\)](#); [David and Gonçalves \(2019\)](#) pour les épisodes de tarissement des flux de capitaux internationaux ou sudden stops. Chaque méthodologie a ses spécificités pour dater les crises, mais il apparaît néanmoins que les années 1990 sont marquées par des crises bancaires et des défauts souverains, qui durent souvent plusieurs années, au début de la période de transition vers l’économie de marché. Elles sont suivies de crises de change en Bulgarie, Roumanie et République Tchèque, qui conduisent à un changement de régime de change pour la Bulgarie. Les crises financières changent ensuite de nature durant les années 2000 et deviennent presque exclusivement des sudden stops. La décennie des années 2010 fait suite à la crise financière globale en 2008-2009 qui a provoqué des crises de balance des paiements en Hongrie et en Roumanie, qui ont nécessité une aide conjointe du FMI et de l’Union Européenne. Certains pays CESEE ont aussi été confrontés à la réapparition de crises bancaires domestiques (Bulgarie) et des phénomènes globaux de tarissement des flux de capitaux internationaux (en 2013 et en 2015), à l’origine de dépréciations des monnaies domestiques et d’une plus grande volatilité de la croissance du PIB (Croatie, Hongrie, République Tchèque). Si l’on s’intéresse au coût macroéconomique de ces crises, en menant une analyse standard des taux de croissance du PIB réel et de leurs volatilités au graphique 6, il apparaît une instabilité de la croissance économique, avec un taux de croissance fortement volatil (en absolu et en relatif par rapport à l’Allemagne, qui a connu la réunification). Par ailleurs, il y a eu une baisse très marquée de celui-ci lors de la crise financière globale de 2008, supérieure à celle observée dans d’autres pays émergents ([Allegret, 2012](#)).

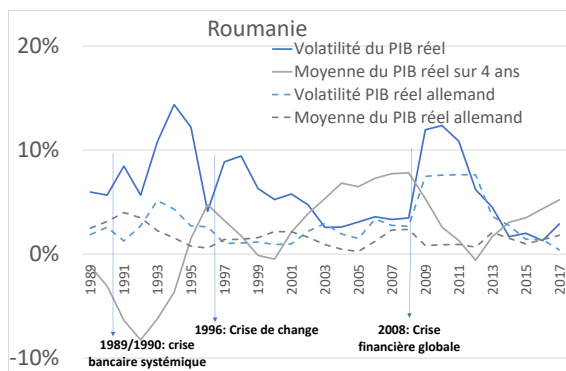
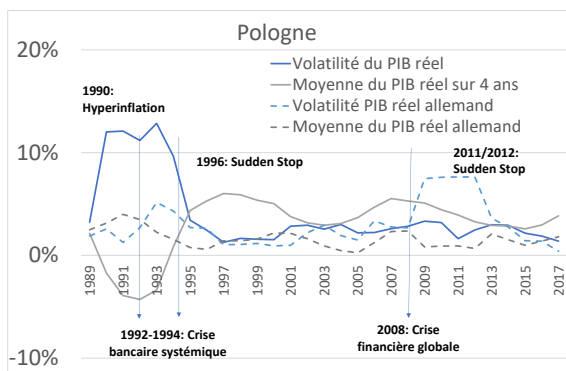
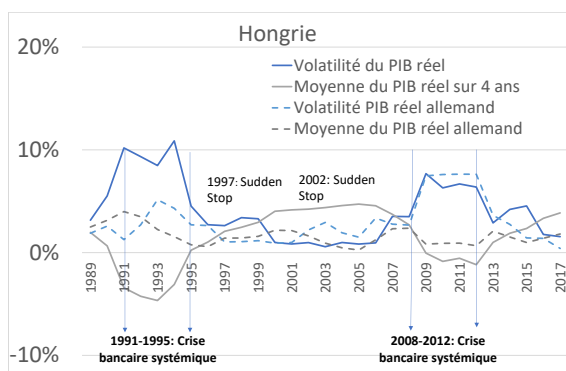
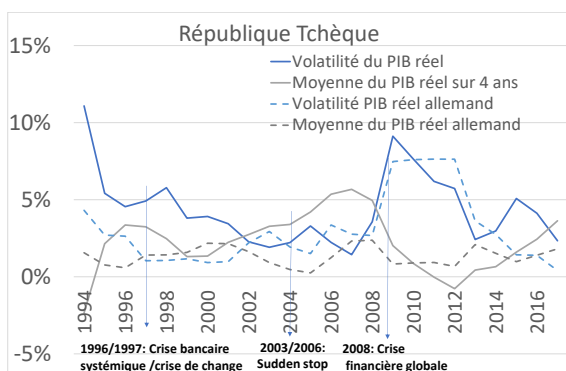
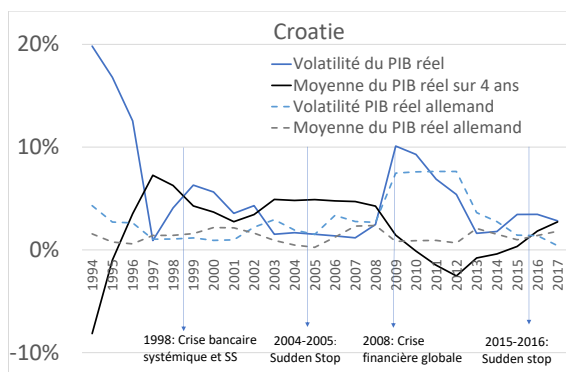
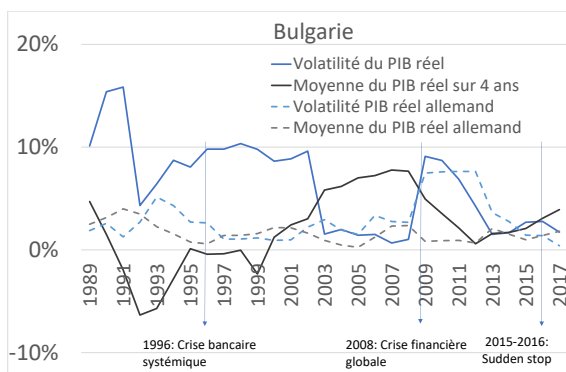


FIGURE 6 – Taux de croissance et volatilité annuels du PIB réel par habitant et par pays

Notes : Volatilité calculée comme l'écart-type du taux de croissance moyen du PIB réel sur les quatre années précédentes, glissantes au cours de la période ; Source PIB réel et population : PWT

Les décennies 1990 et 2000 ont aussi été marquées par la libéralisation financière, particulièrement du compte de capital. La vitesse de libéralisation a été variable selon les pays et souvent fonction des perspectives d’adhésion à l’OCDE et à l’Union Européenne (Arvai, 2005). La République Tchèque fait partie des pays qui ont le plus rapidement ouvert leur compte de capital, tandis que la Hongrie, la Pologne ont été plus prudents dans leur ouverture aux capitaux étrangers. Les pays CESEE ont connu une forte dégradation de leur position extérieure nette entre 1990 et 2009, tout d’abord sous la forme d’entrées nettes massives d’investissements directs à l’étranger dans la décennie 1990, puis à cause du poids des créances bancaires transfrontières (graphique 7). Cette dépendance extérieure est par ailleurs caractérisée par une forte concentration géographique des pays investisseurs et créanciers dans l’Union Européenne.

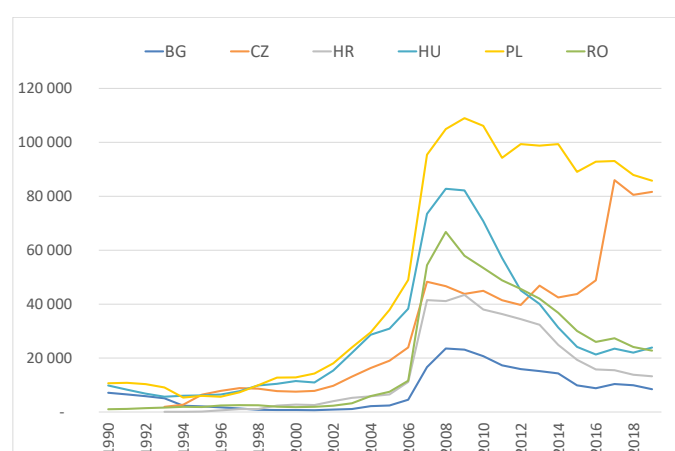


FIGURE 7 – Créances bancaires transfrontières

Notes : en millions de dollars US ; Source : Fond Monétaire International

Cette libéralisation financière a permis à un certain nombre de grands groupes bancaires européens de prendre des participations dans les banques des pays CESEE, lors des vagues de privatisations au début de la période de transition. Les actifs bancaires sont ainsi majoritairement détenus par des groupes bancaires européens. Hüttl and Schoenmaker (2016) précisent qu’entre 55 et 75% des actifs bancaires étrangers trouvent leur origine dans les pays de la zone Euro. Le graphique 9 qui s’intéresse à la période 2007-2019 nous montre qu’il existe deux groupes de pays distincts : d’une part, la Hongrie et la Pologne dont les actifs bancaires sont détenus pour moitié par des investisseurs étrangers (avec un fort mouvement de renationalisation bancaire depuis la crise financière globale de 2008). D’autre part, la Bulgarie, la Croatie, la République Tchèque et la Roumanie dont la proportion de détention étrangère des actifs bancaires varie entre 75 et 90%. Dans les deux cas, ces niveaux de détention étrangère des actifs bancaires sont bien supérieurs au niveau moyen au sein de la zone Euro et de l’UE, respectivement à 15 et 20% en 2019.

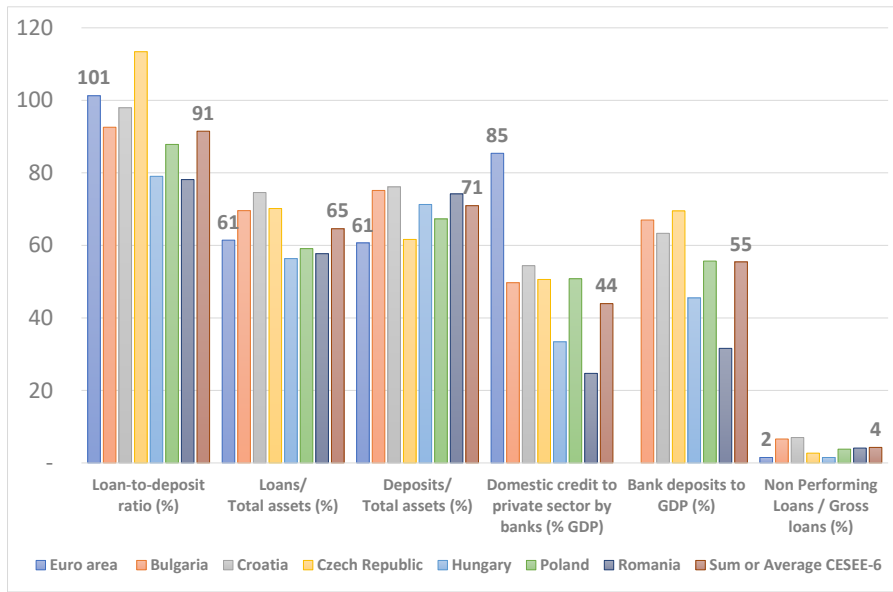


FIGURE 8 – Caractéristiques des systèmes bancaires en 2019  
Source : Statistiques bancaires consolidées de la BCE

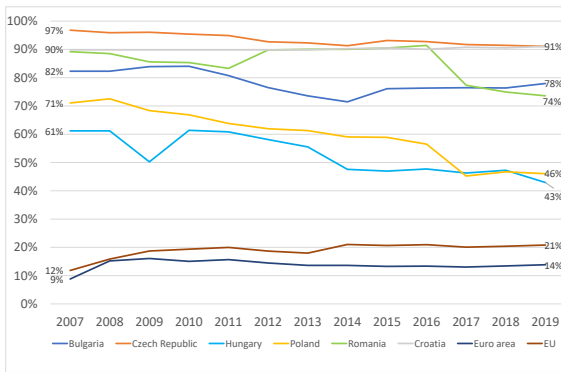


FIGURE 9 – Détention étrangère des actifs bancaires (% total actifs)  
Source : Statistiques bancaires consolidées de la BCE

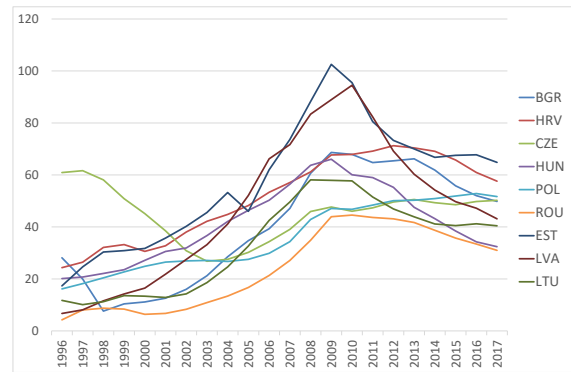


FIGURE 10 – Crédit domestique (% PIB)  
Légende : ISO3-codes ;  
Source : WB Global Financial Development

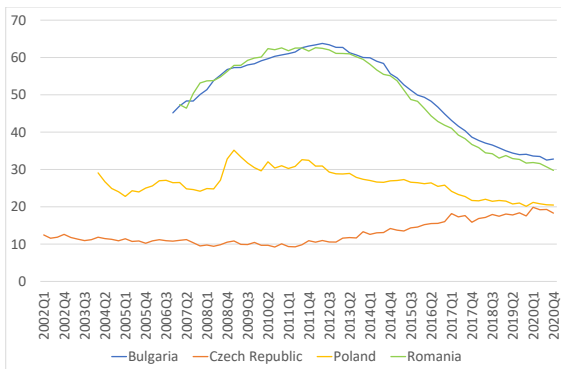


FIGURE 11 – Prêts en devise étrangère (% volume total prêts)  
Source : ECB SDW

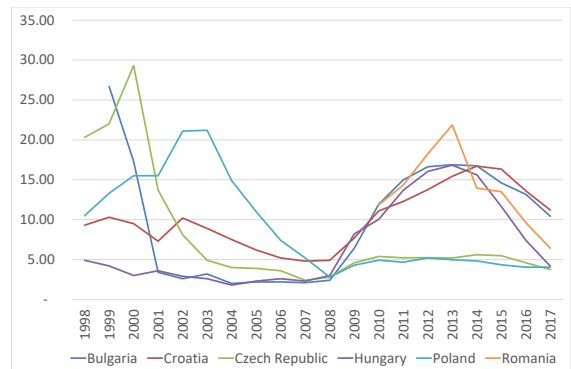


FIGURE 12 – Prêts non performants (% volume total prêts)  
Source : WB WDI

Enfin, si l'on compare les secteurs bancaires des pays CESEE avec celui de la zone Euro, il est notable que la taille des secteurs bancaires (en volume et relativement au PIB) est très inférieure de celle de la zone Euro. En 2019, les actifs bancaires des six pays CESEE représentent 1.13 trillion d'euros, alors qu'au niveau de l'UE ils représentent près de 43 trillions d'euros. Il apparaît aussi que certains ratios de liquidité (ratio prêt/dépôt) ou de financement (ratio dépôts/actif, ratio prêts/actifs) convergent vers voire dépassent la moyenne de la zone Euro. Les dépôts couvrent désormais presque intégralement les prêts. L'ensemble de ces indicateurs sont résumés pour l'année 2019 dans le graphique 8.

Néanmoins, d'autres indicateurs identifiés dans la littérature comme des vulnérabilités financières (Ghosh et al., 2014) tels que les volumes de crédit domestique au secteur privé ou le niveau des prêts en devises étrangères, diffèrent nettement de ceux de l'Union Européenne, en particulier leur dynamique. En effet, le modèle de financement externe de ces économies ainsi que les caractéristiques structurelles de leurs systèmes bancaires ont entraîné une croissance excessive du crédit bancaire domestique privé. La détention massive des actifs bancaires par de grands groupes européens a rendu inopérantes les politiques microprudentielles de contrôle du crédit dans la période précédant la crise financière de 2008. Le graphique 10 montre qu'en moyenne le poids du crédit domestique en proportion du PIB a triplé entre 2000 et 2010, voire quintuplé pour la Bulgarie, la Hongrie et la Roumanie.

Deux dynamiques distinctes ont été à l'oeuvre qui ont renforcé les vulnérabilités financières liées au crédit bancaire :

- en premier lieu, une forte croissance des créances libellées en devises étrangères (graphique 11), en particulier en Hongrie, en Roumanie et en Bulgarie, qui a créé de larges positions de change non couvertes au passif des ménages.

- en second lieu, une croissance exponentielle des prêts locaux en monnaie locale octroyés par les filiales de banques étrangères, dont on voit la dynamique dans les statistiques bancaires consolidées de la BRI (graphique 13). L'extension de ce type de créances est un fait stylisé commun aux pays émergents, mais l'ampleur du phénomène dans les pays CESEE est caractéristique.

Ces phénomènes sont à l'origine d'une forte augmentation des prêts non-performants après la crise financière de 2008 (graphique 12) : ils ont représenté jusqu'à 17% en moyenne du portefeuille de prêts en 2012-2013.

Ces vulnérabilités financières caractéristiques des pays CESEE ont fait l'objet de suivis et de politiques de réduction spécifiques, voire même de restructuration/conversion du portefeuille au niveau national (Hongrie), qui ont été efficaces très rapidement. Le niveau de prêts non performants ne représente plus en 2019 que 4% du portefeuille en moyenne, ce qui correspond néanmoins au double du niveau moyen européen.

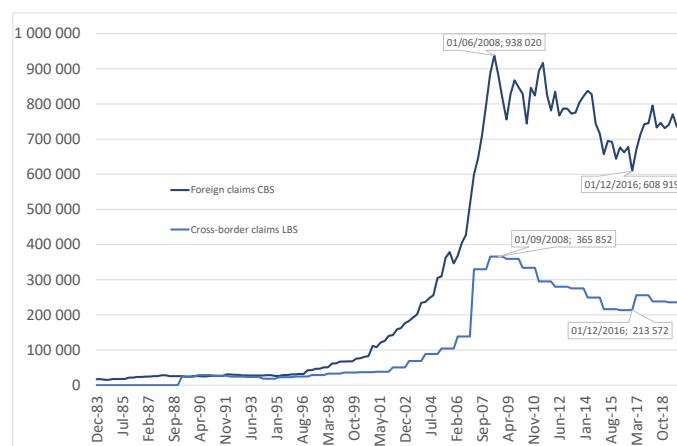


FIGURE 13 – Evolution des créances bancaires transfrontières et consolidées agrégées  
Unité : Millions de dollars US ; Source : Statistiques bancaires territoriales et consolidées de la BRI

Si l'on s'intéresse finalement aux situations de chaque pays vis-à-vis de l'Union Economique et Monétaire, ces Etats Membres ne font actuellement pas partie de la zone Euro et sont censés à terme adhérer à la monnaie unique en vertu du Traité instituant l'UE. Certains pays sont néanmoins plus avancés que d'autres dans le processus d'adhésion à l'euro. La Bulgarie et la Croatie, en régimes de change fixe ou quasi fixe, participent au Mécanisme de change européen (MCE II) depuis juin 2020, récemment renforcé par l'obligatoire participation anticipée à l'Union Bancaire. Les autres pays, en régimes de change flottant ou intermédiaire, n'ont quant à eux pas donné de date cible de candidature au MCE II (à l'exception de la Roumanie qui indiquait en 2018 vouloir candidater en 2026). En termes de convergence nominale mesurée par les critères de Maastricht en juin 2020, les performances nationales sont contrastées, en particulier en termes d'inflation.

Concernant la possibilité de participation anticipée à l'Union Bancaire, facultative pour les pays Membres de l'UE hors MCE II, celle-ci n'a pas été retenue par les autres pays CESEE. L'Union Bancaire a été créée en septembre 2012 en réponse à la crise des dettes souveraines dans l'Union Européenne et repose sur quatre piliers : le Règlement uniforme, la Supervision unique, la Résolution unique et la Garantie des dépôts bancaires. La participation anticipée consiste en une coopération rapprochée avec la BCE en matière de supervision bancaire et une adhésion au Mécanisme de Résolution Unique (et en particulier, l'abondement au Fonds de Résolution Unique). Les pays CESEE participent pourtant depuis 2008 à l'Initiative de Vienne, qui a instauré une coopération multilatérale en matière bancaire depuis la crise financière globale.

Les motivations des chapitres présentées ci-après sont ainsi liées aux vulnérabilités financières communes et au processus d'intégration européenne. Si le premier chapitre cherche à caractériser les flux de prêts bancaires vers les pays CESEE pour orienter

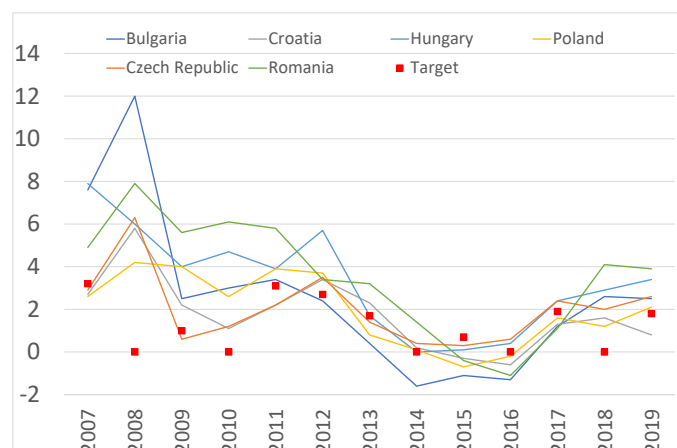


FIGURE 14 – Taux d'inflation harmonisés et références des rapports de Convergence  
Source : INSEE

les choix de politiques économiques en cas de choc, les chapitres deux et trois s'attachent à montrer les interactions existant entre l'intégration financière et monétaire et les mécanismes d'ajustement aux chocs (politique monétaire, partage du risque).

### 0.3 Etat de la littérature et motivations de la recherche

La motivation du premier chapitre est d'analyser les déterminants des vulnérabilités externes d'origine bancaire des pays CESEE pour proposer des réponses de politiques publiques adaptées.

Tout d'abord, les faits stylisés développés dans la section 0.2 de cette introduction font apparaître une forte interdépendance financière et bancaire des pays CESEE avec l'Union Européenne (en particulier leur modèle bancaire), qui s'est faite de façon concomitante avec une augmentation des vulnérabilités financières. Un autre fait stylisé développé dans le chapitre sous-tend le choix des créances bancaires transfrontières comme variable d'intérêt. L'analyse agrégée de la position extérieure nette de ces pays montre une forte dégradation de celle-ci jusqu'à la crise financière globale. La décomposition des engagements dans le temps montre une surpondération des IDE pendant la décennie 1990, et une forte accélération du poids des crédits transfrontières pendant la décennie 2000. Si la tendance actuelle est à la progression du poids des investissements de portefeuille, les créances transfrontières permettent de mener une analyse de long terme, qui est l'horizon d'étude de cette thèse.

Par ailleurs, s'il existe beaucoup de statistiques relatives aux créances bancaires, il existe comparativement peu de littérature spécifique sur les mouvements internationaux de capitaux bancaires vers les pays CESEE. Plus précisément, les pays CESEE sont souvent inclus comme pays destinataires des flux de capitaux bancaires dans les études



empiriques sur l'UE ou les pays émergents (Milesi-Ferretti et al., 2010), qui parfois adoptent une modélisation de type gravitaire (Bouvatier and Delatte, 2015; Herrmann and Mihaljek, 2011; Emter et al., 2019). Quelques exceptions récentes s'intéressent aux déterminants des flux de capitaux (particulièrement bancaires) vers les pays CESEE (Brana and Lahet, 2012; Eller et al., 2016) et complètent une littérature centrée sur les flux de capitaux avant la crise de 2008, particulièrement sur les IDE (Arvai, 2005; Bakker and Gulde, 2010; Buch et al., 2003; Lane and Milesi-Ferretti, 2007; von Hagen and Siedschlag, 2008).

Au contraire, il existe une littérature abondante sur les déterminants des flux de capitaux dans les pays émergents qui va nous guider dans nos analyses. Un pan de cette littérature s'intéresse aux facteurs propres aux économies domestiques, ou facteurs "pull", tels que le taux d'intérêt réel, le taux de change réel, le régime de change, ainsi que la taille, l'ouverture et la fragilité du système financier. Les facteurs qui se transmettent des pays développés vers les pays émergents, tels que la croissance du PIB de l'économie dominante, les conditions de liquidité ou l'aversion au risque, sont des facteurs dits "push" : ils sont récemment analysés dans Cerutti et al. (2019). Enfin, le poids des facteurs globaux, tels que le cycle financier global (identifié par Rey (2013) et revisité par Cerutti et al. (2018)) a pris de l'importance dans la littérature récente.

La motivation du deuxième chapitre est de comprendre les différents stades d'avancement des pays CESEE dans le processus d'adhésion à l'euro.

Un argument en faveur du statu quo vis-à-vis de l'adhésion à l'euro est que les pays CESEE ont largement eu recours à la politique monétaire comme mécanisme d'ajustement aux crises financières récentes. Concernant la crise financière globale de 2008, Gallego et al. (2010) précisent que les réponses de politique monétaire ont été moins rapides que dans les pays de la zone Euro du fait d'une inflation plus prononcée, mais que les baisses des taux directeurs sont néanmoins intervenues à partir de la fin 2008. Ishi et al. (2009) recensent l'ensemble des politiques non conventionnelles utilisées par ces pays : il s'agit principalement d'injections de liquidités dans le système bancaire (baisse des réserves obligatoires, modifications des conditions de collatéral) et d'interventions sur le marché des changes (Hongrie, Pologne, Roumanie). Ces pays ont aussi eu recours, pour la première fois pour la plupart d'entre eux, à des politiques quantitatives d'achats d'actifs lors de la crise du Covid-19 (Magyar Nemzeti Bank, 2020). Enfin, certains pays comme la Hongrie ont utilisé très activement la politique monétaire dans leur gestion des prêts en devise étrangère, en allant jusqu'à modifier leurs instruments de référence (swaps de change).

Un argument en faveur de l'accélération du processus d'adhésion à l'euro est que l'autonomie monétaire des pays CESEE est théoriquement compromise par l'existence des dilemme (Rey, 2013), trilemme (Aizenman et al., 2008; Mundell, 1963; Obstfeld, 2015) voire quadrilemme (Aizenman, 2011) de politique monétaire. Le trilemme de la politique

monétaire de Mundell-Fleming énonce la compatibilité de seulement deux objectifs sur trois entre la stabilité du taux de change, l'indépendance de la politique monétaire et la libre circulation des capitaux. Le dilemme de politique monétaire énoncé par [Rey \(2013\)](#) est que la politique monétaire ne peut être indépendante en l'absence de contrôle des capitaux ou, plus largement, de mesures macroprudentielles, quel que soit le régime de change, du fait de l'existence d'un cycle financier global. Que l'on considère le trilemme ou le dilemme de politique monétaire, les processus d'intégration financière et de convergence nominale avec l'UEM tels que décrits plus haut sont des facteurs théoriquement limitatifs de l'autonomie monétaire pour ces pays.

La littérature empirique ne donne pas de réponse claire sur la problématique que nous soulevons. L'autonomie monétaire des pays CESEE vis-à-vis de la zone Euro a fait l'objet d'études empiriques dans un cadre de long terme de transmission internationale des taux d'intérêt (entre autres [Camarero et al. \(2002\)](#); [Holtemöller \(2005\)](#)) et qui a alors pour corollaire la stationnarité du taux de change. Si l'utilisation de la PTINC comme modèle empirique univarié de long terme est justifiée ([Chinn and Meredith, 2004](#)), l'étude des propriétés des séries de taux de change des pays CESEE montre néanmoins que ces séries ne sont pas stationnaires. Par ailleurs, ces études ne modélisent pas le cadre de convergence nominale de ces pays avec la zone Euro.

La motivation du troisième chapitre est d'analyser l'impact de l'adhésion à l'Union Bancaire sur le mécanisme de partage du risque. En effet, ce point n'est pas débattu dans la littérature sur la participation anticipée des pays CESEE à l'Union Bancaire. Celle-ci s'est surtout concentrée sur les risques institutionnels existant pour les pays CESEE ([Darvas and Wolff, 2013](#); [Howarth and Quaglia, 2016a](#); [Hüttl and Schoenmaker, 2016](#)) et non sur les bénéfices économiques de l'adhésion à l'Union Bancaire, particulièrement en termes d'ajustement et d'intégration. En l'absence d'un système de transfert budgétaire au niveau européen, le mécanisme de partage du risque est pourtant un mécanisme d'ajustement aux chocs domestiques par les marchés internationaux de capitaux et de crédit, potentiellement intéressant pour les pays CESEE très intégrés à l'Europe bancaire.

Celui-ci se fait par le lissage de la consommation et du revenu des ménages via les canaux budgétaires et financiers, qui compensent les pertes salariales liées au choc sur le produit. Le partage du risque s'opère via trois canaux principaux ([Asdrubali et al., 1996](#)) : les revenus internationaux du capital liés à la détention de titres financiers non affectés par le choc idiosyncratique, les transferts budgétaires et l'ajustement du comportement d'épargne (et le recours à l'endettement rendu possible grâce au marché du crédit). Le partage du risque au sein de la zone Euro fait l'objet de recherches empiriques récentes ([European Central Bank, 2018](#); [Ioannou and Schäfer, 2017](#)), qui cherchent à estimer le niveau effectif du partage du risque. Deux méthodologies principales permettent une telle estimation : la première consiste à décomposer la variance des chocs sur le pro-

duit en utilisant des identités de comptabilité nationale qui permettent l'identification des différents revenus (Dufrenot et al., 2020; Poncela et al., 2016; Sørensen and Yosha, 1998). La deuxième méthode consiste à estimer le niveau moyen de partage du risque (principalement le lissage de la consommation) puis les effets des différents canaux de l'intégration financière en utilisant des variables relatives aux mouvements effectifs de capitaux entre économies. (Cimadomo et al., 2020; Kose et al., 2009; Lewis, 1996).

Pour autant, l'impact de l'adhésion à l'Union Bancaire sur le partage du risque au niveau européen ne fait pas à notre connaissance l'objet d'étude empirique, alors même que celle-ci a théoriquement des effets directs et indirects sur le niveau et l'allocation du partage du risque. La revue de ces différents canaux de transmission, l'estimation des effets bilatéraux et unilatéraux de la participation à l'Union Bancaire ainsi que la comparaison avec un autre type de coopération multilatérale bancaire que sont les Initiatives de Vienne seront les principaux objectifs de notre troisième chapitre.

## 0.4 Questions de recherche et contributions

La question de recherche énoncée dans le premier chapitre est de caractériser l'intégration financière des pays CESEE en estimant les déterminants des créances transfrontières. Notre contribution à la littérature est triple : nous estimons un modèle bilatéral de gravité spécifiquement sur le stock de créances transfrontières détenues sur les pays CESEE. Nous estimons par ailleurs les déterminants bilatéraux, individuels (domestiques-pull et externes-push) et globaux de ces capitaux bancaires. Cela est rendu possible par l'utilisation de données bilatérales brutes et nous rattache ainsi à la littérature sur l'importance des capitaux bruts par rapport aux capitaux nets (Forbes and Warnock, 2012). Le modèle avec combinaisons d'effets fixes que nous utilisons permet enfin une estimation sans biais de l'effet institutionnel de l'adhésion à l'Union Européenne d'une part et de la proximité réglementaire entre pays d'autre part.

La question de recherche énoncée dans le deuxième chapitre est de tester et mesurer l'autonomie monétaire des pays CESEE vis-à-vis de la zone Euro, dans le cadre de la convergence nominale avec l'UEM. Nous faisons l'hypothèse que les autorités craignent la perte de deux instruments de politique monétaire, à savoir le taux directeur et les interventions sur le marché des changes. Notre contribution à la littérature est triple : nous utilisons un modèle empirique original sous la forme d'un modèle multivarié de long terme (modèle vectoriel à correction d'erreur - VECM) que nous estimons par pays. Ce modèle est robuste aux ruptures structurelles caractéristiques des séries macroéconomiques des pays CESEE, ce qui permet de mener une analyse de politique monétaire standard. Enfin, nous modélisons la convergence nominale dans l'UEM en incluant des variables de politique monétaire de la zone Euro dans le système de cointégration qui inclut le taux de change nominal.

La question de recherche du troisième chapitre est d'identifier les effets bilatéraux

et unilatéraux de l'Union Bancaire sur le partage du risque en zone Euro et avec les pays CESEE. Le corollaire est de savoir si les effets de transmission de l'Union Bancaire aux pays CESEE, s'ils existent, sont comparables à ceux des Initiatives de Vienne. Notre contribution à la littérature est triple : tout d'abord, nous utilisons des données financières bilatérales (bancaires, investissements de portefeuille) rendant possible cette identification. Nous mettons ensuite en oeuvre deux modélisations robustes aux corrélations inter-individuelles caractéristiques des panels macroéconomiques. Enfin, nous estimons les effets de l'Union Bancaire sur deux types de créances spécifiques aux pays CESEE, à savoir les créances transfrontières des Statistiques bancaires territoriales (LBS) de la Banque des Règlements Internationaux (BRI) et les créances étrangères des Statistiques bancaires consolidées (CBS) de la BRI (graphique 13).

## 0.5 Stratégies empiriques et résultats

Nos stratégies empiriques sont basées sur des modèles d'économie internationale et monétaires dont les fondements théoriques ou les méthodes d'estimation ont été récemment revisités. Elles s'appuient sur des approches économétriques robustes aux données macroéconomiques des pays CESEE caractérisées par des ruptures et souvent une non stationnarité d'une part ; aux panels macroéconomiques qui présentent de la corrélation inter-individuelle, d'autre part.

La stratégie empirique du premier chapitre est ainsi basée sur un modèle de gravité multiplicatif adapté aux flux financiers qui s'apparente au modèle de gravité des flux commerciaux de [Anderson and van Wincoop \(2003\)](#) étendu par [Okawa and van Wincoop \(2012\)](#) et que nous estimons sur données de panel. Dans ce modèle, les échanges financiers sont proportionnels à la taille des économies et inversement proportionnels à un ensemble de frictions à l'échange. La variable dépendante est le niveau des créances bancaires transfrontières, tous secteurs, dans un pays de destination, déclaré par des banques étrangères d'un pays d'origine. Ces données bilatérales sont issues des Statistiques bancaires territoriales de la BRI : les pays d'origine ne se limitent pas à la zone Euro et incluent tous les pays déclarants. Nous estimons trois spécifications qui permettent d'identifier successivement, via des combinaisons d'effets fixes par pays ou par paire de pays, les déterminants bilatéraux invariants, variables puis les déterminants individuels variables de ces créances. L'estimateur du modèle est un estimateur non linéaire de type pseudo-vraisemblance d'une loi de Poisson ([Santos Silva and Tenreyro, 2006](#)), dont la spécificité est d'associer le même poids à chaque observation. Nos résultats sont en référence à deux périodes distinctes, en fonction de la disponibilité des données : l'une avec une grande hétérogénéité temporelle (1990-2019), l'autre sur données plus récentes (1996-2019).

Si l'on s'intéresse aux déterminants bilatéraux (estimés sur la période 1990-2019),

l'équation de gravité standard met en évidence la significativité de la distance dans un rapport inversement proportionnel au niveau des créances transfrontières, mais aussi le poids de l'histoire commune entre les pays (appartenance à un ancien Empire ou relation coloniale). L'équation de gravité augmentée de variables relatives à la bancarisation des économies et à la santé des systèmes bancaires (estimée entre 1996 et 2019) souligne la significativité et l'importance des conditions bancaires domestiques des pays d'origine (facteurs push), ce qui est un résultat en ligne avec le très haut niveau de détention des actifs bancaires par les groupes bancaires européens. L'appartenance à l'Union Européenne est le seul facteur institutionnel significatif parmi ceux testés. Il en est de même pour la base monétaire américaine qui est le seul facteur global significatif et positif. Ces résultats sont robustes à différentes spécifications d'effets fixes.

La stratégie empirique du deuxième chapitre se fonde sur la théorie de la cointégration, c'est-à-dire sur le fait que des variables économiques non stationnaires peuvent être dans une relation d'équilibre de long terme, vers lequel elles convergent grâce à une force de retour à la moyenne (à savoir le terme de correction d'erreur). Nous adoptons l'approche multivariée de [Johansen et al. \(2000\)](#), qui est une extension du modèle traditionnel de [Johansen \(1995\)](#) avec des ruptures déterministes à la fois dans le niveau et la tendance des variables, mais aussi dans l'espace de cointégration. Le choix des variables s'inspire du modèle vectoriel autorégressif (VAR) monétaire de [Peersman and Mojon \(2001\)](#) augmenté des taux directeur et d'inflation de la zone Euro et d'une tendance déterministe. Nous estimons quatre modèles vectoriels à correction d'erreur par pays, sur des périodes individuelles allant des années 1990 à la fin 2014 : un modèle avec ruptures, un modèle sans rupture, un modèle avec ruptures qui inclut le taux d'inflation de la zone Euro, et un modèle de robustesse des résultats à la politique monétaire quantitative en zone Euro qui utilise le taux court shadow de [Krippner \(2015\)](#).

Nos résultats confirment tout d'abord la pertinence de cette modélisation à ruptures structurelles pour la Bulgarie, la Hongrie et la République Tchèque. Cela est particulièrement vrai pour les dates de rupture relatives à l'histoire économique domestique. Leur prise en compte change en effet le nombre et la nature des relations de long terme.

Pour les pays participant au MCE II, nos résultats montrent qu'il existe une interdépendance monétaire entre la zone Euro et la Bulgarie (de type unitaire). Par contre, nous ne trouvons pas de résultat significatif pour la Croatie, et ce quel que soit le modèle : ce résultat pourrait être lié à l'adoption unilatérale de l'euro sans convergence nominale préalable par l'économie croate (euroïsation). Pour les pays hors du MCE II, nous trouvons que la République Tchèque et la Hongrie ont une interdépendance monétaire de long terme forte avec la zone Euro (où le taux directeur zone Euro est force motrice de l'équilibre de long terme). La Pologne est le pays le plus autonome monétairement sur longue période et l'interdépendance entre la Roumanie et la zone Euro est mieux modélisée sans prendre en compte de rupture structurelle.

Le taux de change nominal est pour tous les pays à la fois force motrice du système et force de rappel vers l'équilibre de long terme. Le degré de dépendance monétaire est ainsi lié aux régimes de change, sans que cela soit vérifié pour la Croatie. Enfin, le taux d'inflation de la zone Euro participe à la règle de politique monétaire de la Bulgarie et de la République Tchèque.

Ce modèle multivarié fait donc apparaître différents types d'interdépendance : une transmission internationale des taux d'intérêt via le taux de change (dans le cadre de la PTINC, qui va dans le sens du trilemme de politique monétaire); une transmission du taux d'intérêt étranger quel que soit le régime de change via une règle de politique monétaire domestique augmentée (ce qui va dans le sens d'une perte d'autonomie monétaire du fait de l'intégration européenne ou du dilemme de politique monétaire); enfin une transmission du taux d'inflation étranger.

La stratégie empirique du troisième chapitre se base sur un modèle bilatéral de partage du risque (plus particulièrement de lissage de la consommation), où le partage du risque idiosyncratique se fait entre un pays d'origine et un pays de destination. Nous estimons ce modèle sur des données de panel non cylindrées, en identifiant les effets des différents canaux financiers (Union Bancaire, marchés de crédit et marchés de capitaux) du partage du risque via des termes d'interaction. Notre approche rejoint celles mises en oeuvre par [Lewis \(1996\)](#); [Kose et al. \(2009\)](#) que nous avons décrite en section 0.3 et plus récemment par [Cimadomo et al. \(2020\)](#) pour la dimension individuelle bilatérale.

Nous faisons le choix d'une double stratégie d'identification pour deux raisons. Tout d'abord, il existe des corrélations inter-individuelles dans les panels macroéconomiques qu'on peut corriger de deux façons et comparer. Nous utilisons donc successivement deux estimateurs : l'estimateur à effets fixes temporels et individuels (usuellement utilisé dans la littérature) avec correction des écarts-type de [Driscoll and Kraay \(1998\)](#), puis l'estimateur à effets communs corrélés de [Pesaran \(2006\)](#) qui permet de purger les effets globaux et ainsi d'identifier le risque idiosyncratique. En second lieu, le traitement de l'hétérogénéité individuelle inobservée par effets fixes peut capturer une proportion d'effets idiosyncratiques et ainsi rendre leur identification difficile. C'est en effet ce que nous observons dans la première étape de notre analyse, ce qui nous pousse à retenir l'identification par les facteurs communs.

Concernant la dimension individuelle du panel, nous menons des analyses sur deux groupes de pays. Tout d'abord, nous analysons le partage du risque au sein de 25 pays membres de l'Union Européenne soit les 19 pays de l'Union Bancaire et les 6 pays CESEE qui n'appartiennent pas à l'Union Bancaire. Ceci nous permet d'identifier des effets bilatéraux et unilatéraux de la participation à l'Union Bancaire. Puis nous étudions le partage du risque entre les pays de l'Union Bancaire et les pays CESEE seulement, c'est-à-dire en excluant les pays de l'Union Bancaire des pays destinataires. Ceci nous permet d'identifier les effets directionnels de partage du risque entre l'Union Bancaire et

les pays CESEE, selon qu'ils soient l'origine ou la destination de ces capitaux. Les pays CESEE n'étant pas des pays déclarants, nous utilisons dans le cas des données LBS les engagements des banques résidentes dans les pays CESEE comme les avoirs des banques dans les pays CESEE sur les pays de l'Union Bancaire, suivant de ce point de vue la démarche de [Brei and von Peter \(2018\)](#).

La dimension temporelle est un enjeu spécifique de notre modélisation pour deux raisons. D'une part, les données relatives à la période socialiste peuvent ne pas être fiables. D'autre part, les données bilatérales d'investissements de portefeuille sont disponibles annuellement à partir de 1998 seulement. Nous estimons donc notre modèle sur la période la plus longue (1979-2018), puis sur la période de libéralisation financière en excluant les données de l'époque socialiste (1990-2018); enfin, sur la période 2002-2018 qui permet l'identification des effets du canal des marchés de capitaux. Dans les trois cas, il nous faut privilégier un modèle parcimonieux pour avoir un degré suffisant de liberté et assurer la convergence de l'estimateur.

Si nous nous concentrons sur les principaux résultats relatifs aux pays CESEE sur la période la plus récente, nous trouvons que les pays de l'UE membres de l'Union Bancaire partagent moins de risque idiosyncratique entre eux de façon bilatérale que les pays CESEE et les pays de l'Union Bancaire. Concernant les effets directionnels entre l'Union Bancaire et les pays CESEE, les estimations font apparaître moins de risque idiosyncratique partagé par les pays CESEE vers les pays de l'Union Bancaire que par l'Union Bancaire vers les pays CESEE, bien que nous identifions un renforcement du partage du risque vers l'Union Bancaire de 20 points après 2012. L'intégration bancaire ne contribue pas significativement au partage du risque quand on considère l'intégration transfrontière et est significative et négative en considérant l'intégration bancaire locale. Les Initiatives de Vienne ont été un facteur de moindre partage du risque des pays CESEE vers les pays de l'UE membres de l'Union Bancaire, et d'autant plus fort qu'on considère les créances étrangères de la CBS.

Enfin, nos résultats tendent à montrer qu'il existe une modification des canaux du partage du risque au sein de l'UE, avec tout d'abord une contribution positive des marchés de crédit jusqu'en 2000, ensuite relayés par les marchés de capitaux.

TABLE 1 – Crises financières : crises bancaires, de change, sudden stops

	<b>Crises bancaires systémiques</b> Laeven and Valencia (2018)	<b>Crises bancaires systémiques</b> Reinhart et al. (2008)	<b>Crises de change</b> Reinhart et al. (2008)	<b>Stops (1980-2019)</b> Forbes and Warnock (2012)	<b>Sudden stops</b> Eichengreen and Gupta (2016)	<b>Sudden stops</b> David and Gonçalves (2019)
Bulgarie	Janvier 1996	1994	1996	NA	NA	2008 q4 - 2010 q1 2015 q3- 2016 q1
Croatie	Mars 1998 - 1999	NA	NR	1998 q4-1999 q2 2004 q4-2005 q3 2010 q2-2011 q1 2015 q3-2016 q2	2011 q3 (2)	
Hongrie	1991-1995 Sept 2008 - 2012	1991 2008	NR	1996 q4-1997 q1 2002 q2-2002 q3 2009 q3-2009 q4 2009 q1-2010 q2 2017 q4-2018 q3	1996 q1 (2)	1996 q4- 1997 q2 2009 q1- 2010 q1
Rep Tchèque	Juin 1996 - 2000	NA	1997 m5	2003 q2-2004 q1  2006 q2-2006 q4 2008 q4-2009 q3 2018 q1-2018 q4	2008 q4 (2)	2003 q2- 2004 q1  2006 q2-2006 q3
Pologne	1992 - 1994	1991	NR	1996 q3-1997 q1 2001 q4-2002 q3/1 2008 q4-2009 q3 2017 q3-2017 q4	2008 q4 (2)	2008 q4-2009 q3 2011 q4-2012 q3
Roumanie	1998 - 1999	1990	1996	1999 q4-2000 q1 2008 q3-2009 q4(2010q1)	2008 q4 (2)	2008 q3-2009 q4



## Chapitre 1

The case of financial and banking  
integration of non-Euro CESEE  
EU Members: A gravity model approach



## 1.1 Introduction

Benefits and costs of international financial liberalization, particularly for Developing and Emerging economies, have been a debate in the literature since the start of the globalization period in the 1990s, with renewed interest after the sudden stops and currency crises such as the Mexico peso crisis in 1994, the Asian crisis in 1997, the Russian crisis in 1998 and the Brazilian real collapse in 1999 (Agénor, 2001; Calvo, 2005; Kose et al., 2006; Prasad et al., 2007; Rodrik and Subramanian, 2009). Kose et al. (2006) propose a literature review on the effects of financial liberalization on such countries, both on economic growth and macroeconomic volatility. They conclude that the beneficial effects of financial integration are conditional to the initial macroeconomic conditions in destination countries (“pull” factors, and the existence of thresholds in that respect) and to the composition of incoming capital flows, with some collateral benefits such as the development of institutions and financial markets. They highlight that macroeconomic studies often remain inconclusive on financial liberalization benefits, versus microeconomic data-based research (at firm or industry-level) that often finds evidence of such benefits. On the other hand, they find high capital mobility may create domestic macroeconomic imbalances, such as domestic misallocation of capital leading to inflation, real exchange rate appreciation and widening of current account deficits, with ultimately enhanced risk of a Sudden Stop (defined as a contraction of capital flows with a large surprise element, that is function of domestic vulnerabilities (Calvo, 2005)). The role of foreign bank penetration and currency mismatch balance sheet effects are further investigated in Agénor (2001) and Calvo et al. (2008), respectively.

After the Global Financial Crisis (GFC) in 2008-2009, literature has focused on the destabilizing impact of gross capital flows on these economies, so that inward flows and outward flows, both from domestic and international investors, are considered to assess financial vulnerabilities. Forbes and Warnock (2012) in their seminal paper classify capital flows events as surges, stops, flights and retrenchments. Moreover, the importance of global factors, as opposed to domestic pull factors, in the building up of financial vulnerabilities has gathered interest, with seminal paper from Rey (2013), and largely discussed since with a recent contribution from Cerutti et al. (2019). Finally, foreign bank ownership costs and benefits in terms of financial stability and domestic credit have been further investigated (Claessens and Van Horen, 2015).

Against this background, non-Euro Central Eastern and South Eastern European (CESEE) countries<sup>1</sup> are very good candidates for financial integration analysis, particularly on the liabilities side. On the one hand, they are highly integrated within a very large regional economic union, the Economic and Monetary Union (EMU), since the 2000s, that has triggered real economic convergence with the European Union (EU)<sup>2</sup>.

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<sup>1</sup>Bulgaria, Croatia, the Czech Republic, Hungary, Poland and Roumania; referred to as CESEE or CESEE-6 countries in this research work

<sup>2</sup>Nölke and Vliegthart. (2009) argue that the level of economic integration is so high that these

On the other hand, these countries have accumulated macroeconomic imbalances and financial vulnerabilities (such as large external debt, currency mismatch in domestic balance-sheets or Non-Performing Loans) on the back of global and domestic financial crises since the start of the transition period in the 1990s. The motivation of this chapter is therefore to better understand the determinants of financial integration of CESEE countries, more precisely banking integration, because they lead policy response to the building up of financial vulnerabilities (such as capital controls, restrictions on FDI, macro prudential policies, early participation to the Banking Union and ultimately, the adoption of the Euro). It is also supported by the fact empirical literature on international capital flows does not usually estimate pull, push or global factors specifically for CESEE countries.

Our research question is to estimate the long-term determinants of cross-border banking claims in the CESEE-6 region over the 1990-2019 period. The choice of cross-border banking as our focus for empirical research is supported by the external position analysis in Section 1.2. We first show that the external funding mix of CESEE countries is based on Foreign Direct Investment (FDI) and Debt, with a very strong but evolving EU investor and creditor countries' base. Second, we show that over the long term, cross-border bank lending is a key determinant of external dependence for these countries, with possible additional effect coming from their foreign-owned banking systems.

Since geographic determinants seem to matter in the financial and banking integration processes, our empirical strategy is based on a financial gravity model, derived from the trade gravity model in [Anderson and van Wincoop \(2003\)](#) and developed by [Okawa and van Wincoop \(2012\)](#). It allows to analyze bilateral determinants of financial flows from a geographical, historical and cultural perspective. To the best of our knowledge, our paper fills a gap in the empirical literature that has not estimated such model for CESEE countries as destination countries, alone. For this purpose, we use a bilateral panel dataset based on BIS Locational Banking Statistics (LBS) and estimate a multiplicative gravity model with a non linear estimator, with several specifications being estimated sequentially. Another contribution of this paper is to use country-specific banking variables, that act both as pull (domestic) and push (external) factors, and a global factor.

Our results point out that cross-border banking in CESEE economies is significantly driven by geographic and historical links, particularly with EU Member States. We find that our selection of domestic banking variables are more significant as push than pull factors. They provide evidence in favor of an impact of foreign banking systems on financial liabilities in this region. US global liquidity factor also has significant impact on cross-border banking claims. In terms of policy impacts, results show that EU integration is a key determinant of international banking claims for CESEE countries,

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economies are "market-dependent" economies.

whereas evidence for the multilateral Vienna Initiative 1 is mixed. These results are robust to various specifications, sets of country and countrypair fixed effects. Our article proceeds as follows: Section 1.2 reviews stylized facts on the international financial and banking integration of CESEE countries. Section 1.3 reviews the literature on bilateral financial integration and gravity models and selects variables. Section 1.4 presents the empirical strategy with a focus on specifications, estimators and data. Section 1.5 details our results and Section 1.6 reviews our robustness estimations. Section 1.7 concludes.

## 1.2 Stylized facts

In this section, we first analyse the evolution of CESEE countries' net external position over the 1990-2020 period. Second, we analyze the liabilities side with a decomposition over the main investment categories and focus on FDI and Debt liabilities, to better understand the sources of external financial vulnerabilities. We finally proceed with a cross-border banking claims bilateral analysis.

### 1.2.1 Net external position analysis

Following Lane and Milesi-Ferretti (2007), we first analyse the ratio of external financial assets and liabilities over domestic GDP in Figure 1.1. These countries, as a region, have followed a strong path of financial internationalization during the 1990s and the 2000s, which has reverted in the aftermath of the GFC in 2008. If we first analyze

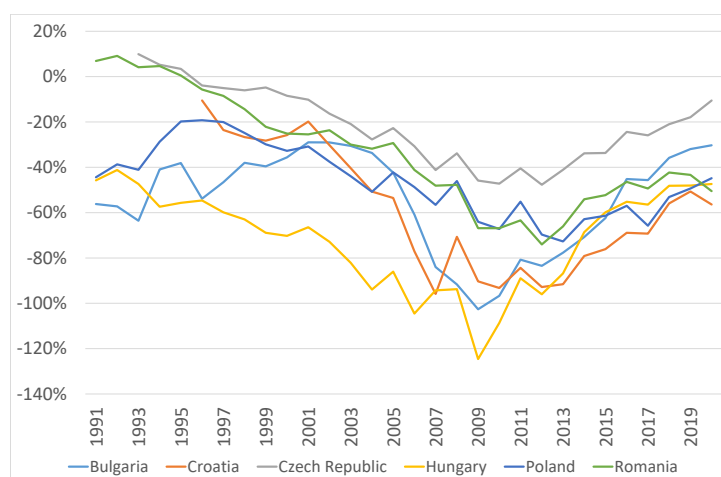


Figure 1.1 – Ratio of Net Foreign Assets to Domestic GDP (in %) - 1990-2020

Data source: External Wealth of Nations -EWN- Mark II database (see Lane and Milesi-Ferretti (2017)) and author's calculations from IMF IIP database. Main characteristics are: an extended country database (211 countries), larger time series compared to International Investment Position IMF database.

the pre-GFC period (from individual start date to 2008), one can distinguish between two groups of countries. Bulgaria, Croatia and Hungary net external positions have deteriorated sharply from -40% to -100% to -120% of domestic GDP. For Bulgaria and

Croatia, this pattern is in line with the quasi fixed or fixed exchange rate regime that fosters foreign investment (by reducing currency risk born by investors). The Czech Republic and Poland net external positions have decreased to a lesser extent (by 40% of GDP in average). Romania stands rather aside with a continuous deterioration of its positive external position since 1990, standing at -65% of GDP in 2009. The CESEE countries' external positions have nevertheless rebounded from either the GFC or the Sovereign Debt Crisis minimums, to a larger extend for the first subgroup of countries (Hungary from -130% to -50% in 2020; Bulgaria from -100% to -30%). Most CESEE-6 countries' (except the Czech Republic) NFA ratios stand at -50% of GDP in 2020, which is still in excess of the NFA position threshold of -35% monitored by the European Union through its Macroeconomic Imbalances Procedure.

### 1.2.2 FDI and Debt liabilities

To understand the dynamics of the net external position, we decompose the assets and liabilities positions by functional category and by country in Figure 1.2, over the 1990-2019 period. Five Investment functional categories are included into international accounts, with some definition variations: (a) Direct Investment; (b) Portfolio Investment; (c) Financial Derivatives (d) Other Investments (e) Reserve assets<sup>3</sup>. We are interested by the liabilities positions and see that the external funding mix of CESEE countries is dominated by FDI and Debt (mostly in the form of loans for all countries, and also in the form of debt securities for the Czech Republic, Poland and Romania recently). These investment patterns are in line with the empirical evidence in [Lane and Milesi-Ferretti \(2007\)](#).

If we first analyze FDI liabilities, we can notice their relative importance compared to other types of liabilities for all CESEE countries. FDI offsets Debt for Bulgaria, the Czech Republic and Poland (around 70% of total liabilities) and accounts for 40% to 50% in average of financial liabilities for Romania and Croatia. Hungary is an outlier as we discuss below. This pattern is different from the stylized facts for Emerging and Developing countries in [Kose et al. \(2006\)](#)<sup>4</sup>. Authors have calculated respective shares of Foreign Direct Investment and Debt in Emerging and other Developing countries. FDI and Debt represent 18% and 68% of gross external position in average, whereas in the case of CESEE countries, they stand in average at 60% and 30% of financial liabilities, respectively. One possible explanation advanced by [Bakker and Gulde \(2010\)](#) is that capital flows from Western parent banks to their local subsidiaries are partly included in FDI, because transactions related to permanent debt and equity are recorded as FDI.

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<sup>3</sup>These investment categories are derived from IMF Balance of Payments Manuals (BPM5 or BPM6).

<sup>4</sup>Cross-country averages of annual data over a sample of 20 Emerging Markets countries and 30 other developing countries, over five five-year periods, starting in 1980 and ending in 2004.

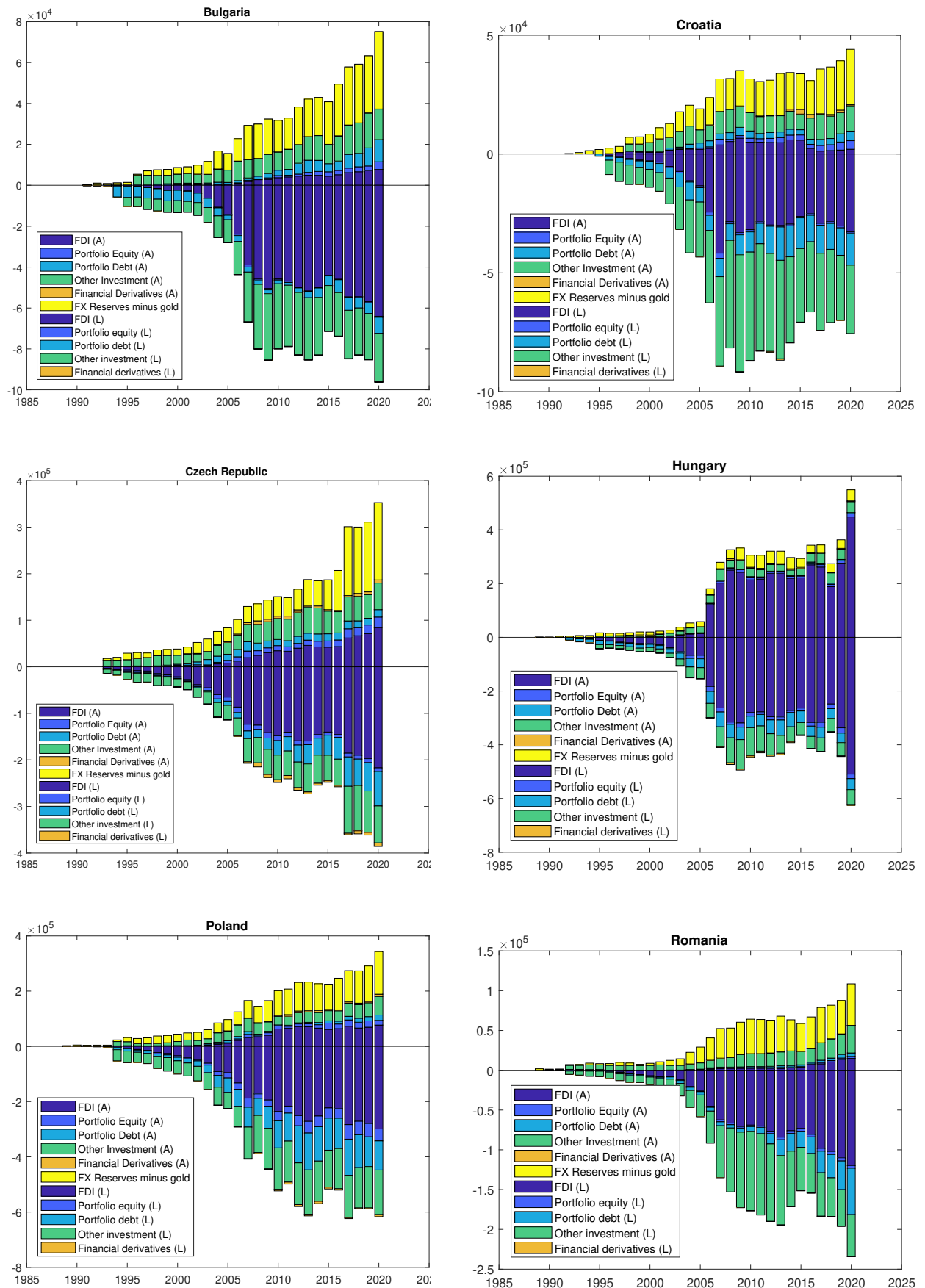


Figure 1.2 – Historical evolution of external assets and liabilities by country (1989-2020)

Source: External Wealth of Nations Mark II database ([Lane and Milesi-Ferretti, 2017](#)) and author's calculations from IMF IIP; Positions in USD hundreds of billion for Hungary, Poland, Romania and the Czech Republic; in USD tens of billion for Croatia and Bulgaria. Gold holdings are excluded from foreign exchange reserves, whereas they are included in official IIP statistics, as these are not financial claims on another economy.

Another explanation may be the weight of international financial centers as direct investors in CESEE countries. In both cases, FDI may therefore include a proportion of short-term investment or pass-through funding, that may be sources of financial vulnerabilities. We explore both assumptions using the IMF Coordinated Direct Investment Survey (CDIS) database<sup>5</sup>, that gives additional information on the evolution of Foreign Direct Investment stocks for the post GFC-period (Figure 1.3a), with the breakdown by direct investor countries (Figure 1.3c) and by type of direct investment (Figure 1.3b).

Direct investment inward accumulated positions in the region have been stabilizing around USD 725 billion in average between 2009 and 2017, with a -15% temporary decline between 2013 and 2015 (Figure 1.3a). FDI breakdown by recipient country has been stable, reflecting that no country rebalancing happened after the GFC. Bulgaria and Croatia get the smallest share of total FDI (5%), Romania and the Czech Republic between 10% and 18% of total FDI, and Hungary and Poland represent 30% of total FDI, respectively. FDI breakdown between direct investment equity and debt (that reflects intercompany lending) is also quite stable over the 2009-2017 period: Figure 1.3b represents the average breakdown between equity and debt by country. Interestingly, equity proportion is the highest for Hungary and Poland (90% of total FDI), whereas all other countries have a 30% debt and 70% equity FDI breakdown.

If we finally turn to the analysis of direct investor countries in 2017<sup>6</sup> (Figure 1.3c), we can see that first, there exist geographical factors driving foreign direct investment. At aggregated regional level, top 20 investor countries represent 95% of total FDI in CESEE countries: this reflects the absence of FDI by many countries (especially Asia and America). Euro area countries account for a massive 70% to 80% of total foreign direct investment in CESEE countries. Germany and Austria play a regional role, accounting for 13.5% and 8% of FDIs respectively. Interestingly, Hungary is a direct investor country within other CESEE countries. Nordic EU countries account for a small proportion of FDI only (2%), lower than CESEE intra-regional direct investment (USD 15bn versus USD 17bn). Offshore financial centers account for 3% of overall FDIs. Finally, if we look at disaggregated data, top 6 direct investor countries at country level are either Austria, Italy, France, Germany, Luxembourg and the Netherlands.

The prominent roles of Ireland, Luxembourg and the Netherlands, that are onshore international financial centers, have to be highlighted: if we sum their respective FDI claims, they are quite active in Central European countries and account for an overwhelming 20%, 52% and 33% of total FDI stocks in the Czech Republic, Hungary and Poland, respectively. Lane and Milesi-Ferretti (2017) estimate that between 75% and 90% of FDI claims and liabilities in Luxembourg and the Netherlands come from Special Purpose Entities (SPEs), which are entities that do not have production activity and

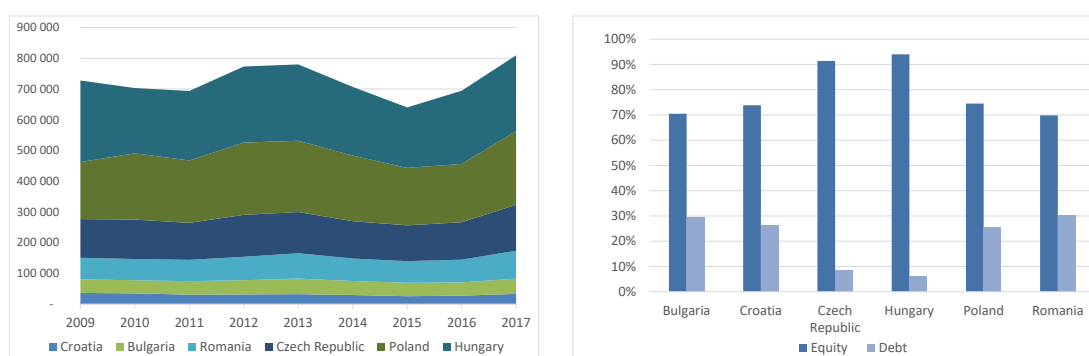
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<sup>5</sup>The purpose of this database is to improve the quality of direct investment position statistics in the International Investment Position database. Database is sponsored by IMF and starts in 2009.

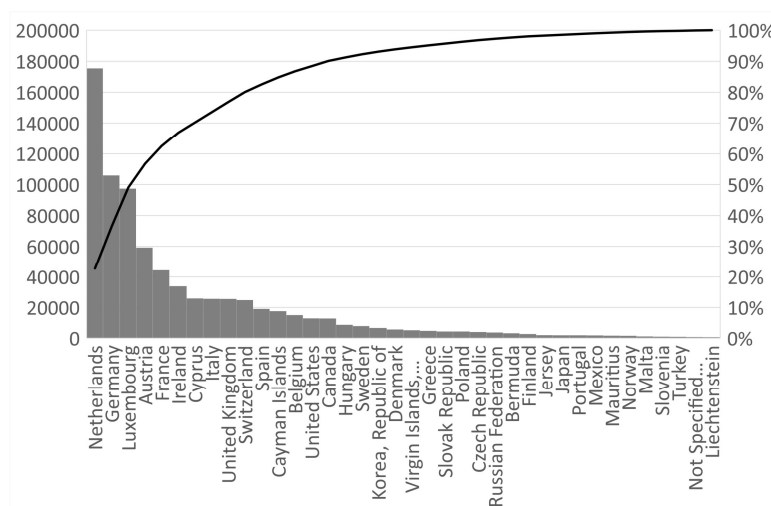
<sup>6</sup>Most recent data available at time of writing.



intermediate funds<sup>7</sup>. All in all, these figures therefore validate the increasing importance of pass-through funds (channeled by SPEs from third countries) in total FDI in CESEE countries over the past decade and their potential for generating financial vulnerabilities in these countries. The consequence is that a significant proportion of real bilateral FDI positions on an ultimate risk basis cannot be traced back from FDI data (since they capture third-party intermediation).



(a) Country FDI stock evolution (in USD million) (b) FDI breakdown by type (country view)



(c) Investor countries' FDI stock in 2017 (in USD million)

Figure 1.3 – Analysis of Net Inward Direct Investment stocks

Data source: IMF Coordinated Direct Investment Survey

<sup>7</sup>They also mention Austria and Hungary as countries reporting large FDI positions through SPEs, which explains why Hungary holds substantial FDI asset positions in other CESEE countries.

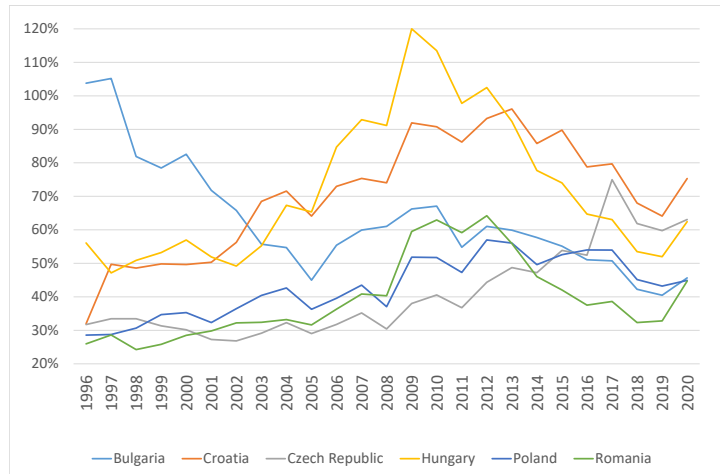


Figure 1.4 – External debt evolution by country (% GDP)

Source: External Wealth of Nations Mark II database (Lane and Milesi-Ferretti, 2017) and author's calculations from IMF International Investment Positions Database for 2016-2020

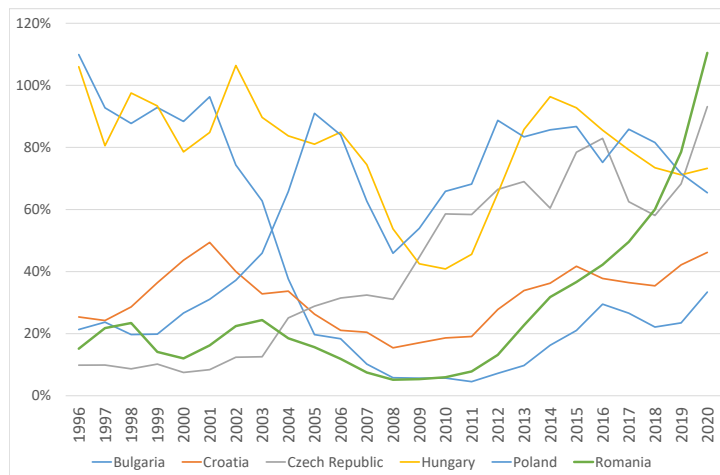


Figure 1.5 – Portfolio Debt/Other Investment liabilities ratio evolution by country

Source: External Wealth of Nations Mark II database (Lane and Milesi-Ferretti, 2017) and author's calculations from IMF International Investment Positions Database for 2016-2020

We now turn to the second most important source of external funding for CESEE countries which is external debt, i.e. the sum of Portfolio Debt and Other Investment Debt (the latter category being comprised of loans and deposits, trade credit and pension schemes). From Figure 1.2, we see that South Eastern European countries (Bulgaria, Croatia and Romania) and Poland share the highest proportion of external debt amongst their regional peers, predominant as Other Investment (except for Romania since 2016) and representing in average 45% of their financial international liabilities. Central European countries (the Czech Republic and Hungary) are less dependent on external debt

(30% in average of total financial liabilities), with the ratio of Portfolio Debt over Other Investment liabilities increasing from 50% in 2008 to 80% in 2020 (Figure 1.5). They follow a global trend of increased foreign portfolio debt holdings, which is probably a consequence of their local financial markets expansion. In terms of external debt sustainability expressed as a share of GDP (Figure 1.4), there are two groups of countries: Croatia and Hungary share the same trend as the Euro area, with external debt levels that have doubled from their 1996 levels. Hungary external debt has decreased from its 120% of GDP highs in 2009 and stands at 60% of GDP in 2020. All other CESEE countries are on a stabilizing trend since the GFC, with external debt accounting for 45% of GDP in average, except the Czech Republic which is on a increasing trend. In order to understand the evolution of CESEE countries' creditor countries, we now turn to the analysis of bilateral banking positions of international banks, that have gained tremendous momentum during the 2000s.

### 1.2.3 Cross-border banking claims bilateral analysis

To better characterize cross-border banking liabilities evolution, we use the Bank of International Settlements - Locational Banking Statistics (LBS) database. As explained in the BIS Quarterly Review (2015), BLS database captures outstanding claims and liabilities of internationally active banks located in 44 reporting countries against counterparties residing in more than 200 countries<sup>8</sup>. Reporting is based on the residency principle of the Balance-of-Payments, which means that outstanding banking claims of BIS reporting banks capture intercompany loans but exclude foreign loans denominated in local currency. Data is reported since 1977 by CESEE main creditor countries, but we start our analysis at the beginning of the transition period from socialism in 1989 for the following reasons. First, there may exist some possible reporting reliability problems during the 1977-1989 period; second, Croatia and the Czech Republic were independent States only in 1991 and 1993, respectively.

CESEE countries are not reporting countries, which means financial liabilities of all reporting countries in CESEE countries can be used as proxy for financial claims of banks located in CESEE countries. Even if we focus on financial liabilities in our analysis, we have nevertheless represented in Appendix 1.A the evolution of the external claims and liabilities of BIS reporting banks against counterparties located in CESEE countries at four landmark dates (1999-Q1: Launch of Euro; 2004-Q1: End of accession phase to the European Union for the Czech Republic, Hungary and Poland; 2008-Q2: Quarter preceding the Global Financial Crisis and 2018-Q4: 10 years after the beginning of the GFC). we can see that external claims on CESEE economies exceeded external liabilities by five times in average just before the Global Financial Crisis, with a large variety of country situations (in line with Figure 1.2). The equivalent cross-border banking claims held by CESEE countries on BIS reporting countries account for USD 10 billion in av-

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<sup>8</sup>The LBS currently capture 95% of all cross-border interbank flows.

erage, except for Poland (USD 40bn).

In terms of volumes, outstanding banking claims of BIS reporting banks into the CESEE-6 region are represented in Figure 1.6. They have increased by 630% during the 2000s in the region (from USD 50bn in 2002 to USD 365bn in 2008) and have been almost halved since the GFC (in 2019, they stand at USD 235bn). As a comparison, EU banks' exposure to EU Member States have increased by 300% over the 2000s period. Cross-border banking evolution at domestic level in Figure 1.7 is more contrasted with three types of country dynamics after the GFC: a very strong deleveraging in Hungary and Romania; a smaller one in Bulgaria, Croatia and Poland; a doubling of outstanding banking claims in the Czech Republic after 2016<sup>9</sup>.

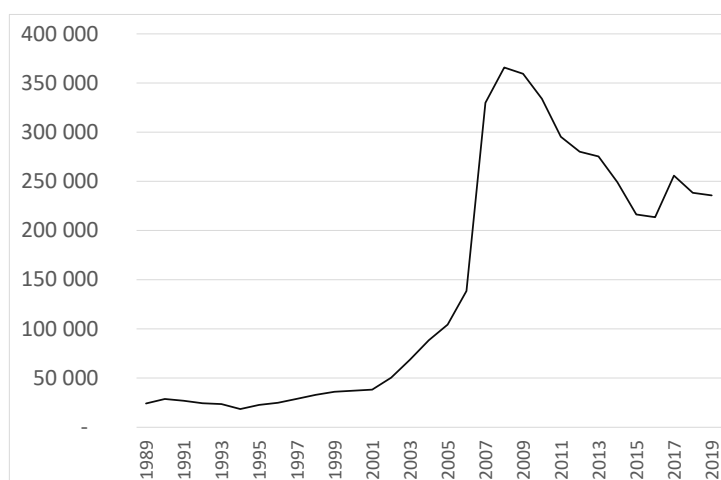


Figure 1.6 – Total outstanding claims of BIS reporting banks (1989-2019)

Source: BIS LBS, in millions USD, all instruments, all sectors, all currencies, no exchange rate adjustment

This deleveraging process after the GFC is a stylized fact for the European Union banking sector and has been analyzed at intra-European Union level (see for instance [Bouvatier and Delatte \(2015\)](#); [Emter et al. \(2019\)](#)).

We finally analyze the dynamic of foreign creditors in Figure 1.8 at the same four landmark dates as in Appendix 1.A. The 1999-2008 period is characterized by the rise of European Union countries as creditor countries, particularly Austria (with an overwhelming USD132bn total outstanding claims in the region at period end, almost twice the second largest position held by Germany, which was the leading creditor at the be-

<sup>9</sup>If we consider loans and deposits only, international banking sector liabilities have been divided by 2. Country situations are dispersed though: cross-border banking flows reversal has been very pronounced for Bulgaria, Croatia, Hungary and Romania, and much less pronounced for the Czech Republic and Poland.

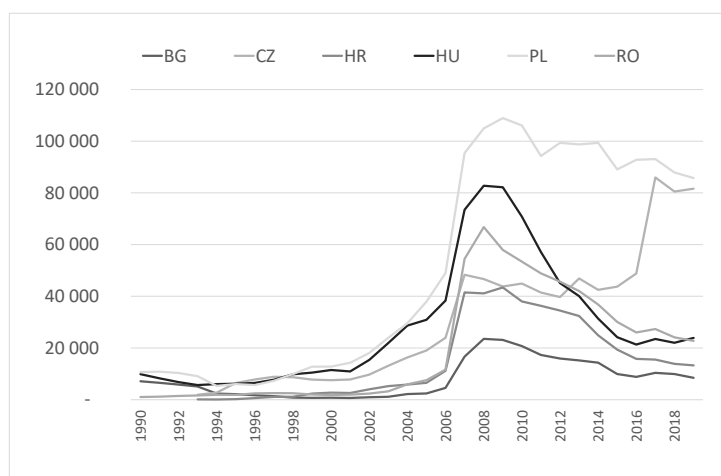


Figure 1.7 – Outstanding claims of BIS reporting banks by country (1989-2019)

Source: BIS Locational Banking Statistics, in millions USD, all instruments, all sectors, all currencies

gining of the 2000s), followed by France, the UK, Ireland, the Netherlands, Belgium, Luxembourg, the US (that held significant cross-border claims at that time) and Japan. These countries grew from an average of USD2bn outstanding claims to an average of USD20bn in eight years. Luxembourg and the Netherlands have a lower rank compared to their dominant positions in FDI: if we sum their respective positions, they account for 9% of total outstanding banking claims. Nordic countries' cross-border banking exposure into the CESEE -6 region is very small compared to their positions in Baltic countries.

Since the GFC, we can see that first, both Austria and Germany have kept their first and second creditor positions both during the 2008-2012 GFC and Sovereign Debt Crisis period, and during the 2012-2018 banking deleveraging process period. There has been a diversification of creditor countries' base, particularly from Asia, but with small volumes only. The USA hold almost no banking positions in the region. Greece, Italy and Spain have started to report their positions in 2007 and 2014 respectively: Italy particularly stands out with an outstanding claims position comparable with Belgium. If European Union countries' relative ranking have not changed much during the 2008-2012 period, France and Belgium have less deleveraged than their peers during the 2012-2018 period and now hold the third and fourth creditor rankings within the region. Finally, cross-border banking diversification outside the European Union seems rather on hold: positions are quite deleveraged and do not allow us to do further analysis.

From this Subsection analysis, we can conclude that creditor countries' base for Other Investment in the CESEE-6 region is quite close to the investor countries' base for FDI and comprises many European Union countries. Nevertheless, the respective country rankings are quite different and as we have seen for cross-border banking claims,

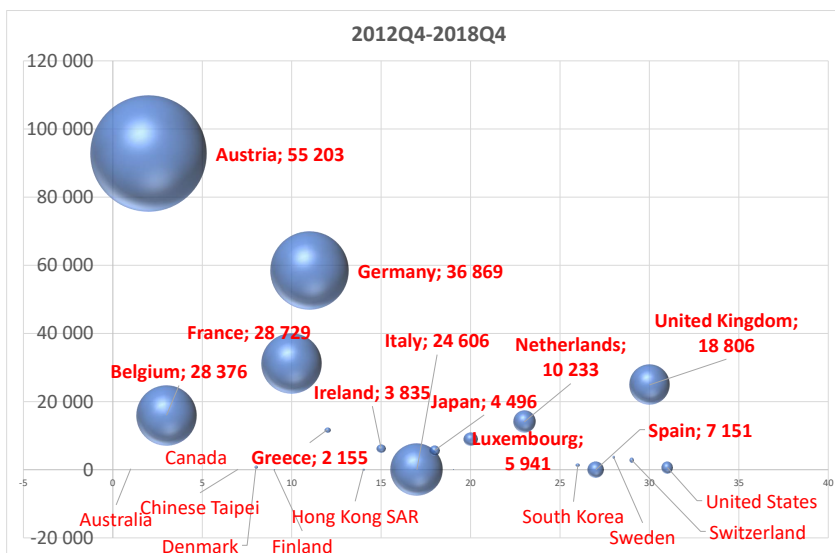
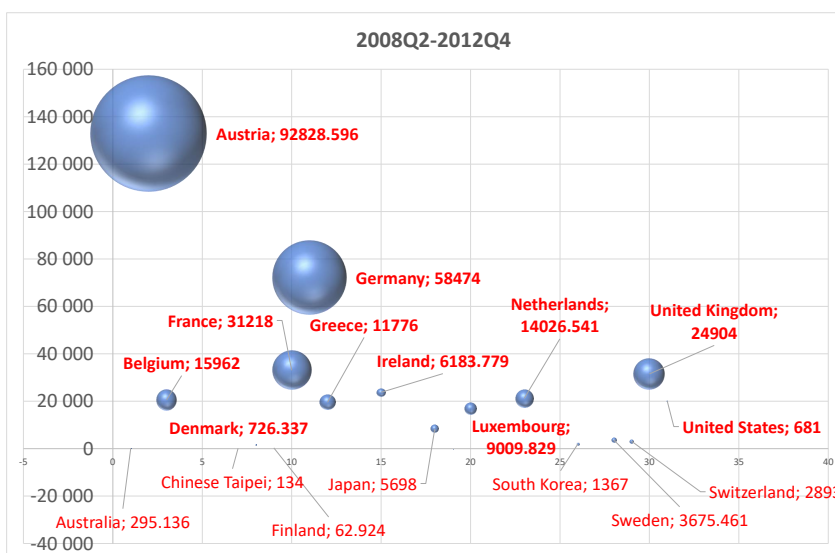
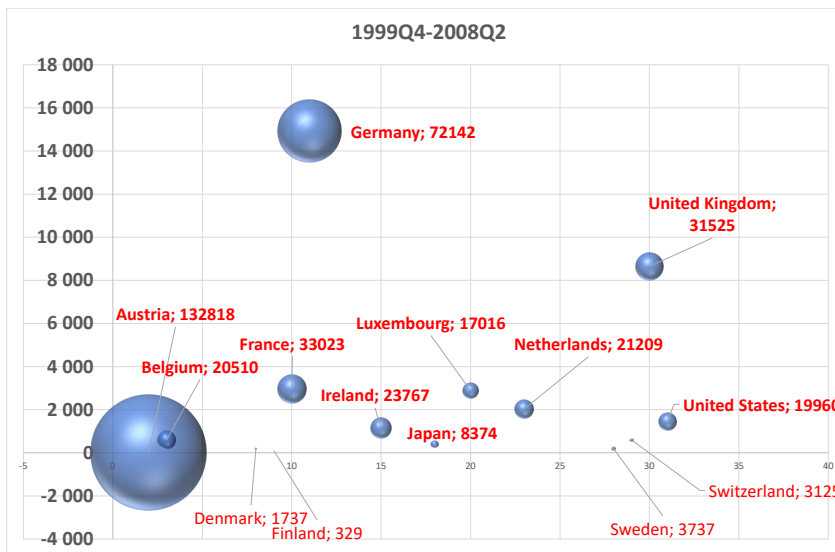
both country base and rankings evolve over time.

This Section has highlighted the potential influence of geographical patterns in determining the most important sources of external financial liabilities of the CESEE-6 region, which are FDI and external debt.

The remaining of this research work will focus on cross-border banking claims for the following reasons. First, they account for a large proportion of External Debt instruments (and thus, external vulnerabilities) and data availability allows us to do a long-term bilateral analysis. Second, we believe long-term determinants of bilateral FDI are difficult to assess because of the overwhelming weight of onshore International Financial centers for these countries, that act for a third party and do not reflect a real bilateral FDI position. Third, the recent increase of portfolio debt holdings during the 2010s is an interesting stylized fact but available data does not allow us to perform a long-term empirical analysis. Last but not least, CESEE-6 countries share some banking system characteristics that are quite specific to the region, particularly the fact that their banking sector assets are controlled by non-domestic banks. This is all the more true for the Czech Republic, Croatia and Bulgaria. Foreign banks control between 45% and 88% of total assets, whereas at European Union level, foreign banks control 20% of domestic banking assets in average (as of 2019). Furthermore, in terms of geographic scope, as emphasized by [Hüttl and Schoenmaker \(2016\)](#), 55% to 78% of foreign banks assets in CESEE countries originate in the European Banking Union.

Figure 1.8 – CESEE-6: Evolution of foreign creditor countries

Source: BIS Locational Banking Statistics; in USD million; start and end dates indicated in titles.  
 Bubble size indicates country ranking (with outstanding banking claims indicated in red) at period end;  
 left hand scale indicates banking claims at period start.



### 1.3 Literature review

Financial and banking integration can be defined and estimated in many ways. At the macro level, analysis proceeds from the external position of countries (and calculated as the ratio of external assets and liabilities over GDP), as in [Lane and Milesi-Ferretti \(2007\)](#). Another methodology, as in [European Central Bank \(2018\)](#), is based on quantity or price-based indicators, usually split between several categories of cross-border assets. These two examples are representative of the plurality of approaches that can be adopted to analyze cross-border financial and banking linkages, which subsequently translates into an extended empirical literature. Policy research from International Financial Institutions has also complemented empirical research and has focused on financial stability and macroprudential issues after the Global Financial Crisis<sup>10</sup>.

Therefore, given this empirical research universe and the stylized facts we have highlighted in Section 1.2 (particularly the geographical patterns of cross-border banking over the past thirty years), our literature review focuses on empirical papers analyzing financial and banking cross-border links of CESEE countries with foreign creditors, and more precisely, that make use of bilateral data to assess dynamics, determinants and impacts of financial and banking integration.

Our research question is linked to a first strand of literature that analyzes macroeconomic and stability impacts of financial integration, by using bilateral trade or financial links between countries. This literature is rather unified in terms of methodology, since it analyzes CESEE countries' macroeconomic interdependence with the European Union using Global VAR models ([Backé et al., 2013](#); [Bicu and Candelon, 2013](#); [Sgherri and Galesi, 2009](#); [Sun et al., 2013](#)). Country weights used in the GVAR are usually representative of cross-border trade or financial flows, or both, between countries. [Sun et al. \(2013\)](#) interestingly use cross-border bank exposure data to model financial links between European countries. These papers typically analyze real or financial spillovers to countries included in the GVAR and help quantifying the degree of economic or financial vulnerability of these countries.

Closer to our research question, a second strand of literature explores the global dynamics of international investment flows, sometimes in CESEE countries only, and draws conclusions in terms of geographical concentration of creditor or investors countries' risk. CESEE countries<sup>11</sup> are usually included as destination countries in empirical panel studies on the European Union or on Emerging countries. Specifically to the cross-

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<sup>10</sup>Specific reports have been regularly published by the International Monetary Fund -IMF-, the European Bank for Reconstruction and Development – ERBD- or the European Investment Bank – EIB-, ad-hoc working groups sponsored by the European Bank Coordination “Vienna” Initiative (EBCI) or National Central Banks (such as the ECB or the Austrian Oesterreichische Nationalbank- OeNB-).

<sup>11</sup>Countries analyzed often comprise Slovakia, Slovenia and the Baltic countries- Estonia, Latvia and Lithuania. In some cases, Ukraine, Russia, Turkey are also included in the CESEE region.



border banking claims analysis, recent empirical literature has often used the gravity modelling approach to determine factors. Finally, there has been specific research on the impact of foreign bank presence in the CESEE countries. We review these three strands of literature successively.

As regards international investment analysis, two noticeable articles focus on CESEE countries. [Bakker and Gulde \(2010\)](#) review some stylized facts about the 2003-2008 external position deterioration of CESEE countries. Using BIS Locational Banking Statistics data, they show that the external positions of European reporting banks have exploded in the CESEE region and have fueled the credit boom through local lending from their subsidiaries. [Lane and Milesi-Ferretti \(2007\)](#) examine the evolution of the external positions of CESEE countries between 1994 and 2004, by type of investment, and proceed with a bilateral analysis of financial liabilities for each investment category. They show that geographical proximity is an important driver of direct investment and banking claims in CESEE countries, with Western banks and countries outweighing other regions in that respect. On a larger scale, [Lane and Milesi-Ferretti \(2017\)](#) assess the global dynamics of cross-border holdings of financial assets and liabilities since the GFC over 210 economies, for the 1970–2015 period: amongst other conclusions, they emphasize the fact that portfolio investment has gained momentum over banking loans since the GFC. They find future financial integration of developing countries is likely to be a regional phenomenon. [Milesi-Ferretti et al. \(2010\)](#) study the great retrenchment in international capital flows during the GFC using a large panel of 75 Developed and Emerging economies (inclusive of 15 CESEE countries): based on regressions of gross capital and banking inflows, they find that sudden stops were more severe for Emerging countries with pre-GFC larger net liabilities in debt instruments, faster GDP growth and large private credit.

Specifically to cross-border banking claims analysis, literature has recently used financial gravity models to assess their determinants. Gravity models have been extensively used in international economics since the 1960s to analyze the determinants of bilateral trade flows. As explained in [Head and Mayer \(2013\)](#), by analogy with the gravity force equation, gravity equations are a model of bilateral interactions in which size and distance effects enter multiplicatively. There exist as many variants to the gravity equation as possible explanatory and control variables entering it. The gravity modelling of bilateral trade flows has spilled over the international finance and banking literature, with important theoretical papers by [Portes and Rey \(2005\)](#); [Okawa and van Wincoop \(2012\)](#). One recent contribution on the role of distance is from [Brei and von Peter \(2018\)](#), that focus on the distance puzzle in both trade and banking flows. Using an advanced model and database for both types of international flows, they find that the role of distance is significant when setting cross-border transactions against domestic ones.

Closer to our countries of interest, gravity models have been recently estimated to analyze the retrenchment of cross-border banking flows in Europe. [Bouvatier and Delatte \(2015\)](#) find that the international banking integration of the Euro area has been cyclical since 1999, with a peak in 2006 and a reversal since. This decline is not a correction of previous overshooting but a market disintegration. [Emter et al. \(2019\)](#) estimate a gravity model between 2008 and 2015 on cross-border loans and deposits, using indicators of banking stability, prudential policy and bank levies. They show that there is a significant link between deteriorating asset quality (typically, Non-Performing Loans) and the decline in cross-border banking transactions within the European Union since the GFC. In [European Central Bank \(2016\)](#), a standard gravity model is estimated to analyze change in cross-border portfolio investments within Euro area countries before and after the sovereign debt crisis in 2013. Authors find evidence of a sudden stop accompanied by a flight to quality within the currency union. These references on gravity models for banking claims are reviewed in detail in Appendix 1.B.

Related to the literature on cross-border banking claims and specifically to the CESEE countries, there is finally a strand of literature focusing on the impact of foreign banks' presence on local credit growth using macro or microeconomic cross-border banking data. They usually find a positive impact of the 2008-2009 Vienna Initiative (VI 1), that has moderated lending decline through subsidiaries in CESEE countries. [Cetorelli and Goldberg \(2011\)](#) analyse the bank balance-sheet channel of a USD funding shock on both local and international banking claims growth in Emerging markets<sup>12</sup>, using funding vulnerabilities and VI 1 participation variables. They find VI 1 has had a mitigation impact on local claims' decline in the aftermath of the GFC. [De Haas et al. \(2012\)](#) study the link between banks' ownership and credit growth during the 2008-2009 GFC, within the context of the Vienna Initiative, using bank-level data. They find that foreign banks participating in the VI 1 have been stable lenders. [Temesvary and Banai \(2017\)](#) analyze lending behaviour between foreign subsidiary and parent banks in Central and Eastern European countries post-GFC based on bank-level data, depending on their participation to Vienna Initiatives and proportion of foreign-currency denominated loans. They find that both Non Performing Loans and parent capitalization are determinants of lending growth, together with a positive impact of the VI 1 on lending.

If we finally focus on the determinants of international capital flows, literature over the past twenty-five years highlights the potential importance of both "pull" and "push" factors in determining international capital flows, starting from the seminal paper of [Calvo et al. \(1993\)](#). Pull factors refer to country-specific characteristics of recipient countries, whereas push factors refer to external conditions: they may be characteristics from the creditor countries or global factors. [Forbes and Warnock \(2012\)](#) summarize the

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<sup>12</sup>Using Consolidated Banking Statistics

key findings of this literature in terms of broad classes of factors usually found significant in explaining capital flows. In terms of push factors, they highlight the importance of global liquidity conditions, risk aversion, interest rates and changes in economic growth in advanced economies. In terms of pull factors, financial determinants such as financial openness of the recipient countries, together with the size and vulnerabilities of financial systems are also found to be significant in explaining international capital flows. Moreover, macroeconomic factors of the recipient countries such as fiscal positions, exchange rate regimes, real interest rates, real exchange rates and changes in domestic growth play a role in the development of capital flows. Empirical findings are quite dependent on the period and countries analyzed: [Koepke \(2019\)](#) performs a qualitative meta-analysis of 40 studies to assess the most significant pull and push factors for non-resident capital flows in Emerging countries: he finds stronger evidence in favor of pull factors' impact on banking flows, with a positive relationship with domestic output growth and asset return indicators and a negative relationship with country risk indicators.

Specifically to the CESEE countries, some empirical articles focus on pull and push determinants of cross-border banking claims, that are reviewed in Table 12<sup>13</sup>. Three of these studies find a significant role of Non Performing Loans and Return on Equity both as pull and push factors. The VIX index as a proxy for global aversion is also found significant. [Brana and Lahet \(2012\)](#) study the links between foreign banks' presence and lending stability in CESEE countries between 2000 and 2008. Using a ACP methodology, they find that foreign bank presence is associated with the financial development of receiving economies, together with some performance indicators of their financial systems. Using an econometric approach, they find that foreign banks' presence is determined by pull factors and by EU integration. [Herrmann and Mihaljek \(2011\)](#) study determinants of external positions of BIS reporting banks in a panel of 45 Developed and Emerging countries (inclusive of CESEE countries) from 1993 to 2008, using a gravity modelling inclusive of country fixed effects only. They find that healthier banking sectors, more rigid exchange rate regimes and stronger financial integration contributed to the stability of cross-border bank flows for these countries compared to other Emerging regions.

Regarding global factors, the roles of global risk aversion and of liquidity in explaining international capital flows (and cross-border banking flows) have gathered interest since the GFC. We focus herebelow on two contributions and related empirical works. First, the existence of a Global Financial Cycle of capital flows, credit and asset prices has been analyzed by [Rey \(2013\)](#). It is linked to both monetary conditions in the USA and to changes in risk aversion and uncertainty (as measured by the VIX Index). This financial cycle transforms the monetary policy trilemma into a dilemma, that leaves countries with less monetary policy autonomy. The role of such financial cycle is subject to debate:

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<sup>13</sup>Even though we don't explore Foreign Direct Investment on the empirical side of this research work, it is worth noting that there has been quite a few empirical articles related to FDI determinants (see [Iwasaki and Tokunaga \(2014\)](#) for a meta-analysis).

[Cerutti et al. \(2018\)](#) find little empirical evidence of financial cycle impact on capital flows during the 1990-2015 period when using VIX or factor variables.

Second, [Brunnermeier \(2009\)](#) has analyzed the transmission channels of liquidity crises to the financial system during the GFC and highlights the importance of both borrower's balance-sheet and lending channels in amplifying the liquidity shock and triggering a full-scale financial crisis. The links between global liquidity conditions and cross-border banking flows are empirically estimated in [Cerutti et al. \(2017\)](#) over a panel of 77 countries over the 1990-2012 period. They find that the most relevant G4 financial conditions are uncertainty (VIX), US monetary policy (particularly the slope of the yield curve) and funding conditions for global banks (leverage and TED spreads). Short-term interest rates and growth in monetary aggregates are not robust to explain cross-border banking claims.

Global factors have been identified as determinants of capital flows in the CESEE countries. [Eller et al. \(2016\)](#) show, using a variance decomposition model, that the largest share of capital flows' volatility in CESEE-12 countries between 1994 and 2014 is explained by global financial factors, extracted from a list of macroeconomic and financial variables. In [International Monetary Fund \(2014\)](#), global liquidity indices are significant determinants of cross-border banking flows as well.

Based on stylized facts and literature review just developed, we can now turn to our empirical model specification.

## 1.4 Empirical strategy

Our empirical strategy consists in estimating a gravity model to assess the determinants of cross-border banking claims in CESEE countries. Main methodological references on gravity models (drawing from the international trade literature) are [Bacchetta et al. \(2012\)](#); [Baldwin and Taglioni \(2006\)](#); [Eichengreen and Irwin \(1998\)](#); [Head and Mayer \(2013\)](#); [Santos Silva and Tenreyro \(2006\)](#); [Yotov et al. \(2016\)](#).

### 1.4.1 Specifications

#### 1.4.1.1 Traditional versus structural gravity

Traditional equation is not derived from a structural model but from Newton's law of universal gravitation. It formulates that international trade between two countries is proportional to the product of their sizes (here, approximated by their GDP sizes) and inversely proportional to trade frictions. By analogy to the trade model, we write the multiplicative form of this law, adapted to financial assets holdings such as external positions of BIS- reporting banks from Reporting Country  $i$  to Counterparty Country  $j$  at time  $t$  (noted  $IC_{i,j,t}$ ):

$$IC_{i,j,t} = G \times \frac{Y_{i,t}Y_{j,t}}{dist_{i,j}^2} \quad (1.1)$$

With  $Y_{i,t}$  and  $Y_{j,t}$  origin and destination countries GDP at time  $t$ ,  $G$  the gravitational constant and  $dist_{i,j}$  the bilateral distance between two countries. If we log-linearize this model for estimation purposes, with  $\epsilon_{i,j,t}$  i.i.d. errors with zero mean and constant variance:

$$\ln IC_{i,j,t} = \ln G + \alpha_0 \ln Y_{i,t} + \alpha_1 \ln Y_{j,t} - \beta_0 \ln dist_{i,j} + \epsilon_{i,j,t} \quad (1.2)$$

As shown below, this specification suffers from omitted variable bias that has been resolved by structural models.

The multiplicative structural gravity model in [Anderson and van Wincoop \(2003\)](#) includes a gravitational time-varying term  $G_{i,j,t}$ . With same notations:

$$IC_{i,j,t} = G_{i,j,t} \times \frac{Y_{i,t}Y_{j,t}}{T_{ij}^{\sigma-1}}$$
$$T_{ij} = dist_{i,j}^\rho \exp^{\omega' Z_{ij}} \quad (1.3)$$

$T_{ij}$  are the trade bilateral frictions between origin country  $i$  and destination country  $j$  at time  $t$  (with  $\sigma$  the elasticity of substitution,  $Z_{i,j}$  a vector of  $k$  bilateral gravity variables and its associated  $k$ -vector of parameters  $\omega$ ) and  $G_{i,j,t}$  the product of two multilateral resistance time-varying terms (in trade gravity model, it is a function of market potential of origin country  $i$  and price index of destination country  $j$  at time  $t$ ).

Okawa and van Wincoop (2012) derive the financial gravity equation for bilateral portfolio asset holdings (equity and bonds) from the same assumptions as in Anderson and van Wincoop (2003), adapted to financial holdings. They find bilateral holdings are driven by the same three factors as for the trade gravity equation: first, a size factor (based on respective holdings and supply of financial assets from country  $i$  and country  $j$ ), a bilateral and asymmetric information friction (replacing the trade frictions) and a relative financial friction between countries (based on two financial multilateral resistance terms, from country  $i$  and country  $j$ 's perspectives).

Multilateral resistance terms are critical in both models and have therefore to be accounted for in empirical models to insure estimation is unbiased (all the more in panel studies where they are time-varying). Since they are unobservable (or quite difficult to assess), empirical literature uses a combination of origin country  $i$ , destination country  $j$  and countrypair fixed effects (Baldwin and Taglioni, 2006; Yotov, 2012). We develop herebelow the three types of fixed effects that correct the omitted variable bias.

#### 1.4.1.2 Correction of the omitted cost-related variable bias with fixed effects

First, country time-invariant fixed effects (TI FE) constitute a partial correction for the omitted variable bias since  $G_{i,j,t}$  varies over time: they account only for the cross-section correlation between omitted terms and explanatory variables, not for the time series bias. This model does not allow the inclusion of country-specific time-invariant variables because country fixed effects make their identification impossible.

If we log-linearize Model 1.3 and replace the relative friction term by individual country TI FE, with same notations as previously, with vectors of origin and destination countries time-invariant fixed effects  $\delta_i, \gamma_j$  and time fixed effects  $\mu_t$  (to account for unobserved time heterogeneity, particularly time-varying price effects), we get the following econometric specification:

$$\ln IC_{ij,t} = \alpha_0 \ln Y_{i,t} + \alpha_1 \ln Y_{j,t} + \rho(1 - \sigma) \ln dist_{i,j} + (1 - \sigma)\omega' Z_{ij} + \delta_i + \gamma_j + \mu_t + \epsilon_{ij,t} \quad (1.4)$$

or, with GDP adjustment on the left-hand side (to insure unit elasticities with GDPs):

$$\ln\left(\frac{IC_{ij,t}}{Y_{i,t}Y_{j,t}}\right) = \rho(1 - \sigma) \ln dist_{i,j} + (1 - \sigma)\omega' Z_{ij} + \delta_i + \gamma_j + \mu_t + \epsilon_{ij,t} \quad (1.5)$$

Using the exponential function to estimate the multiplicative form of the gravity

equation, with  $IC_{ij,t}$  in levels, we find the following specification:

$$IC_{ij,t} = \exp^{(\alpha_0 \ln Y_{i,t} + \alpha_1 \ln Y_{j,t} + \rho(1-\sigma) \ln dist_{i,j} + (1-\sigma)\omega' Z_{ij} + \delta_i + \gamma_j + \mu_t)} \times \epsilon_{ij,t} \quad (1.6)$$

Second, country time-varying fixed effects (TV FE) are an alternative and correct the full omitted variable bias. It is noticeable that in this case, country time-varying variables are not identified but captured directly by TV FE. We write first in log-linearized format, then convert back into the multiplicative format, with  $\delta_{i,t}$  and  $\gamma_{j,t}$  the TV FE:

$$\ln IC_{ij,t} = \rho(1-\sigma) \ln dist_{i,j} + (1-\sigma)\omega' Z_{ij} + \delta_{i,t} + \gamma_{j,t} + \mu_t + \epsilon_{ij,t} \quad (1.7)$$

$$IC_{ij,t} = \exp^{(\rho(1-\sigma) \ln dist_{i,j} + (1-\sigma)\omega' Z_{ij} + \delta_{i,t} + \gamma_{j,t} + \mu_t)} \times \epsilon_{ij,t} \quad (1.8)$$

Specifications 1.7 and 1.8 are suited to get unbiased estimates of gravity coefficients, particularly the distance effect.

Third, countrypair time-invariant fixed effects  $\theta_{ij}$  capture the countrypair unobserved heterogeneity, control for bilateral information frictions and addresses the issue of endogeneity of policy variables (Baier and Bergstrand, 2005). In this case, country pair time-invariant characteristics such as the set of standard gravity variables are not identified. We can also add country-specific time-varying fixed effects so that the model does not have omitted variable bias (neither would in this case time-variant country variables be identified). We can write with  $X_{ij,t}$  a vector of bilateral time-varying variables and  $\beta$  its associated vector of parameters:

$$\ln IC_{ij,t} = \beta' X_{ij,t} + \delta_{i,t} + \gamma_{j,t} + \mu_t + \theta_{ij} + \epsilon_{ij,t} \quad (1.9)$$

$$IC_{ij,t} = \exp^{(\beta' X_{ij,t} + \delta_{i,t} + \gamma_{j,t} + \theta_{ij} + \mu_t)} \times \epsilon_{ij,t} \quad (1.10)$$

Specifications 1.9 and 1.10 allow to estimate the impact of institutional variables (such as the European Union dual membership). If we exclude time-varying country fixed effects from Equation 1.10 and augment it with  $X_{i,t}$  and  $X_{j,t}$  the vectors of time-varying country determinants of banking claims for the origin countries and destination countries, respectively, we have the following augmented gravity specification:

$$\ln IC_{ij,t} = \alpha_0 \ln Y_{i,t} + \alpha_1 \ln Y_{j,t} + \nu' X_{i,t} + \chi' X_{j,t} + \theta_{ij} + \mu_t + \epsilon_{ij,t} \quad (1.11)$$

$$IC_{ij,t} = \exp^{(\alpha_0 \ln Y_{i,t} + \alpha_1 \ln Y_{j,t} + \nu' X_{i,t} + \chi' X_{j,t} + \theta_{ij} + \mu_t)} \times \epsilon_{ij,t} \quad (1.12)$$

## 1.4.2 Estimators

We first use Ordinary Least Squares estimator with fixed effects at country level as a starting point of the empirical analysis. We use the log-linearized specification 1.5 and estimate gravity coefficients using standard errors (and covariance matrix) that are robust to heteroscedascity and clustering (i.e. error correlation within groups). Nevertheless, as emphasized by [Santos Silva and Tenreyro \(2006\)](#) for log-linearized constant elasticity models such as the structural gravity model, the error properties (their conditional distribution) are modified in such a way that OLS estimates become inconsistent if error homoscedasticity condition does not hold. Hence, nonlinear estimators should be used.

Alternative estimators for trade gravity equations have been extensively analyzed ([Gómez-Herrera, 2013](#); [Shepherd, 2012](#)). The Poisson Pseudo Maximum Likelihood (PPML) estimator is consistent under quite general forms of error heteroscedasticity. Under the assumption that conditional variance of the Data Generating process is proportional to its conditional mean, PPML estimator's consistency relies on conditional expectation's correct specification "only". Ramsey's RESET test specification test may therefore be used ([Santos Silva and Tenreyro, 2006](#)). Accordingly to the initial assumption, PPML estimator assigns the same weights to all observations (because weight does not depend on variance). We therefore use the Poisson Pseudo-Maximum-Likelihood estimator for the specifications derived from the multiplicative models 1.6, 1.8, 1.10, 1.12. This estimator is non linear and has a lot of properties that are suited for three-dimensional data such as gravity datasets. Methodological reference is [Santos Silva and Tenreyro \(2006\)](#), further extended in 2011<sup>14</sup>. First, there is no requirement on the Data Generating Process distribution (no need for data to be Poisson-distributed) for the estimator to be consistent. Second, PPML estimator takes into account the zeros in the banking claims matrix as opposed to the log-linearized model (no selection bias inherent with unbalanced data- [Carrère \(2006\)](#) for another possible correction methodology). Third, it supports both individual and country pair explanatory variables at the same time since it is a non linear estimator<sup>15</sup>. Finally, PPML estimator supports time-invariant or time-varying fixed effects by origin and destination countries together with time-invariant countrypair fixed effects.

Even though the use of fixed effects is strongly justified by theoretical backgrounds, we nevertheless perform an [Hausman \(1978\)](#) specification test between individual random or fixed effects. It is a challenge to perform such test for the gravity equation due to the following reasons. First, even if we assume that errors satisfy the homoscedasticity condition (which they usually do not), bilateral gravity variables are not identified in the fixed effects model on bilateral data. We therefore perform a modified version of

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<sup>14</sup>We use the ppml Stata function developed by authors for our estimations.

<sup>15</sup>Potential collinearity issues on explanatory variables should therefore be treated specifically (Variance Inflation Factor analysis on linear regression).



the Hausman test that is robust to intra-individual error correlation (based on bootstrap error clustering) on Specification 1.12 inclusive of banking variables (as developed hereafter) and countrypairs TI FE: we reject the null hypothesis of random effects at 5%.

### 1.4.3 Choice of variables and database construction

In our financial gravity model, our bilateral dependent variable is Reporting Country  $i$ 's outstanding banking claims on counterparties resident in Counterparty Country  $j$ , from BIS Locational Banking Statistics (by residence). These claims include intercompany loans but not foreign subsidiaries' lending in local currency. Precisely, we use external positions of BIS-reporting banks in USD, all instruments, all currencies, all sectors and without exchange rate adjustment. In order to have the longest estimation period, we use annual or annualized data. We nevertheless exclude the pre-transition period from our empirical work, as we did for the stylized facts, and start the analysis in 1990.

In order to assess the determinants of cross-border banking, we use three types of variables that can be identified in the empirical model just specified: first, bilateral variables, comprised of gravity variables (time-invariant) and institutional variables (either time-varying or dummy variables); second, individual variables (country-specific), comprised of financial variables mostly related to banking sector and individual controls (either time-varying or dummy); third, global factors.

If we first turn to bilateral gravity variables, candidate variables for financial gravity models follow the trade gravity models, since both trade and finance models noticeably share similar bilateral observable variables (as explained in [Brei and von Peter \(2018\)](#)). Moreover, regarding the use of financial variables in the financial gravity model, [Okawa and van Wincoop \(2012\)](#) insist on the fact that for estimation purposes, the unobservable financial frictions should be accounted for by variables that can generate information frictions, such as language, legal or regulatory differences; financial variables such as asset returns or return correlations are to be excluded from this perspective. First, GDPs account for the mass effect of the gravity equation. They are also a control for demand shocks. Second, gravity models have to account for historical and geographical frictions, that are mostly time-invariant. Most frequently used variables as regards natural barriers are bilateral distance, contiguity (common border), number of hours difference between origin and destination. Then, variables dealing with cultural barriers are common language, common religion and common legal origins. Historical barriers refer to sibling countries (two colonies of the same empire), or a colonial relationship. Currency union and use of common currency have become standard variables in the extended literature on the links between currency unions and trade. Finally, Preferential, Regional or Free Trade Agreements -PTA, RTA or FTA- can be used as controls in financial gravity models.

In terms of gravity variables selection, we first assessed gravity variables' multicollinearity with cross-correlation analysis. Average bilateral correlations are low (Appendix 1.F), with highest absolute average correlation of 20% between pair of distance on the one hand, and contiguity, common religion or sibling relationship on the second hand. Moreover, Variance Inflation Factor analysis for main specifications (Appendix 1.H) does not indicate a multicollinearity problem. We then proceed with a standard variable selection process using Stepwise Regression, by excluding insignificant variables and adding significant ones. We initially excluded common currency variable as it was not significant at 5%. As indicated in the empirical model specification, these variables are identified without omitted variable bias in a gravity modelling setting that includes country time-invariant or time-varying fixed effects (Specifications 1.6 and 1.8). All gravity variables come from the CEPII Geodist database, except GDP for which we use the constant 2010 USD GDP series from the World Bank World Development Indicators (WDI) database<sup>16</sup>.

Table 1.1 – Candidate bilateral gravity variables

Gravity variable	Description	Expected sign
ldistw	Log of population-weighted cross-border distance	-
lcomrelig	Log of religious proximity index	+
contig	Dummy for contiguity (common border)	+
colony	Dummy for pair ever in colonial relationship	+
sibling	Dummy for pair ever in sibling relationship	?
comleg_posttrans	Dummy for common legal origins, post transition	+
fta_wto	Dummy for Regional Trade Agreement	+
real_gdp_o_growth	GDP (constant 2010 USD) reporting country (annual growth)	+
real_gdp_d_growth	GDP (constant 2010 USD) counterparty country (annual growth)	+

Source: CEPII Geodist database and WB WDI. Note: Common language or ethnicity dummy variables take the value of zero in all our panel.

If we now turn to individual financial variables, that are potential time-varying determinants of banking integration, our selection is based on stylized facts reviewed in Section 1.2 and comprises variables identified as significant in empirical literature in Table 12. Individual variables are used both as pull or push factors, which means we have in the same specification a variable for the Reporting (origin) Country  $i$  (labelled with an "\_o") and the Counterparty (destination) Country  $j$  (labelled with an "\_d"). As indicated in the empirical model specification, these variables are identified in a gravity modelling setting within which bilateral gravity effects are accounted for by countrypair time-invariant fixed effects (Specification 1.12).

Our variable selection proceeds as follows. We first use banking sector health variables: binary variable for banking crises calculated by [Laeven and Valencia \(2008, 2018\)](#),

<sup>16</sup>We first used the GDP series in current US dollars, because as indicated in [Baldwin and Taglioni \(2006\)](#), time dummies included in the model partial out the implicit conversion factors between US dollars in different years. Nevertheless, applying a single exchange rate transformation does not account for currency crises in Bulgaria and the Czech Republic, and large inflation rates.

the ratio of Non Performing Loans over total loans, bank regulatory capital to risk-weighted assets (as a measure of regulatory stance). We also use variables reflecting the characteristics of domestic banking systems: domestic credit market size and bank concentration. Data source for these variables is the World Financial Development (WFD) database from the World Bank and start in 1996<sup>17</sup>. In order to capture the effects of exchange rate arrangements on capital flows, we use the [Aizenman et al. \(2008\)](#) Exchange Rate Stability Index by country, which is one of the trilemma indices (with values between 0 and 1, 1 indicating exchange rate fixity). Finally, individual controls reflect CESEE countries' integration level into the international trade in merchandises and the international productive investment at country level: we use FDI volumes and the ratio of merchandises exports and imports over GDP (in current USD) from World Bank WFD.

If we now turn to global factors, we use both liquidity and risk aversion variables. Regarding global liquidity variables, we use first, the US Ted spread that reflects liquidity conditions difference between risk-free and interbank markets<sup>18</sup>; second, the US monetary base growth rate as a proxy for the extension of global liquidity conditions. Regarding risk aversion, we use a global factor index estimated by [Miranda-Agrippino et al. \(2020\)](#) (standardized version). It is a Global Financial Cycle estimate obtained by applying a dynamic factor model (described in [Miranda-Agrippino and Rey \(2020\)](#)) to a panel of worldwide risky asset prices. This global factor can be interpreted as reflecting market volatility and aggregate risk aversion in global markets (Figure 1.9).

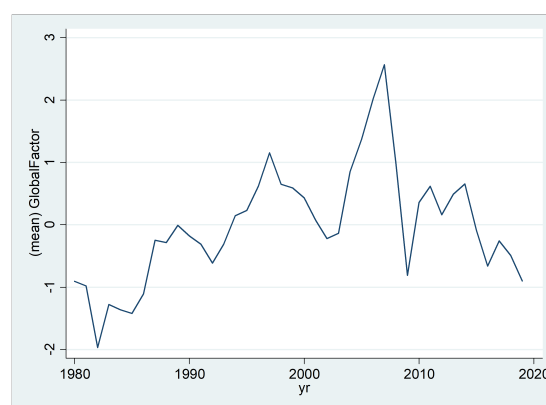


Figure 1.9 – Global Factor - Standardized variable

Note: Annual averaging of original series; Data source: [Miranda-Agrippino et al. \(2020\)](#)

Finally, two main bilateral time-varying institutional variables are included: first, the European Union common membership dummy which is the product of individual membership dummies between origin and destination countries; second, a calculated institutional quality variable based on the Regulatory Quality country indices from the

<sup>17</sup>We do not include a foreign bank presence variable because of lack of data since 2014.

<sup>18</sup>Calculated as the difference between USD 3-Month Libor and 3-Month Treasury Bill, and sourced from the Federal Reserve.

World Bank Worldwide Governance Indicators Database. It reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. It ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance. We use the absolute value of the difference between Reporting Country *i* and Counterparty Country *j* indices as a measure of their institutional distance. We chose to focus on this index because it potentially impacts private investment but other methodologies are worth noting (such as simple averaging of the six indices<sup>19</sup>) or successive testings of all indices.

We finally use an institutional dummy for Reporting Country *i*'s participation to the Vienna Initiative 1<sup>20</sup>. Table 1.2 summarizes the variables' descriptions and sources.

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<sup>19</sup>Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption.

<sup>20</sup>It is an informal governance framework implemented in 2008 to stabilize CESEE countries' financial systems. Home and host countries, banking groups and IFIs committed to maintaining capital and liquidity exposure in CESEE countries. Subsection 3.4.2 of this thesis is dedicated to the Vienna Initiatives.

Table 1.2 – Individual and institutional variables  
(o: reporting/origin country; d: counterparty/destination country)

Variable	Definition	Expected sign	Data source
<b>Country specific - Exchange rate and Banking</b>			
ER_stability_o ER_stability_d	Exchange Rate Stability Index	Positive	Chinn Ito trilemma indices
NPL_o NPL_d	Bank non-performing loans to gross loans (%) (measure of banking sector health)	Negative	World Financial Development (World Bank)
reg_capita_o reg_capita_d	Bank regulatory capital to risk-weighted assets (%) – (measure of banking sector leverage and regulatory stance)	Negative for origin	World Financial Development (WB)
banking_crisis_dum_o banking_crisis_dum_d	Dummy for banking crisis	Negative	<a href="#">Laeven and Valencia (2018)</a>
bank_conce_o bank_conce_d	Banking sector concentration (%)	Positive for origin / Negative for destination	World Financial Development (WB)
creditmark_o creditmark_d	Domestic credit provided by financial sector (% GDP)	Positive	World Financial Development (WB)
<b>Institutional variables</b>			
Regulatory_quality_bilat	Bilateral variable: absolute value of the difference between Regulatory_quality_o and Regulatory_quality_d	Negative	Author's calculations
Regulatory_quality_o Regulatory_quality_d	Regulatory Quality index for Reporting Country i and Counterparty Country j, respectively	Positive	WB Worldwide Governance Indicators
eu_both	Bilateral dummy variable for EU dual membership (product of eu_o and eu_d)	Positive	Author's calculations
eu_o eu_d	Dummy for EU membership	Positive	CEPII
vienna_1_o	Dummy for Vienna Initiative 1 participant country	Positive	Author's calculations (2008-2012)
<b>Global Factor variables</b>			
Global Factor	Global Financial Cycle estimate obtained from a dynamic factor model	Positive	Miranda-Agrippino, Nenova and Rey (2020)
US TED spread	USD 3-Month Libor rate - 3-Month Treasury bill rate	Negative	Federal Reserve (2020)
US Monetary Base growth rate	Annual log difference, in USD million	Positive	Federal Reserve (2020)
<b>Individual Control variables</b>			
lfdi_d	Foreign Direct Investment volumes in USD millions (logs)	Positive	World Financial Development (WB)
ouv_comm_o ouv_comm_d	Ratio of Merchandises exports and imports, over GDP in current USD	Positive	WB WDI

#### 1.4.4 Panel statistics and unit root testing

Table 1.3 – List of BIS reporting countries included in dataset (ISO-3 codes)

Australia	AUS	Germany	DEU		
Austria	AUT	Greece	GRC	South Africa	ZAF
Belgium	BEL	Hong Kong SAR	HKG	South Korea	KOR
Brazil	BRA	Ireland	IRL	Spain	ESP
Canada	CAN	Italy	ITA	Sweden	SWE
Chinese Taipei	TWN	Japan	JPN	Switzerland	CHE
Denmark	DNK	Luxembourg	LUX	United Kingdom	GBR
Finland	FIN	Macao SAR	MAC	United States	USA
France	FRA	Netherlands	NLD	Mexico	MEX

Our database includes 26 origin countries, out of 44 reporting countries as of 2014<sup>21</sup>. The CESEE countries are not BIS reporting countries. Jersey, Guernsey and Isle of Man are not included in our panel analysis since gravity variables are missing. Nevertheless, their outstanding banking claims in the CESEE region do not stand at high levels and offshore centers are usually excluded from gravity analysis. We selected the 6 CESEE countries as destination countries. The individual dimension of our panel (number of country pairs) is  $N=147$  and the time dimension (number of years) is  $T = 30$  (from 1990 to 2019). We therefore have an unbalanced panel database. Total number of bilateral cross-border observations is 2615. Maximum number of observations is 4530. Table 1.5 gives descriptive statistics of our dataset. Figure 1.10 shows that the relationship between outstanding banking claims and distance may be modelled with a gravity model.

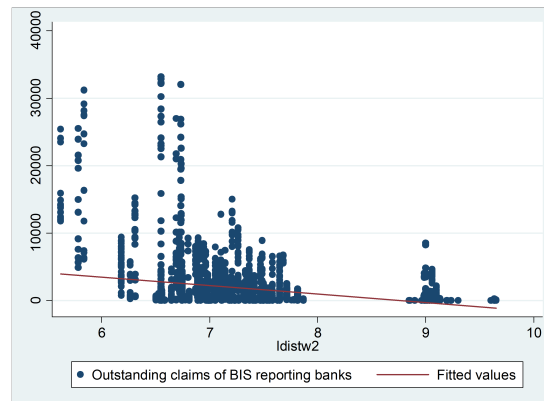


Figure 1.10 – Scatter graph of outstanding cross-border banking claims against distance

Regarding panel unit root testing, most articles do not provide test results, even though they perform panel estimations and not cross-section ones (Bouvatier and Delatte, 2015; Yotov, 2012). Noticeably, Herrmann and Mihaljek (2011) use the log of quarterly change in external positions as the dependent variable, after performing sev-

<sup>21</sup>Austria started reporting in 2007. For new reporting countries, data not reported before are indicated as “missing values”, so that there exists both missing values and NaN.

eral unit root tests. We perform [Im et al. \(2003\)](#) (IPS) unit panel root test that is robust to unit root heterogeneity under the alternative and accomodates unbalanced panel datasets. To perform this test, we have to exclude from our dataset reporting countries that have too few observations<sup>22</sup>. Individual error autocorrelation is corrected through the addition of an autogressive term in the test regression, with lag length selection done with the AIC criteria (with robustness with the BIC and HQ criteria for our dependent variable). Graphical analysis of our dependent variable by countrypair is reported in Appendix 1.B, pointing towards stationarity in the individual dimension. Table 1.4 provides results for all bilateral and country-specific variables: almost all test statistic values are below the critical value of -1.96 at 5%, which means we reject the null of unit root for all panel units for all variables, except real GDPs, credit market size and US monetary base that we first differentiate to insure stationarity at panel level.

Table 1.4 – [Im et al. \(2003\)](#) IPS unit root test results

Variables	Avg ADF lag	i	Avg nb of periods	W.t.bar
<i>Cross-border banking claims</i>				
AIC criteria	0.39	119	20.85	-4.75
BIC criteria	0.34	119	20.85	-4.76
HQ criteria	0.39	119	20.85	-4.99
Predefined	1	119		-3.89
<i>Individual and institutional variables</i>				
bank_conce_o	0.25	119	21.55	-4.54
bank_conce_d	0.31	119	21.92	-7.17
NPL_o	0.52	113	18.88	-6.96
NPL_d	0.66	119	17.41	-6.25
reg_cap_o	0.2	113	19.42	12.67
reg_cap_d	0.5	119	17.75	-4.02
ERstability_o	0.18	102	30	-20.55
ERstability_d	0	99	28.98	-13.03
Regulatory_quality_o	0.20	119	24	-4.65
Regulatory_quality_d	0.50	119	23.97	-2.29
<i>Global and individual controls</i>				
Global_factor	1	119	30	-15.89
Log_USMonetaryBase (trend)	0	119	30	6.56
TedSpreadUS	1	119	30	-35.26
cred_market_size_o	0.69	113	27.58	2.17
cred_market_size_d	0.83	119	25.77	-3.93
lfdi_d	0.5	119	28.05	-12.77
ouv_comm_o (trend)	0.11	113	28.57	-2.79
ouv_comm_d (trend)	0.34	119	28.50	-8.16
<i>GDP variables</i>				
lgdp_real_o (trend)	0.58	113	30	2.09
lgdp_real_d (trend)	0.83	119	29	10.39

HO: All panel units have unit root; H1: Some panel units are stationary; Avg: average; Nb: Number  
W.t.bar: standardized test statistic; Test critical value is the value of standardized  $N(0,1)$  @ 5% -1.96

<sup>22</sup>Brazil, Canada, Mexico, Macao, South Africa.

Table 1.5 – Descriptive statistics (with variable labels)

	Nb obs	mean	sd	min	max
Outstanding claims of BIS reporting banks	2615.00	1697.50	3904.99	0.00	33181.00
Distance (logs)	4525.00	7.91	1.08	5.62	9.65
1=Contiguity	4512.00	0.03	0.18	0.00	1.00
1=Pair ever in sibling relationship	4527.00	0.01	0.11	0.00	1.00
1=Pair ever in colonial relationship	4514.00	0.02	0.14	0.00	1.00
1=Common legal origins after transition	4514.00	0.26	0.44	0.00	1.00
1=RTA (Source: WTO, 2015)	4514.00	0.34	0.47	0.00	1.00
Religious proximity (L.religion, in logs)	4516.00	-3.07	2.13	-9.63	-0.24
Real USD GDP_o (L.gdp_real_o, in logs)	4188.00	27.17	1.43	22.73	30.54
Real USD GDP_d (L.gdp_real_d, in logs)	4389.00	25.54	0.76	24.16	27.22
Regulatory quality index o	3528.00	1.36	0.49	-0.32	2.23
Regulatory quality index d	3619.00	0.69	0.37	-0.18	1.31
Regulatory quality distance index	3525.00	0.77	0.46	0.00	2.21
EU common membership	4516.00	0.17	0.38	0.00	1.00
Vienna Initiative 1 participant	4530.00	0.03	0.18	0.00	1.00
Banking crisis dummy - o	4222.00	0.11	0.31	0.00	1.00
Banking crisis dummy - d	4218.00	0.13	0.34	0.00	1.00
Bank non-performing loans to gross loans (%) - o	2700.00	3.51	5.08	0.09	45.57
Bank non-performing loans to gross loans (%) - d	2634.00	9.06	6.16	1.80	29.30
Bank regulatory capital to risk-weighted assets (%) - o	2765.00	14.18	3.16	7.00	26.94
Bank regulatory capital to risk-weighted assets (%) - d	2686.00	16.66	5.09	10.40	41.80
Domestic credit to private sector (% of GDP) - o	3953.00	103.09	45.70	12.88	233.21
Domestic credit to private sector (% of GDP) - d	3899.00	39.73	17.85	7.13	82.80
Bank concentration (%) - o	3240.00	66.68	19.51	20.19	100.00
Bank concentration (%) - d	3312.00	57.73	12.38	34.32	100.00
Exchange Rate Stability Index <sub>o</sub>	3750.00	0.66	0.33	0.05	1.00
Exchange Rate Stability Index <sub>d</sub>	3623.00	0.43	0.26	0.02	1.00
GlobalFactor	4530.00	0.30	0.78	-0.90	2.57
US Monetary base (L.monetarybase, in logs)	4530.00	13.88	0.88	12.66	15.19
Ted spread USD	4530.00	0.46	0.30	0.14	1.34
FDI in destination country (L.fdi_d, in logs)	4085.00	21.53	1.91	9.21	25.04
ouv_commerce_o	4068.00	67.57	59.62	9.03	419.96
ouv_commerce_d	4311.00	84.94	33.61	32.21	159.14



## 1.5 Empirical findings

### 1.5.1 Estimation of the structural-consistent gravity model and the distance effect

We first estimate the gravity model over the 1990-2019 period: results are indicated in Table 1.6. We use both OLS and Poisson Pseudo Maximum Likelihood estimators. As explained in Subsection 1.4.1, to insure unbiased estimation of gravity variables, we include time-invariant or time-varying fixed effects by origin and destination country, time fixed effects and real GDP growth controls for supply and demand. More precisely, Equation 1 has a transformed size-adjusted dependent variable as in [Anderson and van Wincoop \(2003\)](#), defined in Equation 1.5 as the ratio between banking claims and the product of real GDPs of origin and destination country<sup>23</sup>. Several gravity variables (such as common language) were equal to zero in the full panel sample, so they are not included in the regression.

Equation 1 estimated with OLS has a distance elasticity that is much lower compared to usual findings (around -1) and is not significant at 5%. Fixed effects are significant at 5% (F-statistics); residuals are heteroscedastic<sup>24</sup>. These estimation diagnostics do not validate the use of the OLS estimator.

Equation 2 estimated with PPML and country TI FE and time fixed effects shows that banking claims' elasticity to distance is estimated at -1.43 and is significant at 5%. This means a 1 per cent increase in distance tends to reduce cross-border banking claims by about 1.43 per cent. This estimate is above the estimate of -1 from meta-analyses on gravity coefficients for trade equations. Gravity models for financial flows are more recent; nevertheless, [Brei and von Peter \(2018\)](#) assume cross-border banking's elasticity to distance is lower than for trade. We believe this parameter may be overestimated due to the inclusion of common religion as gravity variable. Legal origins are not significant at 5% and we exclude the variable in subsequent equations.

Religion proximity variable is significant at 5%, but with an unexpected negative sign, meaning that if religious links between the two countries increase by 1 percent, cross-border banking claims decrease by 0.35 per cent. It is really difficult to give an economic interpretation to this religion index so that we exclude this variable from subsequent specifications, all the more since it is not robust to a set of country time-varying fixed effects (Equation 4). Nevertheless, it reinforces our view that gravity variables are significant determinants of cross-border banking for CESEE countries. Without such variable (Equation 3), distance is significant at 5% with an estimated coefficient at -1.17.

Another interesting result in Equation 2 is that sibling relationship variable is significant for countries that have been part of a same empire (Greece/Bulgaria, Greece/Romania,

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<sup>23</sup>As noted in [Yotov et al. \(2016\)](#), “the intuition behind this adjustment is that, arguably, the variance of the error term  $ij,t$  is proportional to the product of the sizes of the two markets.”

<sup>24</sup>Residual graphs, White and Breusch-Pagan test results in Appendix 1.C

Austria/Hungary). They have 15 times more cross-border banking claims in CESEE-6 countries compared with other countries. This estimate is quite high and reflects the importance of historical links in the region: it is probably not fully captured because Austria started to report Locational Banking Statistics in 2007. At the same time, one can acknowledge that even if model is well specified (according to RESET specification test that is not rejected at 5%), identification can be improved. Without the religion index variable (Equation 3), sibling relationship is also significant with a much lower estimate at 2.47 (equivalent to 12 times more cross-border banking claims).

Table 1.6 – Gravity equation and the distance effect

	(1)	(2)	(3)	(4)	(5)
Specification	( 1.5)	( 1.6)	( 1.6)	( 1.8)	( 1.8)
Estimator	OLS	PPML	PPML	PPML	PPML
Dependent	ln.q	q	q	q	q
Distance	-0.47 (-1.04)	-1.43** (-2.15)	-1.17** (-2.15)	-1.38*** (-2.89)	-2.07*** (-4.54)
Religion	-0.04 (-0.55)	-0.35** (-2.02)		-0.25 (-1.59)	
Contiguity	-0.72** (-2.09)	-0.41 (-0.99)	-0.71*** (-2.79)	-0.66*** (-2.87)	-0.52 (-1.64)
Colony	0.39 (1.04)		0.69*** (4.09)	0.70*** (4.88)	
Sibling	5.68*** (7.04)	2.82*** (3.18)	2.47*** (3.40)	2.43*** (3.22)	
Common legal origins	0.12 (0.53)	-0.25 (-0.84)			
real_gdp_o_growth		-0.03*** (-3.08)	-0.03*** (-3.26)		
real_gdp_d_growth		-0.03*** (-2.74)	-0.03*** (-2.85)		
Constant	4.66 (1.43)	7.57 (1.15)	6.30 (1.28)	8.17** (2.12)	18.28*** (5.00)
Observations	2438	2389	2404	2581	2598
$R^2$	0.845	0.703	0.732	0.857	0.792
Country Fixed Effects	TI	TI	TI	TV	TV
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Error clustering (over distance)	Yes	Yes	Yes	Yes	Yes
Countrypair Fixed Effects	No	No	No	No	No
RESET specification F-test (p-value)	0.016		0.38		

$z$  statistics in parentheses; TI: Time invariant; TV: Time varying

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Contiguity variable becomes significant in Equation 3 when colonial relationships variable is added (reflecting links between Austria and the Czech Republic on the one hand, and between Germany and Poland on the other hand). This points towards the fact the gravity model has difficulties in discriminating whether history or distance matters most for these pairs of countries. If we exclude contiguity variable and keep the colonial and siblings variables, distance is not significant anymore<sup>25</sup>. If we do the

<sup>25</sup>Not reported in Table.

opposite, distance estimate is -2.07, with the contiguity variable not significant anymore (Equation 5). We believe these results come from the PPML estimator that equally weights all observations: in the present case, it may overweight the historical links between several countrypairs only. Real GDP growth rates are significant at 5% for both reporting and destination countries, with a rather unexpected negative sign though.

Equation 4 shows that the most robust estimate of cross-border banking elasticity to distance (-1.43 in Equation 2) is robust to a longer time span and to another specification accounting for time-varying unobserved individual heterogeneity (using time-varying country fixed effects). Several distance robustness analyses are performed in Section 1.6.

### 1.5.2 Country-specific determinants of cross-banking banking claims

Estimations based on Specification 1.12 are reported in Table 1.7. Depending on data availability, we have therefore two types of equations. Equations 1 and 2 refer to the most recent period between 1996 and 2019, because they embed country-specific financial and banking system variables as described above. Equations 3 and 4 focus on identification of country-specific financial stability variables (exchange rate stability, banking crises) with individual controls relative to trade and FDI integration, over the 1990-2019 period. For all equations, the number of observations is lower than in the standard gravity model because of incomplete series on the countrypair dimension. We use the Poisson Pseudo Maximum Likelihood panel estimator, with countrypair and time fixed effects. Most gravity effects and unobserved heterogeneity (typically, unobserved bilateral banking transaction costs) are accounted for with countrypair time-invariant fixed effects. Hence, equations do not have gravity variables but the set of fixed effects and the inclusion of GDPs account for a gravity-compliant setting for estimation.

First interesting result is that our selection of banking sector variables are relevant either as push or pull factors. It means variables are significant at standard levels and have expected signs (except the bank regulatory capital variable), but only for reporting or counterparty countries. They may also be significant on the short term (Equations 1 and 2), and not on the longer period (Equations 3 and 4). More precisely, banking crisis events in origin countries are significant at 5% over the longer sample period and have a significant and large negative impact on cross-border banking flows (-17.23% in average). The banking crisis estimate for destination countries is not significant either on the most recent or longer period. Cross-border banking claims are significantly increased by 17.35% if origin countries have been participating to Vienna Initiative 1, at 10% significance (which offsets the banking crisis estimate). This last result is in line with the empirical literature results on foreign banking presence and Vienna Initiative impact described in the literature review. Several other push factors are identified: first, Non Performing Loans that have an impact on cross-border banking claims in origin countries only, at highest standard, and negatively impact cross-border banking claims by 2% in average. Second, both their domestic credit size (in % of GDP) and

real GDP growth are significant at 5%. Two pull factors are identified as well: first, banking sector concentration and second, regulatory capital, that are significant over the 1996-2019 period, with a negative sign indicating their countercyclical role. Individual control variables for merchandise trade and FDI integration are not significant at 5% (Equation 4). Overall, these results point towards the importance of reporting countries' banking and economic factors over domestic factors.

Table 1.7 – Country-specific determinants of cross-border banking claims - Eq 1.12

	(1)	(2)	(3)	(4)
	q	q	q	q
real_gdp_o.growth	-0.02*	-0.02**	-0.03**	-0.03**
	(-1.67)	(-1.99)	(-2.30)	(-2.40)
real_gdp_d.growth	-0.02*	-0.02	0.00	-0.00
	(-1.76)	(-1.57)	(0.22)	(-0.41)
banking_crisis_dum_o	-0.07	-0.08	-0.23***	-0.15**
	(-1.23)	(-1.34)	(-2.95)	(-2.15)
banking_crisis_dum_d	0.22	0.12	0.31	0.36
	(0.62)	(0.26)	(0.96)	(1.35)
vienna_1_o	0.08	0.11	0.03	0.16*
	(0.95)	(1.44)	(0.25)	(1.81)
NPL_o	-0.02***	-0.02***		
	(-2.89)	(-2.84)		
NPL_d	-0.00	-0.00		
	(-0.10)	(-0.05)		
reg_capital_o	0.01	0.01		
	(0.41)	(0.34)		
reg_capital_d	-0.05**	-0.05**		
	(-2.31)	(-2.52)		
bank_concentration_o	-0.01	-0.01		
	(-1.40)	(-1.57)		
bank_concentration_d	-0.02***	-0.02***		
	(-3.09)	(-3.06)		
ExchangeRateStabilityIndex_o	0.22	0.15	0.77**	0.72**
	(0.81)	(0.57)	(2.52)	(2.46)
ExchangeRateStabilityIndex_d	1.02***	1.02***	-0.70*	-0.43
	(2.89)	(2.72)	(-1.73)	(-0.81)
credit_size_growth_o	0.00		0.01***	
	(1.51)		(2.61)	
credit_size_growth_d	-0.00		-0.00	
	(-0.80)		(-1.01)	
ouv_commerce_o			-0.00	0.00
			(-0.24)	(0.34)
ouv_commerce_d			0.01	0.01*
			(1.18)	(1.74)
lfdi_d			0.01	0.03
			(0.46)	(1.40)
_cons	-3.73***	1.01	0.75	-3.44***
	(-4.99)	(1.20)	(0.53)	(-4.11)
<i>N</i>	1070	1110	1393	1549
<i>R</i> <sup>2</sup>	0.949	0.947	0.922	0.922
Error clustering (over distance)	Yes	Yes	Yes	Yes
Countrypair Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes

*z* statistics in parentheses

Finally, the exchange rate arrangement, more precisely its stability, is identified both as a pull and push factor, but its role depends on the period considered. If we consider the most recent period (Equations 1 and 2), exchange rate stability is significant for destination countries, at highest significance level, with a positive sign. If we consider the longer period, exchange rate stability is a significant and positive push factor, only.

### 1.5.3 Global and institutional determinants of cross-banking banking claims

We first turn to the global factors that can be potential determinants of cross-border banking claims. Our estimations are based on the same specification as in previous Sub-section which adds countrypair time-invariant and time fixed effects (Specification 1.12) and are reported in Table 1.8.

Over the three global factors tested, we can see that the Global Financial Cycle factor is not significant at 5% (Equation 2). On the contrary, from the global liquidity candidates, the US monetary base growth rate is significant at highest level on the longest period, and is positively associated with the extension of cross-border banking claims. The TED spread is not significant at 5%. As for the Global Financial, we believe both results emphasize the fact that financial variables that are observed on a very high frequency may not suited for gravity models. Additionally, these results may point out that risk aversion plays a lower role for CESEE countries compared to liquidity cycles as regard the extension of their banking liabilities. If we now turn to the institutional determinants of cross border banking flows, we first test the significance of the bilateral Regulatory Quality Distance index calculated from the WGI country indices. Some endogeneity bias may still be present, but at a lesser extend compared to the inclusion of individual indices. We find in Equation 4 that regulatory distance is identified as a determinant at 10% significance, but with mixed evidence given the estimated parameters of the other variables.

Table 1.8 – Determinants of cross-border banking flows - Global factors and Institutional distance

	(1)	(2)	(3)	(4)
	q	q	q	q
real_gdp_o.growth	-0.02 (-1.57)	-0.02 (-1.57)	-0.02 (-1.57)	-0.02* (-1.80)
real_gdp_d.growth	-0.01 (-0.90)	-0.01 (-0.90)	-0.01 (-0.90)	-0.01 (-0.59)
banking_crisis_dum_o	-0.15** (-2.21)	-0.15** (-2.21)	-0.15** (-2.21)	-0.15** (-2.31)
banking_crisis_dum_d	0.33 (0.94)	0.33 (0.94)	0.33 (0.94)	1.07*** (4.46)
vienna_1_o	0.10 (1.01)	0.10 (1.01)	0.10 (1.01)	0.11 (1.14)
ExchangeRateStabilityIndex_o	0.71**	0.71**	0.71**	0.66**

	(2.28)	(2.28)	(2.28)	(2.48)
ExchangeRateStabilityIndex_d	-0.14	-0.14	-0.14	0.45
	(-0.27)	(-0.27)	(-0.27)	(1.11)
ouv_commerce_o	-0.00	-0.00	-0.00	0.00
	(-0.12)	(-0.12)	(-0.12)	(0.01)
ouv_commerce_d	0.01	0.01	0.01	0.01*
	(1.62)	(1.62)	(1.62)	(1.83)
lfdi_d	0.03	0.03	0.03	0.06***
	(1.47)	(1.47)	(1.47)	(2.81)
credit_size_growth_o	0.01**	0.01**	0.01**	0.01**
	(2.35)	(2.35)	(2.35)	(2.13)
credit_size_growth_d	-0.01	-0.01	-0.01	0.00
	(-1.37)	(-1.37)	(-1.37)	(0.21)
TedsreadUSD	0.11			
	(1.13)			
GlobalFactor		-0.03		
		(-0.70)		
monet_base_growth			0.03***	
			(4.39)	
Regulatory_Quality_Distance				-0.36*
				(-1.88)
_cons	0.10	0.09	-1.64**	-1.06
	(0.12)	(0.11)	(-2.33)	(-0.83)
<i>N</i>	1447	1447	1447	1362
<i>R</i> <sup>2</sup>	0.924	0.924	0.924	0.933
Error clustering (over distance)	Yes	Yes	Yes	Yes
Countrypair Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
<i>t</i> statistics in parentheses				
* $p < 0.10$ , ** $p < 0.05$ , *** $p < 0.01$				

Before analyzing the impact of policy variables on cross-border banking in a unbiased setting, Table 1.9 provides results on standardized variables, which allow us to rank the variables by their relative effect (measured as standard deviations -std-). We have estimated again the equations in which most factors are identified.

On the 1996-2019 period (Equation 1), we interestingly find that banking pull factors have the largest relative weights (bank concentration -0.25 std and regulatory capital -0.27 std). From the push factors, only the Non Performing Loans have a -0.11 std impact on cross-border banking claims. Banking crises and Vienna Initiatives do not strongly determine cross-border banking claims when we use that unit. The exchange rate arrangement has also a strong contribution (+0.26 std). Size effects of the economy proxied with real GDP growth are significant for reporting countries, at 10% only.

On the 1990-2009 sample (Equations 2 to 4), global and push factors have a much larger weight on cross-border banking claims compared to pull factors: credit market size and banking crises are significant at 5% with +0.07 and -0.04 standard deviations, and most importantly the exchange rate stability of reporting countries (+0.23std). The weight of the US monetary base growth rate, which is significant at highest standard, is +0.40 std, largest above all.

Table 1.9 – Determinants of cross-border banking claims - Standardized results

	(1)	(2)	(3)	(4)
	q	q	q	q
real_gdp_o.growth_SD	-0.07*	-0.06	-0.06	-0.07*
	(-1.67)	(-1.57)	(-1.57)	(-1.80)
real_gdp_d.growth_SD	-0.07*	-0.04	-0.04	-0.02
	(-1.76)	(-0.90)	(-0.90)	(-0.59)
banking_crisis_dum_o_sd	-0.02	-0.04**	-0.04**	-0.04**
	(-1.23)	(-2.21)	(-2.21)	(-2.31)
banking_crisis_dum_d_sd	0.06	0.10	0.10	0.31***
	(0.62)	(0.94)	(0.94)	(4.46)
vienna_1.o_sd	0.01	0.01	0.01	0.02
	(0.95)	(1.01)	(1.01)	(1.14)
NPL_o_sd	-0.11***			
	(-2.89)			
NPL_d_sd	-0.01			
	(-0.10)			
reg_capital_o_sd	0.03			
	(0.41)			
reg_capital_d_sd	-0.27**			
	(-2.31)			
bank_concentration_o_sd	-0.11			
	(-1.40)			
bank_concentration_d_sd	-0.25***			
	(-3.09)			
credit_size_growth_o_sd	0.04	0.07**	0.07**	0.07**
	(1.51)	(2.35)	(2.35)	(2.13)
credit_size_growth_d_sd	-0.03	-0.04	-0.04	0.01
	(-0.80)	(-1.37)	(-1.37)	(0.21)
ExchangeRateStabilityIndex_o_sd	0.07	0.23**	0.23**	0.22**
	(0.81)	(2.28)	(2.28)	(2.48)
ExchangeRateStabilityIndex_d_sd	0.26***	-0.04	-0.04	0.12
	(2.89)	(-0.27)	(-0.27)	(1.11)
ouv_commerce_o_sd		-0.02	-0.02	0.00
		(-0.12)	(-0.12)	(0.01)
ouv_commerce_d_sd		0.32	0.32	0.31*
		(1.62)	(1.62)	(1.83)
lfdi_d_sd		0.08	0.08	0.13***
		(1.47)	(1.47)	(2.81)
monet_base_growth_SD			0.40***	
			(4.39)	
instit_SD				-0.16*
				(-1.88)
_cons	-5.57***	0.25	0.47	1.33
	(-13.38)	(1.10)	(1.24)	(1.62)
<i>N</i>	1070	1447	1447	1362
<i>R</i> <sup>2</sup>	0.949	0.924	0.924	0.933
Error clustering (over distance)	Yes	Yes	Yes	Yes
Countrypair Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes

*z* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 1.5.4 Impact of policy variables on cross-border banking claims (European Union, RTA)

We finally want to test the significance of two types of institutional impacts: first, international country agreements reflected in dual membership (European Union and Regional Trade Agreement) and second, the impact of private sector regulation distance on cross-border banking claims in CESEE countries. In order to deal with potential endogeneity issues of policy variables, we use the Poisson Pseudo Maximum Likelihood estimator for Equation 1.10, that includes countrypair fixed effects and origin/destination time-varying individual fixed effects. Our results are in Table 1.10.

This empirical model can identify impact of time-varying bilateral variables only. This means country-specific time dummy variables (such as the Vienna Initiative 1 participation) are not identified. Moreover, even if we create an interaction term between dummy variables of origin and destination countries, they may not be identified as well due to their lack of variability. This lack of variability impacts the Vienna Initiative case, but also the European Banking Union one, because they have no within group variability. As stated by [Baldwin and Taglioni \(2006\)](#), countrypair fixed effects wipe out information in the cross-section variation so that all identification comes from time variation in the variables.

Table 1.10 – Institutional determinants of cross-border banking claims

	(1)	(2)	(3)	(4)	(5)
	q	q	q	q	q
eu_both	0.34*		0.35**		0.39**
	(1.88)		(1.97)		(2.33)
1=RTA (Source: WTO, 2015)		0.04	0.21		
		(0.14)	(0.77)		
insti_bilat				0.41	0.41
				(0.87)	(0.88)
Observations	2615	2113	2113	2300	2300
$R^2$	0.979	0.986	0.986	0.980	0.980

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Regarding European Union impact, Equation 1 shows that common European Union membership increases significantly (at 10%, then 5% in Equation 5) and very positively cross-border banking claims in CESEE countries, by 40% compared to average. On the contrary, Equation 2 shows that common trade agreement has no significant impact on cross-border banking claims in CESEE countries, which may be an indication of the disconnection between banking and trade. If we control for trade on a different time period in Equation 3<sup>26</sup>, EU membership is still significant at 5%. As a robustness check of the EU dual membership impact, we estimate a standard gravity equation with country-fixed effects: EU membership is not significant at 5% (Table 1.11). In this robustness

<sup>26</sup>Variance inflation factor between RTA and EU membership is relatively low at 1.43, allowing to include both variables in Equation 3.



estimation, we don't control for correlation between EU common membership and other unobservable factors relative to cross-border banking, which have possibly a drag-down effect on outstanding claims or are negatively correlated with the other variable since EU membership estimate is lower than in Equation 1.

If we now turn to regulatory quality distance which is a time-varying bilateral variable, it is not significant at 5% over the full 1990-2019 sample. This result is different from Table 1.8 for the following reasons: first, this estimate is based on a larger individual dimension (103 versus 142 countrypairs) and second, the specification better controls for policy endogeneity.

## 1.6 Robustness

### 1.6.1 Distance estimates on 1977-2019 data sample

In Table 1.11, we check the distance estimates from Table 1.6, using PPML estimator with time and country fixed effects, by extending the dataset and adding the European Union membership dummies, both bilateral in Equation 1 and individual in Equation 2. Indeed, EU partners have supposedly less information and friction costs due to unified legal framework, EU trade integration and European Banking Union. Neither type of variables is significant at 5%, meaning that European Union membership is not identified in this set up of fixed effects, whereas we know that it plays a crucial role in the development of cross-border banking in CESEE countries from previous Subsection. Distance estimates are nevertheless robust to the inclusion of such variables in the three specifications estimated.

In Equation 3, we added a distance adjustment by country, that accounts for internal distance, that is found significant in [Brei and von Peter \(2018\)](#). The larger the country compared to its financial partners, the lower the financial exchanges. An approximation for this internal distance is provided by the square root of the country's area multiplied by about 0.4 ([Head and Mayer, 2013](#)). It is significant for origin countries at 10% only, and distance estimate is rather unchanged.

Table 1.11 – Gravity equation - Robustness (1977-2015)

	(1)	(2)	(3)
	q	q	q
Distance	-1.310*	-1.307*	-1.298*
	(-1.69)	(-1.70)	(-1.67)
1=Contiguity	-0.367	-0.363	-0.359
	(-0.97)	(-0.96)	(-0.95)
1=Pair ever in sibling relationship	2.316**	2.325**	2.338**
	(2.47)	(2.48)	(2.48)
1=Common legal origins after transition	-0.0687	-0.0721	-0.0740
	(-0.23)	(-0.24)	(-0.24)
eu_both	0.184		
	(1.04)		
lgdp_o	0.124	0.164	0.158
	(0.33)	(0.42)	(0.41)
lgdp_d	0.659***	0.664***	0.670***
	(3.15)	(3.14)	(3.17)
1=Origin is a EU member		0.290	
		(0.49)	
1=Destination is a EU member		0.0765	
		(0.59)	
int_dist_o			-0.00291*
			(-1.80)
int_dist_d			-0.000671
			(-0.21)
Constant	-2.655	-3.824	-3.977
	(-0.25)	(-0.34)	(-0.36)
Observations	2672	2672	2672
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

z statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 1.7 Conclusion

The choice of the gravity model has been relevant in analyzing the determinants of cross-border banking claims of CESEE countries: many gravity variables together with pull, push and global factors are found significant at standard levels. Results are robust to various specifications and controls for fixed or time-varying heterogeneity across countries and countrypairs. Historical, geographical and cultural links have played an important role in financial integration of CESEE countries, together as the European Union bilateral membership and the multilateral Vienna Initiative 1. Nevertheless, the gravity model does not always identify correctly distance from historical effects.

Characteristics of foreign banking systems are important drivers of cross-border banking claims over the longest estimation sample, with push factors being more significant than pull factors. As in [Emter et al. \(2019\)](#), we also find that Non-Performing Loans drive down cross-border banking claims, but only as push factors. The results are different on the shorter 1996-2019 sample: push factors become less significant than pull factors. Banking concentration and regulatory capital in CESEE destination countries, which are usually identified in the theoretical literature as positive stability and performance spillovers from financial integration, come with negative signs in our estimations. These variables play a significant counter cyclical role, which is an interesting policy result for the regulatory variable. The global liquidity influence on cross-border banking claims in these countries has also been identified. Finally, exchange rate regimes have played and continue to be an important determinant of cross-border banking claims: this obviously has an impact on the timing of the Euro area accession. Exchange rate stability comes at a cost in terms of capital flows' regulation. Since push, global and exchange rate factors are significant determinants in the long run, we formulate the following policy recommendation: if CESEE countries want to exercise better control over the level of their external banking liabilities, fostering international cooperation is necessary, maybe through European Banking Union or Euro area early membership.

Further research could extend the analysis from various perspectives, particularly on the role of institutions and regulation. Our results are mixed since regulatory quality distance variable has been found statistically insignificant, but at the same time regulatory capital, European Union membership and Vienna Initiative variables are significant variables. The role of macroprudential measures in this respect should be further investigated. Second, gravity model estimates point towards a large influence of time-invariant characteristics, particularly the (low) distance and the historical relationships. In our opinion, this means we could estimate a panel model with a spatial interdependence structure. To illustrate our point, we have included in Appendix 1.H an isochrone railway map of the Austro-Hungarian Empire in 1914, that shows a very high level railway density from Austria towards Hungary, Poland and even Croatia at this time. Nevertheless, real distance may not account for most of the information frictions.



## 1.A Evolution of cross-border loans and deposits of BIS reporting banks in CESEE countries

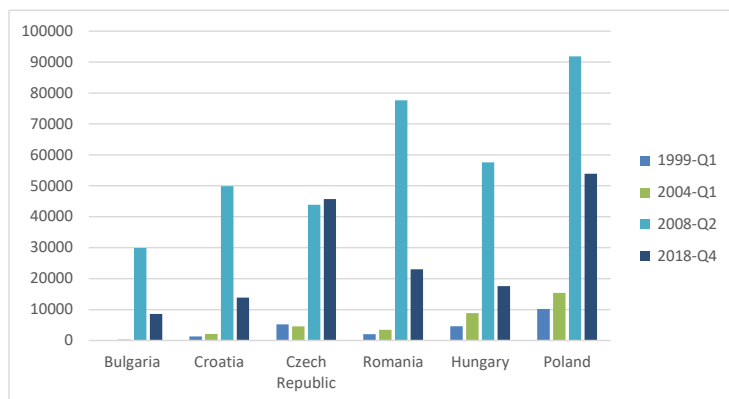


Figure 11 – Loans and deposits- Claims in USD million (BIS LBS)

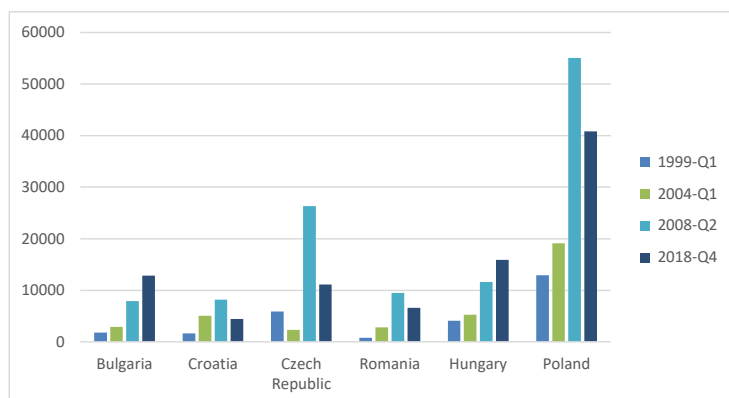


Figure 12 – Loans and deposits- Liabilities in USD million (BIS LBS)

## 1.B Literature review

Reference and research question	Variables and methodology	Data source and additional information
<p><a href="#">European Central Bank (2016)</a></p> <p>Is there a positive impact of EMU on portfolio investments within the EU?</p> <p>Re-estimate the empirical model of Lane (2006) and focus on direction of portfolio investments within the Euro Area</p>	<p>Cross section analysis 2004 (pre GFC) /2013 (post GFC) Dependent var: Cross-border portfolio investments</p> <p>Expl var 1: Euro area membership *** Expl var 1bis: Flow from non-vulnerable EU country (one-way downhill flows in 2004***) Expl var 2bis: Flow towards non-vulnerable EU country (* one-way uphill flows – sudden stop- in 2013)</p>	<p>880 observations each year</p> <p>Dep: IMF CPIS (Coordinated Portfolio Investment Survey)</p> <p>Gravity variables: CEPII (distance, common language, colony, contiguity)</p> <p>Controls for trade linkages (imports)</p>
<p><a href="#">Bouvatier and Delatte (2015)</a></p> <p>Identifying cyclical patterns in international banking integration – identification: non linear trends included in the gravity equation Conclusion for Europe: it's been cyclical.</p>	<p>Gravity model estimated Hausman and Taylor estimator</p> <p>Panel dependent: Bilateral Consolidated Foreign claims, deflated by US GDP deflator (USD)</p> <p>Set of gravity expl variables (distance***)</p> <p>Expl var 2: Real GDPs*** List of variables controlling time-varying frictions Control for institutional financial integration: European Economic Area membership (28 EU + Iceland, Norway, Lichtenstein)*** Control for banking sector size: Credit/GDP normalized by year (ranking of countries by the size of their banking sector) *** Control for financial agreements: EIA (equivalent of Regional Trade Agreement) for services Control for time-varying frictions: Chinn-Ito index, legal structure/property rights index from Fraser Institute and bank concentration index from GFD*** Interaction terms between trend and core/periphery countries</p>	<p>Unbalanced dataset of 22077 observations Period: 1999-2012 186 partner countries 14 reporting countries including 7 Euro area members Dep: BIS Consolidated International Banking Statistics</p> <p>Gravity variables: CEPII (distance, common language, common legal origin, contiguity) Real GDPs: UN Statistics</p> <p>Banking sector size: Global Financial Development - WB</p> <p>EIAs: see Guillin (2013b)</p>
<p><a href="#">Brei and von Peter (2018)</a></p> <p>Does the distance puzzle (i.e.: gaining strength over time) in banking disappear when measuring cross-border distance relative to domestic distance? They find distance friction in banking falls as globalization advances, with a reversal since 2008 (comparison trade and banking)</p>	<p>Methodo: gravity equation in its multiplicative form, including time-varying fixed effects and relative distance Estimators: OLS and PPML Dependent: Bilateral banking transactions (transformation of BIS LBS data to obtain a country-to-country data: combine assets and liabilities (bank-to-country format) to capture all cross-border transactions through banks between two countries)</p> <p>Internal trade proxied by (GDP – exports) Internal banking: total domestic credit</p>	<p>Banking sample: 1977-2016 Trade sample: 1960 onwards Up to 216 countries and jurisdictions Dep: Transformed BIS Locational Banking statistics</p> <p>Gravity variables: CEPII (use of bilateral trade), common language, contiguity, colonial relationship</p> <p>Trade equation: IMF Direction of Trade Statistics</p>

<p><a href="#">Cetorelli and Goldberg (2011)</a></p> <p>Research question: global banks and international shock transmission – identification of the bank balance sheet channel: Vienna Initiative has significantly contributed to soften the local currency credit crush</p>	<p>Methodology: Panel within estimator</p> <p>Dependent: Cross-border lending growth in EM countries - two main lending variables: international claims (proxy for cross-border lending) and local claims in local currency (proxy for local lending)</p> <p>Expl var: vulnerability to US funding and Vienna Initiative members dummy</p> <p>Control for bank demand shock</p>	<p>17 source countries 94 destination countries Dep: BIS Consolidated International Banking Statistics</p> <p>Financial indicators from McGuire and von Peter- (2009a, 2009b)</p>
<p><a href="#">Emter et al. (2019)</a></p> <p>Research question: Explaining the great retrenchment in cross-border banking in Europe</p>	<p>Methodology: Panel fixed effects</p> <p>Panel dependent: Bilateral cross-border banking loans and deposits (in logs), to banks and non-banks sequentially</p> <p>Expl1: NPL ratio over total gross loans***</p> <p>Expl2: Index of prudential policy stringency</p> <p>Expl3: Measure of tax burden from levies on banks (from National Tax List, Eurostat) = <math>\lambda</math>, not significant</p> <p>Control for institutional change: average score of the WB WW Governance indicators, Euro Area entry date for host countries that joined after 2008***</p> <p>Controls for banking sector profitability: leverage ratio, return on equity: not significant</p> <p>Control for central bank liquidity provisions</p>	<p>28 EU countries: 15 reporting countries, 28 destination 2001-2015, annual Dep: BIS Locational Banking Statistics (LBS)- use granularity by counterparty sector and by instrument</p> <p>Prudential variable: created from database by (Cerutti, Claessens, &amp; Laeven, 2015) and ESRB (2016), captures tightness</p> <p>Gravity variables: CEPII*** (use of bilateral trade***)</p> <p>Banking controls: IMF FSIs, ECB CBS, ECB BSI Macro variables: ECB SDW, IMF IFS, WEO database</p>
<p><a href="#">McGuire and von Peter (2016)</a></p> <p>Research question: understanding the role of banks' structure and funding mix (core and non-core, i.e. liabilities other than retail deposits) played in the resilience of balance sheets post GFC[1]; data suggest a negative relationship between the contraction of foreign claims and the local share of foreign banking systems in foreign claims</p>	<p>Methodology: gravity equation with only distance</p>	<p>Database: BIS International Banking Statistics – crossing bank nationality (CBS) and location (LBS) to capture affiliates' local positions</p>

Table 12 – Push and pull factors identified in selected literature related to CESEE capital flows

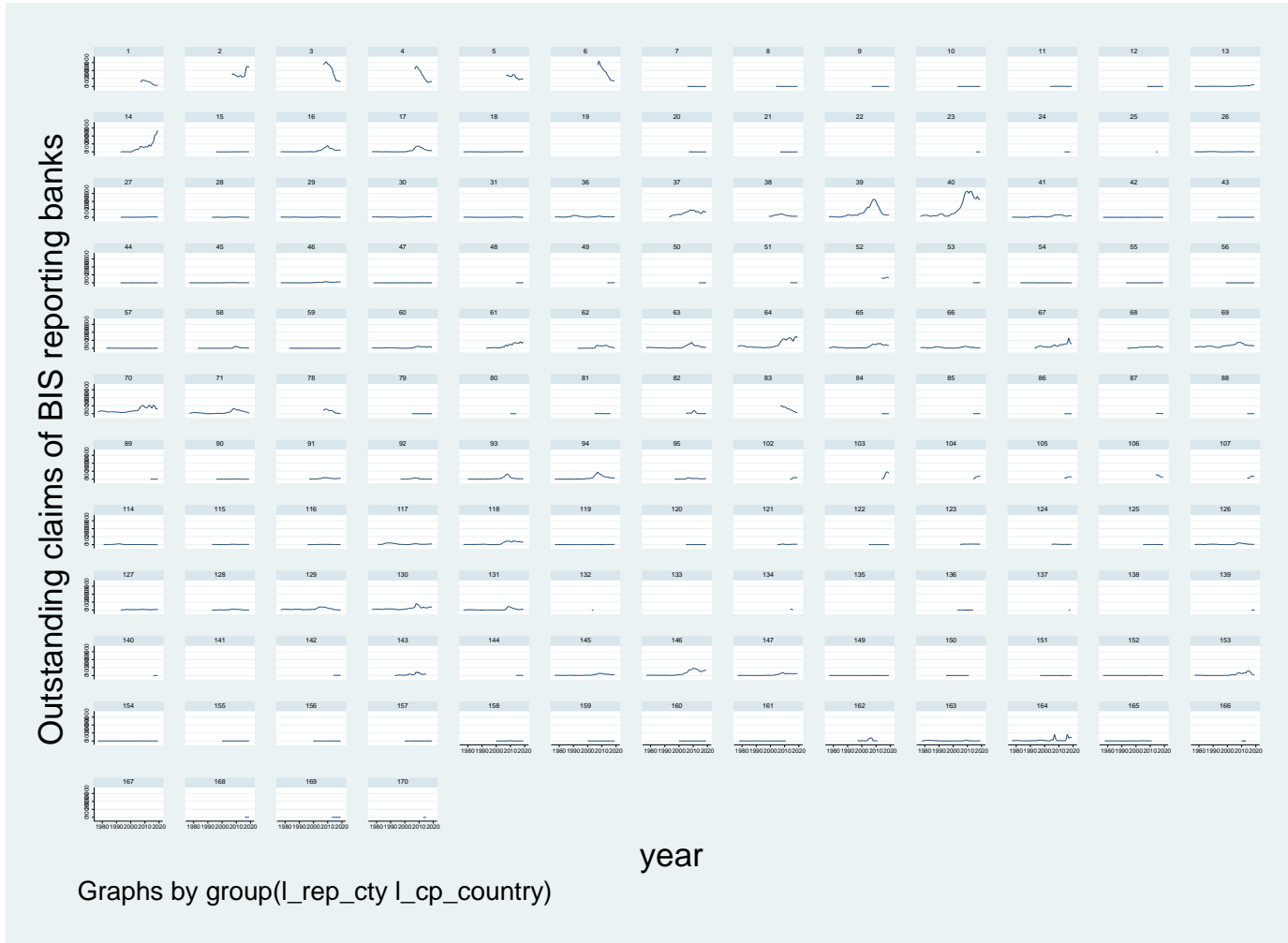
	Pull factors (Country-specific, Destination countries)	Push factors (Global or from Origin countries)
<b>Brana and Lahet (2012)</b> Macro-level	<i>Country growth rate - destination countries</i> <i>Foreign banks assets among total banks assets</i>  Country rating (Standard & Poors) ERDB transition indicators Bank capitalization ratio Bank liquidity ratio	<i>Country growth rate - origin countries</i> <i>Non Performing Loans (% total loans) - origin countries</i>  <i>Bank profitability - origin countries</i> Euro area M3 growth rate M3/PIB excess liquidity ratio US and Euro Ted spread
<b>International Monetary Fund (2014)</b> Macro-level Dep: Cross-border bank flows  18 CESEE countries 2009-Q2/2013Q3  Dep: Changes in BIS locational data (exchange rate adjusted)	<i>Lagged real GDP growth</i> <i>Loan-to-deposit ratio</i>  <i>Lagged ROE</i> <i>Non Performing Loans (% total loans) - origin countries</i> <i>Level of parent bank funding as a share of GDP (Cerutti 2013)</i> <i>Changes in sovereign CDS spreads</i>  Government debt (% of GDP) Current account balance (% of GDP) Bank credit growth	<i>Global investor risk aversion (VIX)</i> <i>G4 Financial Leverage (non core bank funding/total funding)</i> <i>USD-DEU 10-year yield spread</i> Price index of global liquidity (Chen et al (2013)) US 10-year government bond yield  Weighted average of CDS spreads of parent banks in host country Key policy rates in advanced economies
<b>Herrmann and Mihaljek (2011)</b> Dep: log of quarterly, change in  BIS external positions, exchange-rate adjusted (not strictly a pull/push analysis)	<i>General government balance (borrower country risk)</i> <i>Bilateral financial openness ratio</i> <i>Reinhart- Rogoff (2004) exchange rate regime index</i> <i>Deviation of the banking subindex from the main equity index</i>	<i>VIX Index</i>  Common lender effect indicator Deviation of the banking subindex from the main equity index
<b>Emter et al. (2019)</b> Dep: Cross-border loans to banks  2008-2015 EU-27 or EU-18 Gravity model	<i>Non Performing Loans (% total loans) - origin countries</i> <i>Return On Equity (ROE)</i> Leverage ratio Short-term interest rate Long-term interest rate Central Bank liquidity <i>Index of prudential policy stringency (PPI) - lender</i> Index of prudential policy stringency (PPI) - borrower Measure of the tax burden arising from levies on banks (TAX)	<i>Non Performing Loans (% total loans) - origin countries</i> Return On Equity (ROE) Leverage ratio Short-term interest rate Long-term interest rate Central Bank liquidity <i>Index of prudential policy stringency (PPI) - lender</i> Index of prudential policy stringency (PPI) - borrower Measure of the tax burden arising from levies on banks (TAX)

Note: Significant variables are highlighted in red.



# 1.C Outstanding banking claims of BIS reporting banks in CESEE countries - View by countrypair

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## 1.D Specification and diagnostic tests for OLS estimation

Equation 1 in Table 1.6 is estimated with OLS.

- Fixed effects F-tests :  $F(5, 136) = 108.91$  ;  $F(24,136) = 46.13$ ;  $F(19, 136) = 20.41$ .

For all types of fixed effects, we reject  $H_0$  at 5%.

- White's general test statistic : 918.9891 Chi-sq(638) P-value = 0.00

- Breusch-Pagan LM statistic: 503.3751 Chi-sq(54) P-value=0.00

- Ramsey RESET test using powers of the independent variables (Ho: model has no omitted variables) -  $F(3, 1744) = 0.77$  ; Prob > F= 0.5114

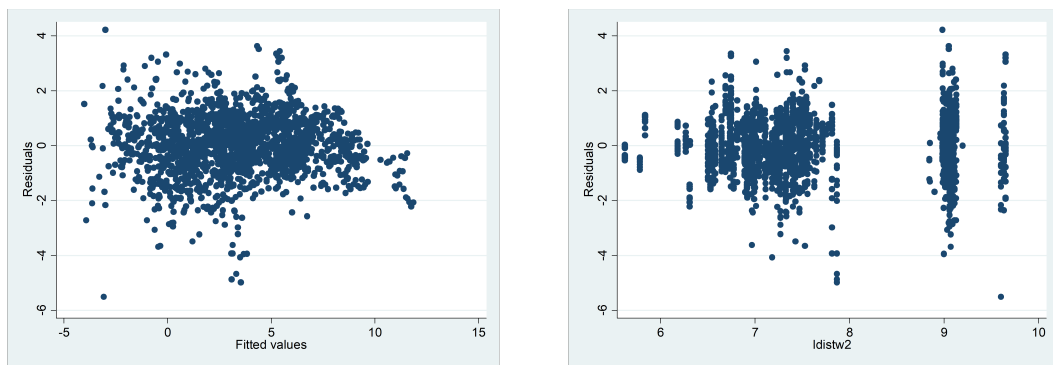


Figure 13 – Residuals against fitted values (left) and against distance (right)

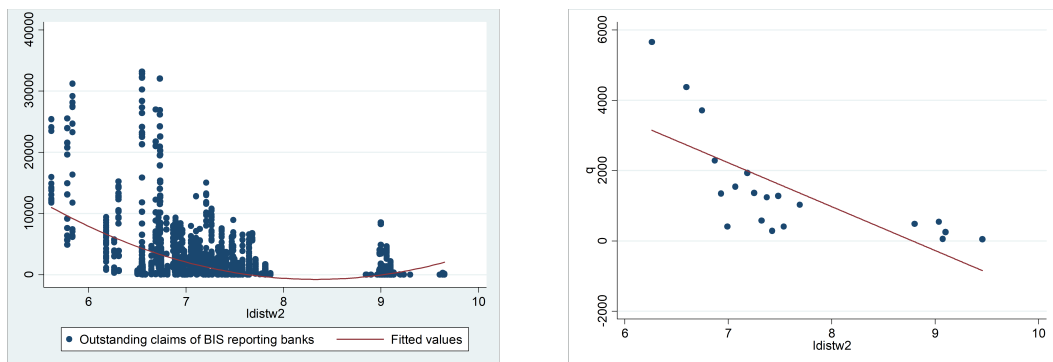


Figure 14 – Scatter graph of dependent against distance (with polynomial regression)

## 1.E Correlation matrix of banking variables

Table 13 – Cross-correlations

Variables	q	vienna_1	BU	Concent o	Concent d	Crisis o	Crisis d	NPLs o	NPLs d	Reg o	Reg d	Credit o	Credit d	GlobalFactor	FDLd
Outstanding claims of BIS reporting banks	1.000														
vienna_1_o	0.251 (0.000)	1.000													
banking_union	0.220 (0.000)	0.078 (0.000)	1.000												
Bank concentration (%) - o	0.003 (0.898)	0.043 (0.014)	0.056 (0.001)	1.000											
Bank concentration (%) - d	-0.208 (0.000)	-0.116 (0.000)	-0.094 (0.000)	-0.004 (0.836)	1.000										
Banking crisis - o	0.233 (0.000)	0.296 (0.000)	-0.015 (0.252)	-0.108 (0.000)	-0.135 (0.000)	1.000									
Banking crisis -d	0.007 (0.690)	0.040 (0.002)	-0.066 (0.000)	-0.031 (0.073)	0.145 (0.000)	0.079 (0.000)	1.000								
Bank NPLs to gross loans (%) -o	0.009 (0.710)	0.109 (0.000)	0.373 (0.000)	0.006 (0.750)	0.011 (0.564)	0.111 (0.000)	0.014 (0.465)	1.000							
Bank NPLs to gross loans (%) - d	-0.108 (0.000)	0.031 (0.110)	0.151 (0.000)	-0.038 (0.052)	0.355 (0.000)	-0.083 (0.000)	0.279 (0.000)	0.096 (0.000)	1.000						
Bank regulatory capital to RWA (%) - o	0.086 (0.000)	-0.033 (0.082)	0.600 (0.000)	-0.056 (0.003)	-0.113 (0.000)	-0.028 (0.139)	-0.071 (0.000)	0.099 (0.000)	0.087 (0.000)	1.000					
Bank regulatory capital to RWA (%) - d	-0.150 (0.000)	-0.040 (0.038)	0.159 (0.000)	-0.034 (0.084)	0.211 (0.000)	-0.109 (0.000)	-0.135 (0.000)	0.082 (0.000)	0.359 (0.000)	0.128 (0.000)	1.000				
Domestic credit private sector (% of GDP) - o	-0.028 (0.140)	0.021 (0.108)	0.103 (0.000)	-0.160 (0.000)	-0.120 (0.000)	0.113 (0.000)	0.016 (0.236)	-0.131 (0.000)	-0.018 (0.371)	-0.004 (0.841)	-0.030 (0.139)	1.000			
Domestic credit private sector (% of GDP) - d	0.132 (0.000)	0.156 (0.000)	0.195 (0.000)	-0.051 (0.004)	-0.462 (0.000)	0.155 (0.000)	0.014 (0.363)	0.054 (0.005)	-0.012 (0.541)	0.294 (0.000)	-0.200 (0.000)	0.086 (0.000)	1.000		
(mean) GlobalFactor	0.079 (0.000)	0.015 (0.206)	-0.044 (0.000)	0.036 (0.042)	-0.104 (0.000)	0.020 (0.136)	0.089 (0.000)	-0.138 (0.000)	-0.205 (0.000)	-0.316 (0.000)	-0.284 (0.000)	0.290 (0.000)	-0.099 (0.000)	1.000	
FDLd	0.153 (0.000)	0.008 (0.537)	0.024 (0.083)	-0.006 (0.737)	-0.226 (0.000)	0.080 (0.000)	0.019 (0.177)	-0.058 (0.003)	-0.259 (0.000)	-0.007 (0.700)	-0.274 (0.000)	0.165 (0.000)	0.067 (0.000)	0.330 (0.000)	1.000

## 1.F Correlation matrix of gravity and policy variables

Table 14 – Cross-correlations

Variables	q	Distance	Contiguity	Sibling	Religion	l_gdp_o_2	l_gdp_d_2	1EU member o	EU member d	eu_both	vienna_1_o	banking_union
Outstanding claims of BIS reporting banks	1.000											
Distance (logs)	-0.324 (0.000)	1.000										
Contiguity	0.429 (0.000)	-0.314 (0.000)	1.000									
Sibling relationship	0.073 (0.000)	-0.153 (0.000)	0.302 (0.000)	1.000								
Common religion	0.228 (0.000)	-0.264 (0.000)	0.052 (0.000)	-0.093 (0.000)	1.000							
l_gdp_o_2	0.149 (0.000)	0.049 (0.000)	0.039 (0.002)	-0.068 (0.000)	-0.024 (0.056)	1.000						
l_gdp_d_2	0.311 (0.000)	-0.040 (0.006)	0.022 (0.129)	-0.072 (0.000)	0.292 (0.000)	0.208 (0.000)	1.000					
EU member o	0.247 (0.000)	-0.742 (0.000)	0.120 (0.000)	0.096 (0.000)	0.198 (0.000)	0.040 (0.002)	0.034 (0.022)	1.000				
EU member d	0.253 (0.000)	0.008 (0.510)	0.017 (0.182)	-0.004 (0.752)	-0.002 (0.890)	0.318 (0.000)	0.674 (0.000)	0.074 (0.000)	1.000			
eu_both	0.388 (0.000)	-0.353 (0.000)	0.091 (0.000)	0.039 (0.001)	0.076 (0.000)	0.190 (0.000)	0.427 (0.000)	0.466 (0.000)	0.670 (0.000)	1.000		
vienna_1_o	0.251 (0.000)	-0.141 (0.000)	0.042 (0.001)	0.056 (0.000)	0.037 (0.003)	0.081 (0.000)	0.122 (0.000)	0.153 (0.000)	0.166 (0.000)	0.262 (0.000)	1.000	
banking_union	0.220 (0.000)	-0.258 (0.000)	0.052 (0.000)	0.032 (0.010)	0.060 (0.000)	0.140 (0.000)	0.268 (0.000)	0.345 (0.000)	0.480 (0.000)	0.720 (0.000)	0.078 (0.000)	1.000

## 1.G Variance Inflation Factor analysis

Table 15 – VIF analysis of Equations in Tables 8, 9 and 13

Variable	VIF	1/VIF	Variable	VIF	1/VIF	Variable	VIF	1/VIF	Variable	VIF	1/VIF	Variable	VIF	1/VIF	Variable	VIF
Distance	1.34	0.75	Reg cap_d	2.01	0.50	Reg cap_d	2.12	0.47	FDL_d	2.73	0.37	Reg cap_d	2.04	0.49	FDL_d	2.73
Religion	1.31	0.76	GDP_d	1.76	0.57	GDP_d	2.01	0.50	GDP_d	2.67	0.38	GDP_d	1.78	0.56	GDP_d	2.69
Contiguity	1.22	0.82	NPL_d	1.45	0.69	NPL_d	1.62	0.62	Reg cap_d	2.26	0.44	Distance	1.55	0.65	Reg cap_d	2.27
Legal	1.11	0.90	banking_crisis_o	1.28	0.78	creditmarketsize_d	1.59	0.63	NPL_d	1.75	0.57	NPL_d	1.46	0.68	Distance	1.87
Sibling	1.1	0.91	banking_crisis_d	1.23	0.81	reg_capital_o	1.49	0.67	reg_capital_o	1.61	0.62	GDP_o	1.43	0.70	NPL_d	1.79
<b>Mean VIF</b>	<b>1.22</b>		Reg cap_o	1.23	0.81	GDP_o	1.48	0.68	creditmarketsize_d	1.61	0.62	Contiguity	1.37	0.73	Reg cap_o	1.73
			vienna_l_o	1.21	0.83	banking_crisis_o	1.44	0.69	GlobalFactor	1.51	0.66	Sibling	1.31	0.76	GDP_o	1.71
			NPL_o	1.07	0.93	creditmarketsize_o	1.4	0.71	GDP_o	1.48	0.67	banking_crisis_o	1.28	0.78	creditmarketsize_d	1.62
			GDP_o	1.04	0.96	bank_concentration_d	1.39	0.72	banking_crisis_o	1.46	0.69	Reg cap_o	1.28	0.78	creditmarketsize_o	1.59
			<b>Mean VIF</b>	<b>1.37</b>		vienna_l_o	1.34	0.75	bank_concentration_d	1.44	0.70	vienna_l_o	1.26	0.79	GlobalFactor	1.51
						bank_concentration_o	1.29	0.77	creditmarketsize_o	1.41	0.71	banking_crisis_d	1.25	0.80	bank_concentration_d	1.49
						banking_crisis_d	1.25	0.80	banking_crisis_d	1.39	0.72	NPL_o	1.25	0.80	banking_crisis_o	1.49
						NPL_o	1.08	0.92	vienna_l_o	1.36	0.74	Legal	1.17	0.85	bank_concentration_o	1.44
						<b>Mean VIF</b>	<b>1.5</b>		bank_concentration_o	1.3	0.77	<b>Mean VIF</b>	<b>1.42</b>		Contiguity	1.41
									NPL_o	1.09	0.92	<b>Mean VIF</b>	<b>1.42</b>		banking_crisis_d	1.4
									<b>Mean VIF</b>	<b>1.67</b>					vienna_l_o	1.39
															Sibling	1.38
															NPL_o	1.28
															Legal	1.21
															<b>Mean VIF</b>	<b>1.68</b>

## 1.H Sibling relationship: the Austro-Hungarian Empire

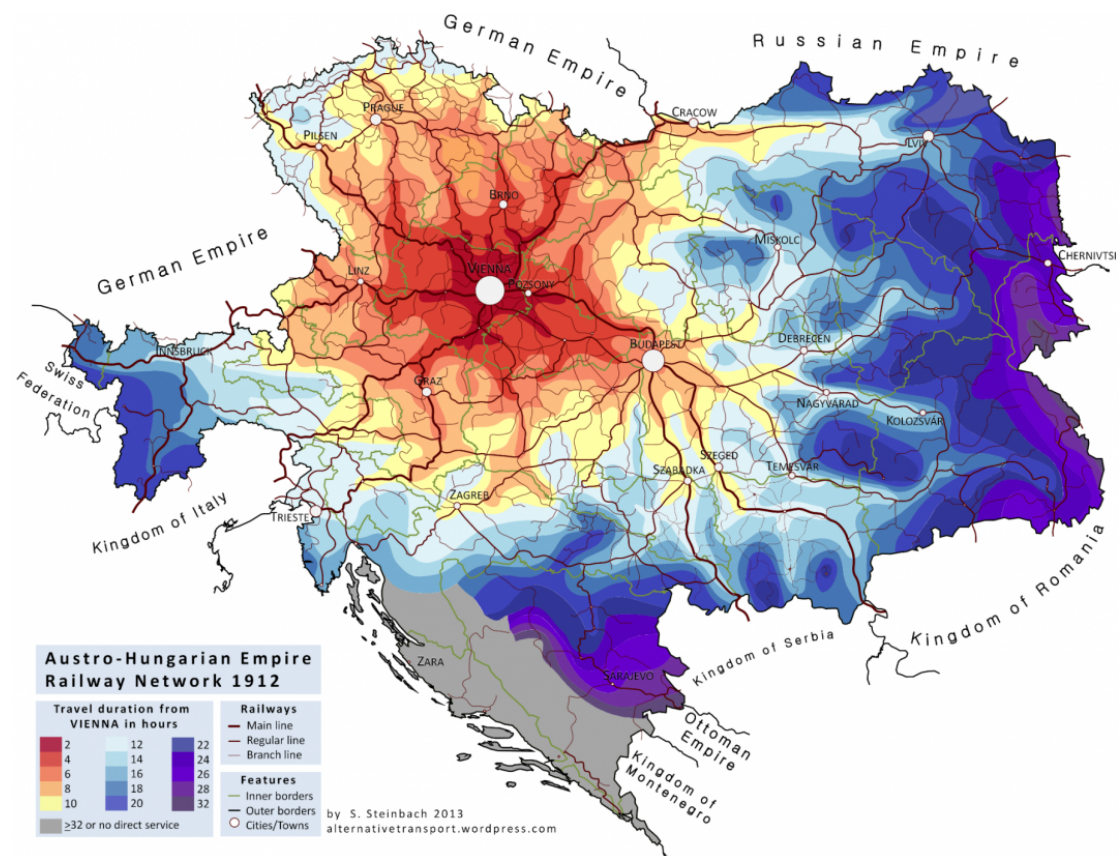


Figure 15 – Isochrone railway map - Austro-Hungarian Empire in 1914; Source: Europe Centrale et Balkanique: Atlas d'histoire politique (Editions Complexe, 1995)

## Chapitre 2

# Monetary autonomy of CESEE countries and nominal convergence in EMU: A cointegration analysis with structural breaks

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## 2.1 Introduction

Central, Eastern and South Eastern European (CESEE) countries<sup>2</sup> share a common history as Socialist economies, as Transition economies after the end of the Soviet Union, and more recently, as European Union (EU) New Member States and now as Euro area Accession countries. These six countries have in common several mechanisms of economy functioning, macroeconomic imbalances (particularly large public and private external debt) and financial vulnerabilities (exacerbated credit cycles, cross border banking relationships with the Euro area and sensitivity to the financial channel). Their development level measured by GDP per capita in purchasing power terms is around half the EU average level and the Global Financial Crisis (GFC) has led to a slowdown of the rate of income convergence with the EU (Crespo-Cuaresma et al., 2012). Institutions standards are in a catch-up process with OECD and EU countries (European Commission, 2018).

To be able to adopt the single currency, CESEE countries are required to fulfill some targets in terms of inflation, long-term interest rates, public debt, public deficit and nominal exchange rates. These requirements are known as Maastricht Convergence Criteria, defined in 1992 in the Treaty on the Functioning of the European Union. Compliance with these requirements is monitored every two year by European Union institutions. As of June 2020, the European Central Bank (ECB) Convergence Report (European Central Bank, 2020a) gives a mixed picture of nominal convergence of CESEE countries, since fixed-exchange rate countries have performed better than floating-exchange rate countries. Regarding the price stability criterion, only fixed or quasi-fixed exchange rate Southern Eastern European countries (Croatia and Bulgaria) comply with the 12-month average inflation rate reference rate of 1.8%. On the contrary, Central Eastern European countries<sup>3</sup> and Romania, that are in a floating or managed floating exchange rate regime, saw their inflation rates above or expected to rise above this reference level<sup>4</sup>. With regard to the convergence of long-term interest rates, all countries recorded below the reference rate of 2.9%, except Romania (4.4%). As regards the fiscal criterion, four countries out of six are compliant with the deficit criteria; Hungary and Romania are under Significant Deviation and Excessive Deficit Procedures respectively. Croatia and Hungary are the only countries with an expected 2021 general government debt-to-GDP ratio exceeding the reference value of 60%. Despite a current heterogeneous inflation situation, performance in terms of fiscal position and long-term interest rates remains fair. Figures 2.1 to 2.3 give a long-term view of country compliance with EMU convergence criteria, which shows inflation criterion is difficult to achieve for most CESEE countries.

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<sup>2</sup>Bulgaria, the Czech Republic, Croatia, Hungary, Poland, Romania.  
ISO-3 country codes: BGR, CZE, HRV, HUN, POL, ROU.

<sup>3</sup>The Czech Republic, Hungary and Poland.

<sup>4</sup>2.9%, 3.7%, 2.8% and 3.7% for the Czech Republic, Hungary, Poland and Romania as of May 2020.



If we finally consider the exchange rate criterion, which is the participation to the Exchange Rate Mechanism II (ERM II), it is noticeable that until July 2020 and despite compliance with Maastricht criteria in some cases, none of the CESEE countries participated. Bulgaria had to delay its application process to ERM II in June 2018 despite fulfillment of Maastricht criteria. The reason lies in the fact that accession criteria to ERM II were reinforced at this occasion by additional "prior commitments" in country-specific policy areas and with mandatory participation to the Banking Union's Single Supervision Mechanism (SSM) through "ECB close cooperation" and to the Single Resolution Mechanism -SRM- (European Central Bank (2020a), box 1.4).

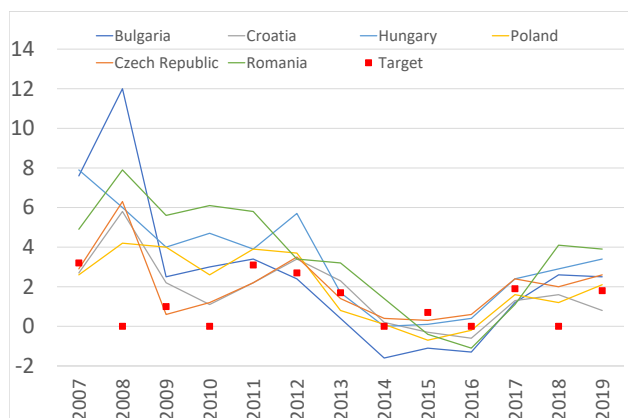


Figure 2.1 – Harmonized inflation rates evolution versus EMU convergence criteria

Notes: LHS in percentage points; Sources: INSEE; ECB Convergence reports

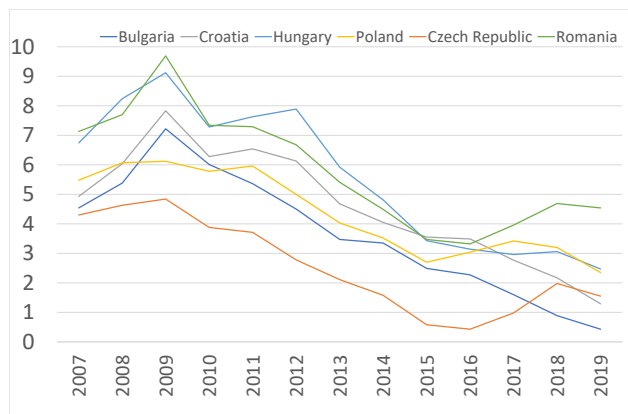


Figure 2.2 – Long term interest rates evolution versus EMU convergence criteria

Notes: LHS in percentage points; Sources: INSEE; ECB Convergence reports and SDW

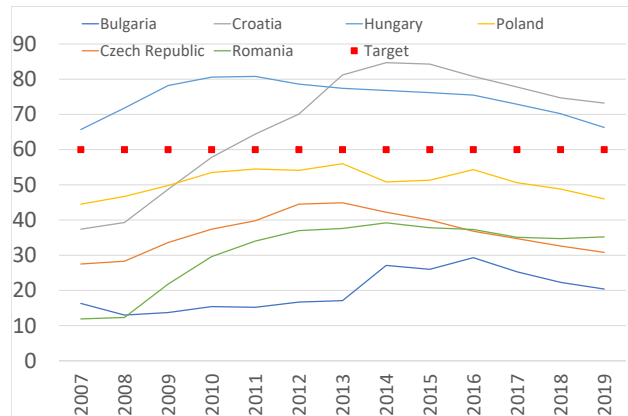


Figure 2.3 – General government debt evolution versus EMU convergence criteria

Notes: LHS in GDP percentage points; Sources: INSEE; ECB Convergence reports

As of February 2021, Bulgaria and Croatia are now participant Member States to the ERM II since July 2020, after being applicant Member States since July 2018 and July 2019, respectively. On the contrary, the Czech Republic, Hungary, Poland and Romania do not plan to apply to ERM II in the near future. One may then wonder why CESEE countries delay their participation to ERM II, instead of choosing to deepen their already encouraging nominal convergence with the EMU as described above.

Some answers may certainly be found in the area of politics, with the rise of Euro scepticism and populism in all EU countries, with UK Brexit exacerbating such movements. Our research hypothesis is that CESEE countries have faced and continue to face macroeconomic policy issues and fear of losing two monetary policy instruments. Firstly, they fear of losing the policy rate to adjust to shocks, particularly to financial crises; secondly, the exchange rate interventions, both as a monetary policy instrument in a context of high exchange rate pass-through to inflation and as a financial stability instrument in the context of large currency mismatch in domestic balance sheets. This type of monetary regime combining inflation targeting and foreign exchange market interventions has been analyzed both empirically and theoretically in Ghosh et al. (2016).

The fear of losing monetary policy rate hypothesis is supported by the fact that monetary policy responses have been extensively used by CESEE countries to adjust to financial shocks in the past decade. If we consider the Global Financial Crisis (GFC) in 2008, CESEE countries have been severely hit, with empirical literature documenting larger output losses in CESEE countries compared to other Emerging regions (Gallego et al., 2010; Allegret, 2012). National Central Banks (NCBs) have globally responded with monetary policy actions, although some responses have been delayed or procyclical as we will discuss below. After this initial phase, CESEE countries used a large spectrum of unconventional monetary policies: according to Ishi et al. (2009) taxonomy,

all CESEE countries except Romania used a domestic mix of liquidity easing measures (reserve requirements, easing of collateral requirements) and Hungary, Poland and Romania used foreign exchange liquidity injections (Magyar Nemzeti Bank, 2018). If we consider the Covid crisis in spring 2020, four NCBs started asset purchase programs which affect long-term yields (Magyar Nemzeti Bank, 2020) and the Hungarian Central Bank (MNB) has even responded with a revision of its instruments.

The fear of losing foreign exchange interventions as a monetary policy instrument is supported by the fact that NCBs both communicate around and use this policy instrument first to maintain price stability (pointing towards a high exchange rate pass-through to inflation, even though the effect has been decreasing as documented in the literature by Égert and Macdonald (2009)). For instance, the Czech National Bank used an exchange rate commitment from November 2013 until April 2017. NCBs also emphasize the interaction between monetary and macroprudential policies even though they theoretically have separate instruments (as stated in Czech National Bank's Inflation Report, for instance), suggesting foreign exchange interventions may be used as an instrument to smooth undesirable currency balance-sheet impacts, particularly during crises. Empirical literature on international real, financial and monetary shock transmissions in CESEE countries (Allegret, 2012; Jiménez-Rodríguez et al., 2010; Josifidis et al., 2014a) supports this view because they emphasize domestic monetary policies following the GFC have been determined by the exchange rate regimes and more generally by the Fear of Floating (Calvo and Reinhart, 2002). For instance, Josifidis et al. (2014a) show within a structural VAR framework that high currency mismatch ratio in these countries explains the lags in monetary policy responses to the GFC (Hungary increased its policy rate in October 2008 and Croatia did not adjust it) and may lead to both Fear of Floating and fear of losing international reserves (Aizenman and Sun, 2012).

Last but not least, because they are EU Member States and part of the Economic Union with free capital movement, CESEE countries are also faced with the traditional monetary policy trilemma (Mundell, 1963), where two monetary policy goals can be achieved only between exchange rate stability, financial openness and monetary independence (defined as the capacity to manage short-term interest rates). They may also be constrained by the monetary dilemma (Rey, 2015) and the transmission of the global financial cycle to domestic monetary policy. CESEE countries' current degree of nominal convergence with the Euro area, combined with exchange rate stability and free capital movement point towards a lack of autonomy of monetary policy within both frameworks.

Given the motivations just developed, our research question is therefore to determine to which extent CESEE countries have monetary policy autonomy with the Euro area in the context of nominal convergence with the EMU, which is our definition of monetary integration in this research work.

We test and estimate the monetary autonomy assumption of CESEE countries over

the long run since it is the horizon over which convergence sustainability is assessed by European institutions. Hence our analysis focuses on long-term relations between domestic variables entering the reaction function of National Central Banks (inflation rates, industrial production, nominal exchange rates with the Euro) and Euro area variables (ECB reference rate, Euro area inflation). To perform this analysis, we rely on individual country time-series analysis, from the middle of the 1990s to 2015. We focus on Euro area conventional monetary policy, based on the fact that CESEE countries have not extensively used Quantitative Easing (QE) measures as in the Euro area since 2015. We nevertheless assess whether unconventional monetary policy (UMP) in the Euro area between 2011 and 2015 has modified their degree of monetary autonomy, by using [Krippner \(2015\)](#) Euro area Shadow Short Rate (SSR).

First contribution of this paper is to exploit all information contained in the monetary variables of CESEE countries, for which broken economic history translates into non-stationary time series. Data are characterized by breaks in levels and trends, and also contain stochastic trends. Second contribution to the literature is to use a multivariate cointegration methodology, which does not predetermine the number and the nature of the cointegrating relations between variables. We therefore use an extension of the Johansen cointegration system ([Johansen et al., 2000](#)) that specifically models structural breaks in the deterministic terms, both for the relations and the underlying time series. By using this modified Vectorial Error Correction Model (VECM), we make the implicit assumption that the nature of the cointegrating relations between variables does not change over time<sup>5</sup>, but that their levels and/or trends may change due to structural breaks. We therefore rely on standard monetary policy analysis to interpret our results. Third contribution is that we assess the importance of the exchange rate in the conduct of monetary policy by including the nominal exchange rate versus Euro in our variables of interest.

Our empirical findings are as follows: for all countries, structural break modelling has changed the number and/or nature of cointegrating relations between our variables compared to the standard VECM without breaks. For Bulgaria, the Czech Republic and Hungary, we find monetary policy dependence with the Euro area in a structural break model, in accordance with their monetary regime. Poland is quite independent from the Euro area, with results robust across various models. On the contrary, the structural break model is not suited for Romania and Croatia, even though we find Euro area monetary spillover to Romania in a standard VECM model. The inclusion of Euro area inflation to our baseline model enriches the cointegrating relations for the Czech Republic and Bulgaria. We also find that the exchange rate variation is not long-term restricted for most cointegrating relations, which potentially validates the importance of the exchange rate in the conduct of monetary policy. Finally, in line with empirical literature on Euro area UMP transmission, we find increased monetary autonomy for

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<sup>5</sup>There is no notion of “regime” such as in the low-volatility/high volatility regimes.

the Czech Republic and evidence of policy dilemma in Hungary.

The paper is organized as follows. Section 2.2 highlights some facts and reviews the empirical literature about the monetary autonomy of CESEE countries within the EMU convergence context. Section 2.3 explains our modelling choice which favors multivariate cointegration, analyzes and discusses the structural breaks. Section 2.4 focuses on the empirical framework. Section 2.5 comments the main results, and proposes a robustness analysis to Euro area unconventional monetary policy. Section 2.6 concludes.

## 2.2 Facts highlights and literature review

CESEE countries formulate their domestic monetary policies independently from the Euro area, either through inflation or exchange rate targets. As EU Member States, they also have EMU nominal convergence framework that implies exchange rate and price stability. We first review the evolution of monetary policy frameworks and exchange rate regimes since the beginning of the transition, together with the EMU convergence requirements within which CESEE countries operate their policies. We then discuss the dynamics of the main monetary variables compared with the Euro area ones. Finally, we review the empirical literature in relation with our research question.

### 2.2.1 Exchange rate regimes, monetary policy frameworks and EMU convergence

Since 1991, CESEE countries have experienced major macroeconomic and institutional changes, switching from socialist planned economies to EU small open economies. Table 2.1 summarizes EU membership application and accession negotiation landmarks for individual countries, together with the evolution of their monetary and exchange rate regimes. The choice of the exchange rate as the nominal anchor has been predominant in the disinflation phase during the 1990s and has changed for inflation targeting for Central Eastern European countries later in the 2000s, which often coincided with EU membership ([Jonas and Mishkin, 2003](#)). CESEE countries now account for a large range of exchange rate regimes and monetary policy frameworks, reflecting their individual economic history.

According to the IMF 2019 Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) classification, Poland has both de jure and de facto free floating exchange rate arrangement. The Czech Republic and Hungary both have de jure free floating and de facto floating regimes, due to NCBs discretionary interventions on foreign exchange markets to stabilize their exchange rates. Croatia and Romania both have de jure managed floating and de facto stabilized arrangements, with narrow fluctuation bands against Euro (since April 2016 and January 2018, respectively). Finally, Bulgaria is in a currency board arrangement since June 1997. Regarding the type of nominal anchor, the Czech Republic, Hungary, Poland and Romania operate mone-

tary policy under either an inflation-targeting or a flexible inflation-targeting framework (with inflation targets evolving within a symmetric  $\pm 1\%$  tolerance band for all countries). Bulgaria and Croatia use the exchange rate as the nominal anchor and as such do not have any inflation target. Euro is the reserve currency under the currency board regime, while there is no predetermined target level for the exchange rate for Croatia.

Along with their own domestic inflation and/or exchange rate targets, CESEE countries have to cope with inflation and exchange rate stability criteria to achieve nominal convergence with the EMU. The price stability criterion states that the rate of consumer prices inflation must not be more than 1.5% higher than the average of the three best performing EU countries. The exchange rate stability criterion is fulfilled if the exchange rate moves within a  $\pm 15\%$  fluctuation band, without devaluation of the central rate and excessive pressures on the exchange rate.

Even though these criteria are not translated into official monetary policy objectives by National Central Banks, they still have potential implications in terms of domestic monetary policy. As regards price stability, CESEE countries have an implicit dual inflation target, i.e. one in terms of national CPI and one in terms of Harmonized CPI. This institutional situation may impact the inflation target set by monetary authorities and lead to enhanced Euro area inflation transmission to domestic inflation. Exchange rate interventions may also be used as an additional instrument to maintain price stability, in case the exchange rate pass-through to inflation is strong<sup>6</sup>. As far as exchange rate stability is concerned, it requires a second monetary instrument to be achieved, for instance interventions on the foreign exchange markets. This is actually the case for the Czech, Hungarian and Romanian central banks that allow foreign exchange market interventions as a monetary policy instrument (European Commission, 2018).

We now turn to the long-term evolution of monetary variables compared to the Euro area ones. These variables will be included in our empirical model. Table 2.1 indicates the analysis start date for each individual country. For all countries except Croatia and Hungary, analysis starts either during the EU membership application period or during the accession negotiations period. For Croatia and Hungary, analysis includes several transition years before the official application to EU membership.

### 2.2.2 Dynamics of exchange rates, inflation and policy rates

Exchange rates, inflation rates and policy rates have globally followed a stabilization path during the first decade of transition from socialism, with varying speeds, and a convergence process with the Euro area, evolving within narrower ranges, afterwards.

Figure 2.4 shows that nominal exchanges rates<sup>7</sup> of countries outside the ERM II have followed a common pattern of managed nominal depreciation until the beginning

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<sup>6</sup>As mentioned before, the Czech Republic has implemented an exchange rate floor of 27 korunas per euro in November 2013 to stop koruna appreciation and help push inflation towards its 2% target.

<sup>7</sup>Expressed as one unit of domestic currency per Euro

Table 2.1 – EU Membership, monetary policy frameworks and de facto exchange rate regimes landmarks

Country	Monetary and exchange rate regimes	Start date	End date
<b>Bulgaria</b>	Application to EU membership	1995:M12	1999:M12
	Exchange rate anchor — Currency board	1997:M6	...
	Accession negotiations	2000:M3	2006:M12
	<i>Analysis</i>	<b>2001:01</b>	<b>2014:M12</b>
	EU membership	2007:M1	...
	ERM II participation	2020:M6	...
<b>Croatia</b>	<i>Analysis</i>	<b>1997:M6</b>	<b>2014:M12</b>
	Application to EU membership	2003	2005
	Accession negotiations	2005	2011:M12
	Exchange rate anchor — Crawl-like arrangement	2010	2014
	EU membership	2013:M7	...
	Exchange rate anchor — Stabilized arrangement	2016:M4	...
	ERM II participation	2020:M6	...
<b>Czech Republic</b>	Exchange rate anchor — Conventional peg (basket)	1993:M1*	1996:M2
	<i>Analysis</i>	<b>1996:M1</b>	<b>2014:M12</b>
	Application for EU membership	1996:M1	1998:M3
	Transitional inflation targeting — Corridor	1996:M2	1997:M12
	Inflation Targeting — Managed floating	1997:M12	2013:M11
	Accession negotiations	1998:M3	2002:M12
	EU membership	2004:M5	...
	Inflation Targeting — Stabilized arrangement	2013:M11	2017:M4
Inflation Targeting — Floating (foreign exchange interventions)	2017:M5	...	
<b>Hungary</b>	<i>Analysis</i>	<b>1994:M1</b>	<b>2014:M12</b>
	Exchange rate anchor — Crawling peg	1995:M5	2001:M5
	Application for EU membership	1996:M1	1998:M3
	Accession negotiations	1998:M3	2002:M12
	Inflation Targeting — Crawling band	2001:M5	2008:M2
	EU membership	2004:M5	...
	Inflation Targeting — Free Floating	2008:M2	...
Inflation Targeting — Floating (foreign exchange interventions)	2008	...	
<b>Poland</b>	Exchange rate anchor — Crawling basket peg	1990:M1	1995:M5
	Transitional inflation targeting — Crawling band	1995:M5	2000:M4
	Application for EU membership	1996:M1	1998:M3
	<i>Analysis</i>	<b>1998:M3</b>	<b>2014:M12</b>
	Accession negotiations	1998:M3	2002:M12
	Inflation Targeting — Free floating	2000:M4	...
EU membership	2004:M5	...	
<b>Romania</b>	De jure Managed floating regime	1991	2004:M11
	Application for EU membership	1995:06	2000:M2
	Accession negotiations	2000:M2	2004:M12
	<i>Analysis</i>	<b>2003:M1</b>	<b>2014:M12</b>
	Inflation Targeting — Free floating	2004:M11	2018: M1
	Inflation Targeting — Stabilized arrangement	2018:M1	...
EU membership	2007:M1	...	

Sources: [Habib \(2002\)](#); [Josifidis et al. \(2014b\)](#); [Nenovsky et al. \(2013\)](#); [Slavov \(2019\)](#), AREAER, National Central Banks. "..." indicate that regime is the current one. \* The Czech Republic has been created in 1993. Definitions as per IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (2019)

of the 2000s (in most cases, through crawling peg arrangements). Polish zloty, Romanian leu and Hungarian forint have depreciated after free floating became the exchange rate regime. Nevertheless, their annual growth rates, in Appendix 2.I, have evolved within a +/-10% range for Hungary since 2002 and +/-5% for Romania since 2010. Exception lies with the Czech koruna that has appreciated. If we now look at countries participant to the ERM II (and the annual growth rate in Appendix 2.I), we can see that Croatian

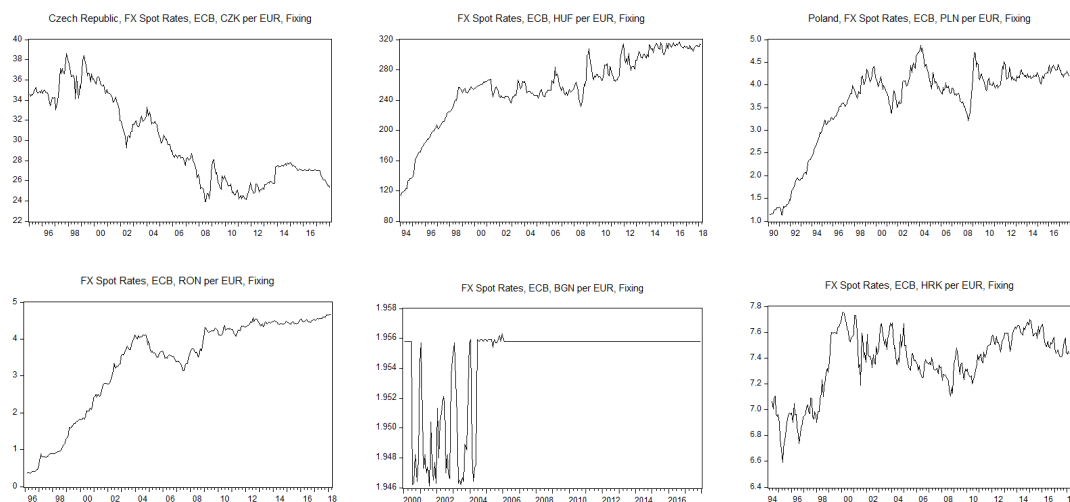


Figure 2.4 – Evolution of nominal exchange rates versus Euro

Source: ECB (monthly fixing); Top left/middle/right: Czech Krona/Hungarian Forint/Polish Zloty  
 Bottom left/middle/right: Romanian Leu/Bulgarian Lev/Croatian Kuna

kuna's growth rates evolve within a narrow 2% band since the beginning of the 2000s and that the Bulgarian Lev is fixed de facto since 2005.

If we now turn to inflation rates analysis, Figure 2.5 displays the inflation differential by country with the Euro area and shows that inflation-targeting countries have managed to stabilize their inflation rates at levels close to the Euro area ones after a long disinflation period. It is noticeable that for these countries, inflation targeting regimes have been put in place despite high inflation levels. Inflation rates have begun to synchronize since the beginning of the 2000s for Croatia, the Czech Republic and Poland, and after the Global Financial Crisis for Hungary and Romania. On the other hand, inflation rates of exchange-rate-targeting countries (in Figure 2.6), particularly Bulgarian inflation, have fluctuated within a large range and do not show a large degree of convergence with Euro area inflation.

If we finally analyze the patterns of domestic central bank policy rates over the long run, their overall decreasing levels are in line with the stabilization of both inflation and exchange rates that occurred during the first decade of transition, with speed of convergence depending on the country considered.

For inflation-targeting countries (Figure 2.7), domestic policy rates share a rapidly decreasing trend during the transition period, up to 2001-2002 for the Czech Republic, Poland and Hungary and up to 2005 for Romania. This period is followed by a flattening/stabilization period when both Euro area and CESEE policy rates seem to follow a similar pattern both in terms of trend and level. For exchange rate-targeting countries



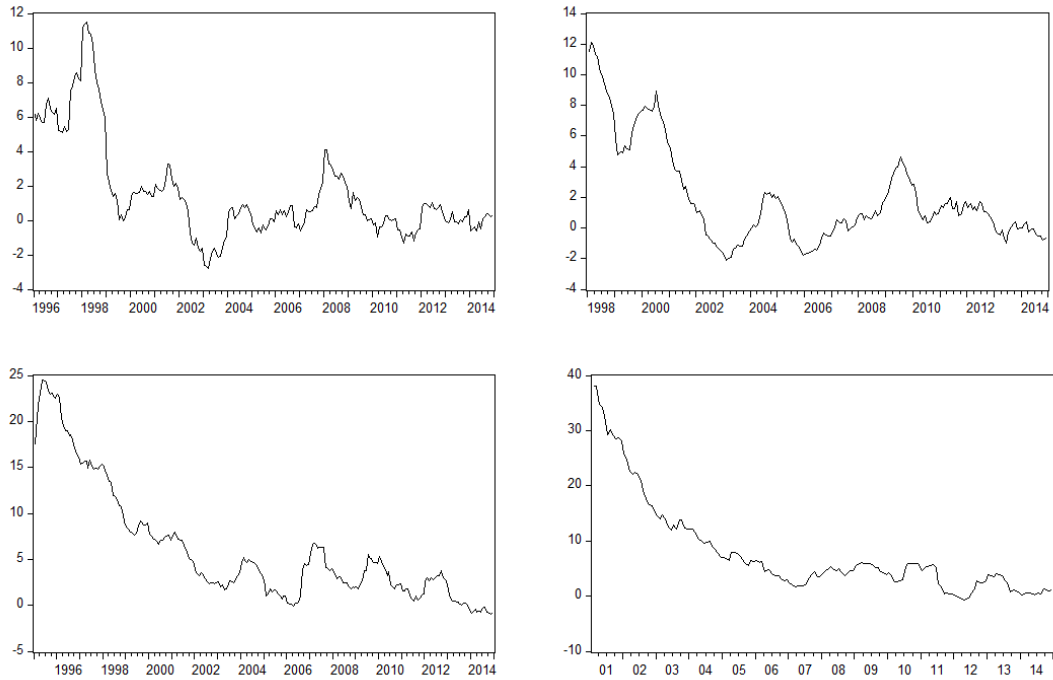


Figure 2.5 – Inflation-targeting countries - Inflation rate differential with Euro area  
 Top left/right: Czech Republic/Poland ; Bottom left/right: Hungary/Romania  
 Notes: Expressed in percent points; Data source: National Central Banks

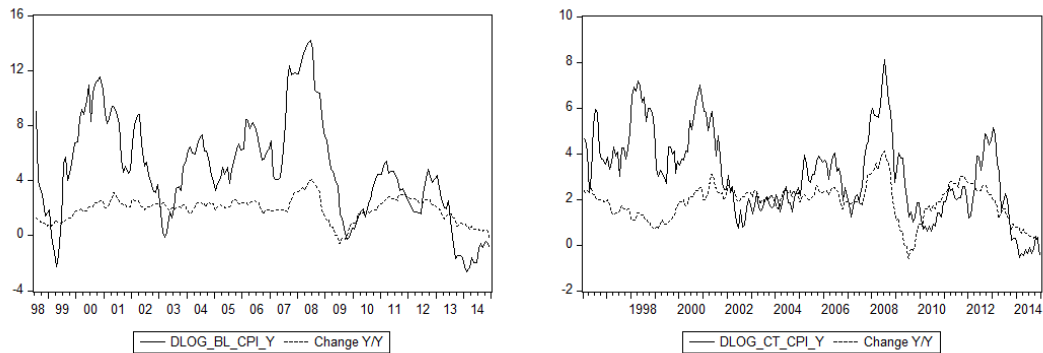


Figure 2.6 – Exchange rate-targeting countries - Inflation rate evolution  
 Left: Bulgaria ; Right: Croatia

Notes: Expressed in percent points; Dashed line: Euro area inflation rate; Data source: NCBs

(Figure 2.8), we have two different cases. Bulgarian policy rate<sup>8</sup> closely mirrors the dynamics of Euro area policy rate (which is in line with the currency board regime, which makes the policy rate endogenous to monetary policy); it is not the case for Croatia policy rate, which has common trends but much higher levels compared with the Euro area policy rate.

<sup>8</sup>discontinued since...

From this preliminary analysis of monetary variables, we can draw two main conclusions: first, recent history of CESEE countries has been punctuated by many institutional and macroeconomic changes. Monetary variables are particularly impacted and are therefore characterized by changes in trends and levels. These structural breaks complexify empirical analysis and are discussed in Section 2.3. Second, if we analyze the stylized facts with reference to monetary policy trilemma, particularly the stabilized exchange rates and convergent policy rates when compared with the Euro area, they are in favour of a lack of monetary policy autonomy. Inflation rates also seem to converge, most likely within the EMU convergence framework. We therefore turn to the empirical findings of the literature regarding monetary policy autonomy of CESEE countries within the EMU convergence framework.

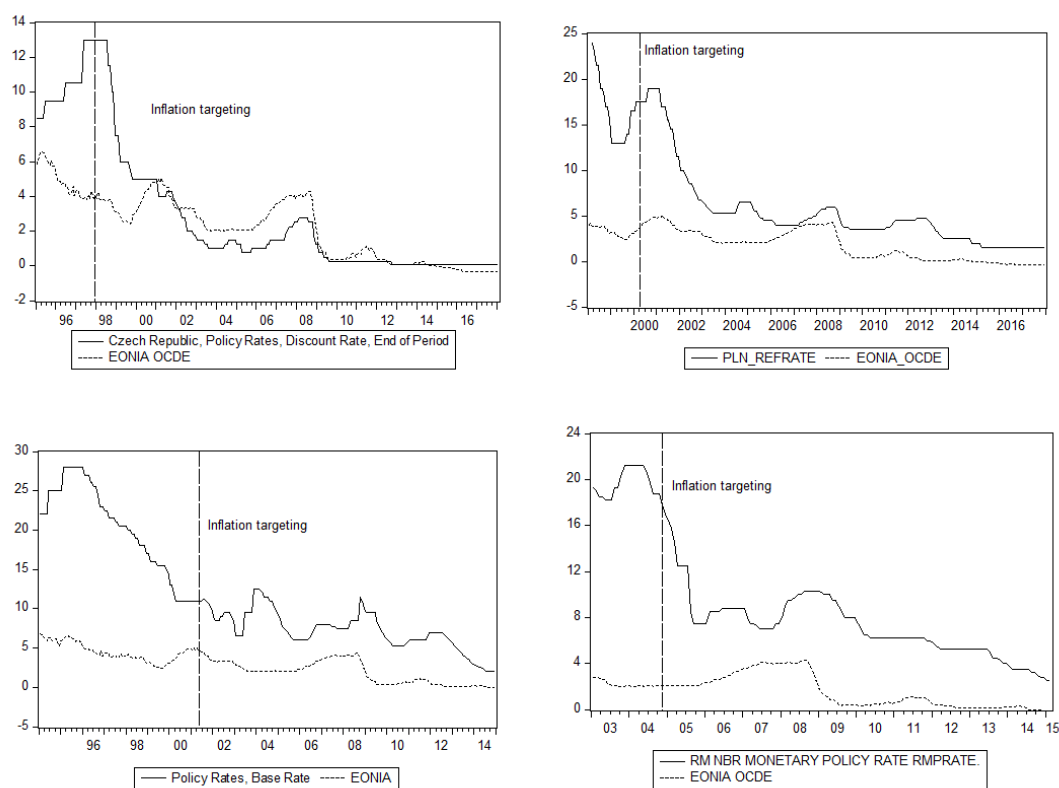


Figure 2.7 – Inflation-targeting countries - Policy rates evolution  
 Top left/right: Czech Republic/Poland; Bottom left/right: Hungary/Romania  
 Notes: Expressed in percent; Dashed line "Inflation-targeting": indicates starting year of IT;  
 Data source: OECD and National Central Banks

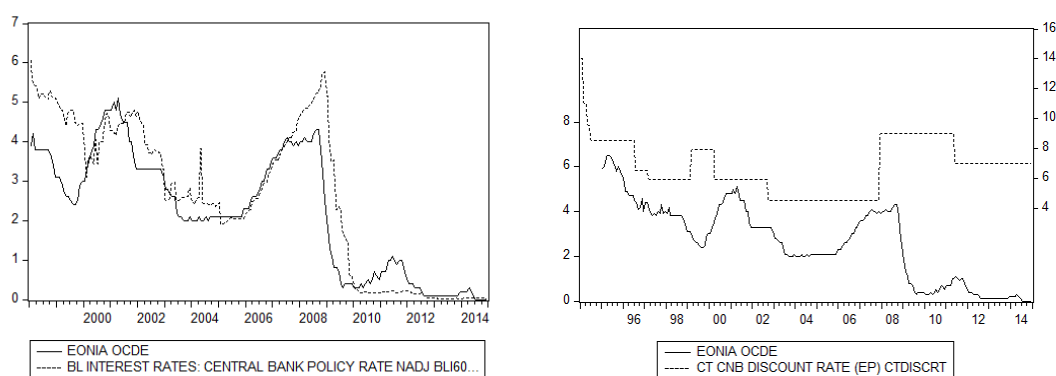


Figure 2.8 – Exchange rate-targeting countries - Policy rates evolution

Left: Bulgaria ; Right: Croatia

Expressed in percent points; Data source: National Central Banks

### 2.2.3 Monetary autonomy of CESEE countries in the empirical literature

The question of monetary autonomy of CESEE countries within the EMU convergence framework is not directly assessed in the literature. We are going to see that first, monetary independence of CESEE countries has been studied in relation with their exchange rates within the trilemma framework, with the Fear of Floating hypothesis also explored in this context. Second, we review the legacies from the earlier European Monetary System (EMS) literature, that does not model the EMS directly as well. In both cases, cointegration and structural breaks methodologies are widely and jointly used to assess either monetary autonomy or integration in the long run. Finally, some recent conclusions from the Euro area conventional and unconventional monetary spillovers literature are reviewed.

#### 2.2.3.1 Monetary independence, exchange rates and Fear of Floating

Monetary independence of CESEE countries has been discussed in relation with their exchange rate regimes. First reason lies in the intermediate nature of exchange rate regimes adopted by CESEE countries over the passing of time, which suggests unclear or time-varying effects. Second reason is that the role of exchange rates regimes in the international transmission of interest rates has been intensely debated in the literature (particularly for Emerging countries), not to mention very recent developments of dilemma (Rey, 2013) or quadrilemma (Aizenman, 2011) hypotheses. With regards to the Mundell (1963) trilemma, large panel studies on both Developed and Emerging countries are inconclusive on the exchange rate regime influence: Frankel et al. (2004) cannot reject the full transmission hypothesis of interest rates even for open economies with a flexible exchange rate. It therefore suggests countries do not have as much mon-

etary autonomy as trilemma implies. On the contrary, [Obstfeld et al. \(2004\)](#) shows in a large pooled panel study that during the post Bretton Woods period, "peggers" countries import foreign interest rates (although at a lower level than expected), while monetary policies of "non-peggers" countries are independent. He also finds evidence of a Fear of Floating effect for open capital market non peggers. Finally, [Chinn and Meredith \(2004\)](#) find large differences in interest rates transmission through the exchange rate for G7 countries, depending whether short or long interest rates are considered.

In line with this empirical literature on international transmission of interest rates, the Uncovered Interest Parity (UIP) framework and the derived univariate monetary spillover equation have been commonly used to test monetary independence of CESEE countries. In terms of empirical results, this literature is rather inconclusive as large panel research works just reviewed. In many articles, a long-term analysis is proposed and monetary independence is defined as the absence of cointegration between foreign and domestic interest rates, under the hypothesis of stationarity of the expected variation in the exchange rate between the two countries ([Fratzscher, 2002](#); [Holtemöller, 2005](#); [Kasman et al., 2008](#)). This hypothesis is one of the main shortcomings of this approach: as highlighted in [Camarero et al. \(2002\)](#), relying on UIP for long-term analysis means to assume that forecast errors, risk premium and exchange rate changes are all stationary processes. Structural changes are modelled to allow for long-term analysis, either through an indirect approach involving rolling econometric methodologies (which also account for monetary convergence) or with direct approach involving structural breaks, like we propose in this research work.

[Fratzscher \(2002\)](#) studies the links between monetary autonomy and flexible exchange rate regimes of twelve Emerging countries (inclusive of Central Eastern European countries) and sixteen Developed countries, assessed against the Euro area, the USA and Japan, over the 1993-2001 period with daily data. He applies the [Engle and Granger \(1987\)](#) error correction methodology to test and estimate the UIP specification and model interest rates with a dynamic GARCH model. Using a split sample approach, he finds increased dependence (or less monetary autonomy) of the Czech Republic, Hungary and Poland over time with the Euro area, regardless of the more flexible exchange rate regimes put in place during the transition decade. [Holtemöller \(2005\)](#) assesses monetary integration of EU New Member States, EU candidates and EU Members with a special status (Denmark, Sweden and UK) with the Euro area from the mid 1990s to 2004. He uses backward recursive Johansen cointegration tests between interest rates and rolling regressions of the exchange rate risk premium. All Central European countries and Romania are found to have a low degree of monetary integration (with interest rates not cointegrated) together with unstable risk premiums. [Kasman et al. \(2008\)](#) test the UIP hypothesis between EU New Member States, four candidate countries and Germany over the 1990-2005 period, using both [Gregory and Hansen \(1996\)](#) cointegration

and bounds tests, and Dynamic OLS estimator. They find significant long-run relation between German rates and Croatia, Hungary and Romania; second, they find that UIP holds for Croatia only.

Outside the UIP framework, [Brada et al. \(2005\)](#) use rolling bivariate cointegration tests to estimate real and monetary time-varying convergence between Germany (or France) and Central Eastern European countries over the 1990-2001 period. In terms of monetary integration (measured out of base money), Poland only has achieved cointegration for the sample periods covering 1994-2000 and even during the early years of transition. The Czech Republic, Hungary and Poland nevertheless exhibit M2 and CPI cointegration with Germany and France.

Finally, the impact of exchange rates regimes on the conduct of monetary policy and the test of the Fear of Floating hypothesis have been usually assessed with the estimation of monetary policy rules (MPR). This modelling choice is in line with the literature on open economy policy rules that assess the importance of the exchange rate in the reaction function of NCBs ([Ball, 2000](#); [Taylor, 2001](#); [Wollmershäuser, 2006](#)). [Allegret and Sallenave \(2015\)](#) estimate a monetary policy rule based on a panel of nine Emerging Europe countries. They find that the currency mismatch has been quite an important constraint to monetary policy during the 2007-2013 period and that Euro area policy rate is a key determinant of monetary policy. [Frömmel et al. \(2011\)](#) investigates the Fear of Floating hypothesis over the 1994-2008 period through the estimate of open economy Taylor rules for CESEE inflation-targeting countries, with dummies accounting for dates of exchange rate regime switches. In a single-equation cointegration setting (following [Gerlach-Kristen \(2003\)](#) in this aspect), they find exchange rate variations are not significant in the conduct of monetary policy whereas exchange rate target zone variable is. [Slavov \(2019\)](#) shows that over the 1999-2015 period, CESEE domestic currencies comove with the Euro (often within a unitary relation), regardless of their de jure exchange rate regimes.

### 2.2.3.2 Methodological legacy and policy implications of EMS and pre-Accession literatures

The literature just reviewed draws from an older literature on monetary integration (or convergence if a time-varying dimension is added) of EU countries within the European Monetary System (EMS)<sup>9</sup>. Most articles use the UIP framework and study the long-term dynamics of interest rates compared to Germany, while modelling non-stationarity of variables and structural breaks. This EMS literature highlights policy implications for New Member States and future EU candidate countries.

[Camarero et al. \(2002\)](#) study two types of monetary convergence (long-term and catching up) of thirteen EU countries with Germany from 1980 to 1996 using unit root test with structural breaks ([Perron and Vogelsang, 1998](#)) and time-varying parameters.

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<sup>9</sup>The EMS was the previous exchange rate stability system prevailing in the EU before the Euro implementation, that was created in 1979. It was based on first Exchange Rate Mechanism.

They find four groups of countries with various levels of convergence and evidence of structural breaks for Finland and Portugal. [Fountas and Wu \(1998\)](#) analyse monetary integration of EMS countries with Germany over the 1979-2005 period. They first apply [Engle and Granger \(1987\)](#) methodology then [Gregory and Hansen \(1996\)](#) bilateral cointegration test that allows for one structural break. They highlight the importance of modelling structural breaks because by doing so, they find interest rates cointegration between Denmark, the Netherlands, Ireland, Belgium and Germany. [Frömmel and Kruse \(2015\)](#) analyze monetary convergence between seven EMS countries and Germany within the UIP framework. Their research hypothesis is that monetary convergence has been achieved if there is a shift from non-stationary to stationary interest rate differentials. They test whether interest rates differentials over the 1983-2007 period have constant or changing persistence. They use the CUSUM-of-squares test of [Leybourne et al. \(2007\)](#) and estimate break points as convergence date estimates. They find that the null of constant persistence is rejected for Belgium, France and Italy. As in [Camarero et al. \(2002\)](#), they emphasize the need for Accession countries to achieve first, monetary integration before their entry into the Euro area and second, fiscal and monetary policy coordination to foster stable exchange rates in the run-up to EMU.

In some articles, EMS has been modelled directly in order to evaluate cross-country differences in monetary policy transmission mechanism. In their monetary VAR, [Peersman and Mojon \(2001\)](#) form three groups of countries from ten Euro area core Members, depending on their monetary regime within the EMS. They define an ad hoc identification scheme for the monetary policy shock for each group: for exchange rate-floating countries, they include both German policy rate and Deutsche Mark bilateral exchange rate to the model. They find output and inflation responses that are consistent with expected effects, whereas empirical works usually find a price puzzle effect (increase in prices following a positive monetary shock).

As in the EMS literature, pre-Accession monetary transmission literature of CEE and Baltic countries also modeled the various changes in exchange rates and monetary policy regimes through a split sample approach, but within a closed economy setting (see [Égert and Macdonald \(2009\)](#) for a literature review and [Creel and Levasseur \(2006\)](#); [Elbourne and de Haan \(2009\)](#); [Josifidis et al. \(2009\)](#); [Matei and Héricourt \(2006\)](#)). Monetary Vectorial Auto Regressive (VAR) representation and estimation is the standard methodology, with either a recursive or structural identification of shocks. EU foreign variables are used as control variables within an exogenous block. An original contribution is [Koukouritakis et al. \(2014\)](#) that use cointegration techniques with structural breaks in a multivariate setting to investigate interest rate and real effective exchange rate channels for five South-Eastern European countries.

### 2.2.3.3 Euro area monetary shock transmission

The Euro area monetary spillover literature gives additional answers to the question of monetary autonomy of CESEE countries within the EMU convergence framework, particularly since the aftermath of the Global Financial Crisis that saw increased interest in financial spillovers.

This literature allows identification of foreign monetary policy transmission channels for CESEE countries. Monetary policy shocks are potentially transmitted by various channels depending whether they are conventional (expectations, interest rate, exchange rate, credit channels to name a few) or unconventional (credit, confidence, wealth, portfolio rebalancing and exchange rate channels). On the conventional side and close to our research question, [Jiménez-Rodríguez et al. \(2010\)](#) investigate foreign shocks, amongst which monetary shock, through a VAR analysis that allows for structural breaks, on a sample of ten CESEE countries during the 1990-2009 period. They globally find heterogeneous country responses from Euro area or US monetary shock on domestic interest rates, which is rather in favor of monetary independence. On the unconventional monetary policy (UMP) side, in line with the post-GFC literature on financial spillovers of monetary policy ([Bruno and Shin, 2015a](#)), recent empirical contributions assess international spillovers of Euro area UMP shocks on the macroeconomic side (output and inflation), but also investigate financial spillovers. Financial variables considered are short-term interest rates ([Potjagailo, 2017](#)), bond yields and equity prices ([Ciarlone and Colabella, 2016](#)), Credit Default Swaps ([Bluwstein and Canova, 2016](#)), private credit ([Feldkircher et al., 2017](#)). Other articles even explore Euro area price shocks on CESEE prices ([Hajek and Horvath, 2018](#)), or financial assets shocks such as reduction in term spread or long-term yields ([Feldkircher et al., 2017](#)). The econometric methodologies follow the conventional monetary spillover literature, with various VAR models used.

[Bluwstein and Canova \(2016\)](#) use a mixed frequency structural BVAR on nine CESEE countries over the 2009-2014 period: they find that international transmission operative channels are the financial links (wealth, risk, portfolio rebalancing) and the exchange rate (to a lower extent than for conventional policy). They first show that there is no difference between floating exchange rate and fixed exchange rate countries in terms of macroeconomic responses to UMP shocks, pointing towards dilemma effect as in [Rey \(2013\)](#). Large foreign bank ownership is associated with a reduction in risk and equity prices increase, meaning that CESEE economies are more sensitive to UMP shocks than financially-matured economies such as Denmark or Sweden. [Ciarlone and Colabella \(2016\)](#) investigate the portfolio rebalancing and the banking liquidity channels of ECB asset purchase programs using fixed effects panel regressions on eleven CESEE countries over the 2009-2015 period: they find significant impact of asset purchases on financial and liquidity conditions such as nominal credit, long-term yields, yield curve slope and M2. [Hajek and Horvath \(2018\)](#) use shadow short rates in a Global VAR setting to assess the importance of Euro area unconventional monetary and inflation

shocks on non-Euro EU Member States using monthly data from 2001 to 2016. They find significant and negative consumer price decrease in Bulgaria and Croatia, that lose significance after 12 months. [Moder \(2017\)](#) analyses Euro area monetary policy spillover on SEE countries. She uses a structural Bayesian VAR over monthly data from 2008 to 2015 and finds that the exchange rate regime does not determine spillover effects.

## 2.3 Cointegration analysis in the presence of structural breaks

This section describes the main features of our empirical model. We first explain the main motivations behind our modelling choice, then present the main features of the model used in this paper, which is the cointegration model with breaks in the deterministic terms developed by [Johansen et al. \(2000\)](#). We finally proceed with structural breaks analysis of our variables.

### 2.3.1 Choice of modelling approach and discussion

Section 2.2 has shown that monetary integration of CESEE countries is a multidimensional process that involves not only policy rates, but also monetary variables such as inflation or exchange rates. We assume this process is therefore best modelled by a multivariate vectorial system that does not impose a predefined relationship between variables. Both literature and stylized facts point towards a long-term relation between monetary variables from the Euro area and CESEE countries, but without clear answer regarding the relevant framework that might be the policy trilemma or dilemma, Fear of Floating, international monetary policy or inflation spillovers. From that perspective, investigating monetary integration without using a predefined framework, like VECM modelling allows, is quite interesting.

We have also seen that recent evolution of CESEE countries history has translated into macroeconomic series that are characterized by broken trend and levels. Global or symmetric shocks such as the Global Financial Crisis also have an impact on domestic macroeconomic series. In terms of methodology, these structural breaks matter for CESEE countries for two reasons:

- Structural breaks change critical values of unit root and cointegration tests. Since our paper is focused on long-term relations between monetary variables, structural breaks are therefore to be modelled.
- Compared to advanced countries for which there exist long data series, CESEE countries have relatively short time series (starting end of the 1980s). Accounting for structural breaks (in the deterministic terms) allows to avoid the “split sample” estimation solution that is suited for large finite samples.

Finally, domestic and foreign monetary variables may share a stochastic trend. As highlighted by [Perron \(1989\)](#), cointegration relations with structural breaks in the deterministic terms are good model candidates for macroeconomic analysis. This conclusion,



applicable for developed countries with stable institutions and macroeconomic regimes, may be questionable for CESEE countries; but we believe it also applies to these countries since they have been engaged in an integration process with the European Union following their independence at the beginning of the 1990s. This assumption is supported by both EU membership application and negotiation start dates, indicated in Table 2.1, that are rather early during the transition period.

All the above reasons support our choice of the cointegrating model with structural breaks in the deterministic trends developed by [Johansen et al. \(2000\)](#) that we introduce in Subsection 2.3.2.

We have also considered threshold cointegration model as a model candidate (either in the short-term dynamics or in the cointegrating vector). We finally decided not to proceed with this type of model for the following reasons. First of all, cointegration tests do not allow to test series displaying deterministic breaks (cf the test regressions for the Gregory-Hansen cointegration test in [Gregory and Hansen \(1996\)](#)). Second reason is that seminal estimation model for threshold cointegration ([Hansen and Seo, 2002](#)) is a bivariate one. We have estimated one relationship between domestic and ECB policy rates that was very difficult to interpret, even though the model did fit the dynamics of the variables (results available on request). Finally, multivariate threshold models use exogenous thresholds (and not the error correction term). Such choice of exogenous threshold variable is not easy between domestic and international variables.

In our model, we focus on first moments of our variables and not on their second moments (volatilities) for the following reasons. First, our multivariate model uses a mix of macroeconomic and financial variables, for which autocorrelation is overall more an issue than heteroscedasticity. Moreover, we calculate annual changes for prices and exchange rates on monthly data, which smoothes volatility effects. Second, volatility transmissions are usually assessed on financial assets for which high-frequency data is available, whereas macroeconomic variables used in this research work are on a monthly basis. Third, our analysis is over the long term (from the mid 1990s to 2015), which does not match usually shorter volatility transmission analyses. Fourth, there are only few articles analyzing volatility transmission in the monetary independence and integration literature for CESEE countries: they are not in a multivariate setting and provide mixed evidence of such phenomenon. [Crespo-Cuaresma and Wójcik \(2006\)](#) assess monetary independence of Central Eastern European countries over time and estimate time-varying shock correlations between interest rates shocks with Germany (using a DCC-Multivariate GARCH model of real interest rates), using daily data from 1994 to 2003. The Polish results provide evidence against the monetary independence hypothesis, particularly during financial crises. The opposite is true for the Czech Republic while the Hungarian case is unclear. They also find that the degree of monetary inde-

pendence depends on the flexibility of the exchange rate regimes. [Habib \(2002\)](#) studies German interest rates and emerging bond markets volatility transmission to CEE countries. They estimate a GARCH model for interest rates and exchange rates (expressed in first differences), using 1997-2001 daily data. He rejects the hypothesis of German volatility contagion to CEE interest rates and exchanges rates, while emerging bond markets volatility is significantly transmitted to CEE exchange rates. In a closer approach to ours, there exist univariate time series models taking into account structural breaks in levels, trends and volatility (such as the model developed by [Wang and Zivot \(2000\)](#)) and some heteroscedasticity-robust unit root tests.

Finally, our choice of variables is aligned with empirical literature on monetary policy independence and transmission: we therefore use industrial production, prices and policy rates and add the relevant foreign variables to model EMU convergence framework (Euro area policy rate and inflation). We use EONIA money market rate to represent Euro area policy rate. We also include nominal exchange rate versus Euro as one of the endogenous variables of our model to understand the links between monetary policies and exchanges rates. They are described in Table 2.2.

We do not include fiscal variables in our model: even though government debt and general government balance are part of the nominal convergence criteria, fiscal policy (government spending) shocks are usually treated independently from monetary shocks in the VAR/VECM models.

Table 2.2 – Variables selection

Variable	Definition	Frequency	Source
$i_t$	Central Bank policy rate	Monthly	National Central Banks
$i_t^*$	EONIA	Monthly	OECD
$\log IPI_t$	Industrial Production Index, SA Seasonal adjustment (X-12 ARIMA) and log transformation	Monthly	IMF IFS Author's calculations
$\Delta CPI_t$	National inflation rate (Annual variation of National CPI)	Monthly Annual log return $\log CPI_t - \log CPI_{t-12}$	CPI from National Statistics Offices Author's calculations
$\Delta CPI_t^*$	Euro area inflation rate (Annual variation of Harmonized CPI)	Monthly Annual log return $\log CPI_t^* - \log CPI_{t-12}^*$	HCPI from Eurostat Author's calculations
$\Delta e_t$	Annual variation of nominal exchange rate against Euro	Monthly Annual log return $\log e_t - \log e_{t-12}$	Exchange rate from ECB Author's calculations

### 2.3.2 Representation of the VECM with structural breaks

General framework for cointegration analysis is the one from [Johansen et al. \(2000\)](#). The error correction formulation of the vector autoregressive model is:

$$\Delta X_t = \alpha \left( \beta' X_{t-1} + \gamma' t \right) + \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \epsilon_t \quad (2.1)$$

Where  $X_t$  is the vector of  $p$  variables at time  $t$ ,  $\Delta X_t$  is the same vector in first differences,  $\alpha$  and  $\beta$  full rank matrices of dimension  $p \times r$  ( $\alpha$  being the long-term adjustment matrix,  $\beta$  being the cointegrating matrix),  $r$  the rank of the matrix  $\alpha\beta'$ ,  $\gamma$  the  $p$ -vector of deterministic trend (drift) parameters,  $\mu$  the  $p$ -vector of constant (mean) parameters,  $k$  the number of lags,  $\epsilon$  the  $p$ -vector of independent and identically distributed errors (iid) with mean 0 and variance  $\omega$  (Gaussian white noise vector).

This initial framework is extended to account for structural breaks in deterministic terms (mean and trend). The original article presents three models, but the most suited to our data and research question is the  $H_l(r)$  model, following article's notations. The data-generating process has the following trend-restricted VECM representation:

$$\Delta X_t = \alpha \begin{pmatrix} \beta \\ \gamma \end{pmatrix}' \begin{pmatrix} X_{t-1} \\ tE_t \end{pmatrix} + \mu E_t + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \sum_{i=1}^k \sum_{j=2}^q k_{j,i} D_{j,t-i} + \epsilon_t \quad (2.2)$$

With the same notations as in Equation 2.1 except for  $q$  the number of samples,  $E_t = (E_{1,t}, \dots, E_{q,t})$  the  $q$ -vector of sample dummies,  $\gamma$  the  $q \times r$  matrix of deterministic trend (drift) parameters,  $\mu$  the  $p \times q$  matrix of mean parameters ( $\mu_j$  varying across samples, from 1 to  $q$ ),  $D_{j,t-i}$  the indicator function for the  $i$ th observation in the  $j$ th sample (corresponding to  $X_{Tj-1+i}$ ),  $k_{j,i}$  the  $p$ -vectors of dummy parameters ( $k$  dummies for each sample to condition the likelihood function over these initial observations at each subperiod).

Model  $H_l(r)$  generates a multidimensional process  $X_t$  with a linear trend since  $\Delta X_t$  has an unrestricted constant term  $\mu E_t$  (which differs between samples). Moreover, the cointegrating relations,  $\beta' X_t$ , are trend stationary. Trend is restricted to the cointegrating vector (by means of the term  $tE_t$ , which also differs between samples) so that time series in  $X_t$  do not exhibit quadratic trends but only a drift. Hence, model  $H_l(r)$  allows both non-stationary series and cointegrating relations to exhibit broken linear trends. This model is therefore suited for our series that potentially present structural breaks in both aspects.

A process satisfying the rank hypothesis of  $H_l(r)$  can be interpreted using Granger representation theorem: linear combinations of the process  $X_t$ , given by  $\beta$ , cointegrate

while the process exhibits a linear trend in each of the subsamples. In vectorial terms, it means that the process  $\beta'X_t + \gamma'tE_t$  is stationary for each sample period and has no trending behavior.

### 2.3.3 Structural breaks analysis

Structural breaks have been a challenge for academic research because they complexify the determination of stochastic or deterministic trends in macroeconomic time series. One important result from the unit root econometric research has been to establish that standard unit root tests' ability to reject the unit root null hypothesis in the presence of structural breaks decreases. In his seminal paper, [Perron \(1989\)](#) challenged the empirical results of the [Nelson and Plosser \(1982\)](#) analysis of American time series over a long period, in which they showed that macroeconomic series had a unit root. To support his analysis, he uses a modified Dickey-Fuller unit root test that includes dummy variables to allow for one known break. [Perron \(1989\)](#) test has been extended in several ways, first by using two types of models (Innovative Outlier -IO- versus Additive Outlier -AO- models, see [Perron and Vogelsang \(1992\)](#)), secondly by using an endogenous procedure to estimate break dates ([Zivot and Andrews, 1992](#)), thirdly by allowing several structural breaks in the data ([Lumsdaine and Papell, 1997](#)) and finally, by accounting for the existence of structural breaks both under the null and the alternative hypotheses ([Clemente et al., 1998](#); [Lee and Strazicich, 2003](#)). Previous tests model breaks under the alternative hypothesis and not under the null. This methodological advance avoids spurious rejection of the null because previous tests cannot identify a unit root process with structural breaks.

In order to determine the degree of integration of CESEE countries' variables, we first proceed with the [Clemente et al. \(1998\)](#) -CMR- unit root test that tests the null hypothesis of a unit root with possibly one endogenous break in mean, against the alternative of no unit root with two endogenous breaks<sup>10</sup>. This test is an extension of the [Perron and Vogelsang \(1992\)](#) unit root test. It is the first test that allows to detect non-stationary variables with breaks under the null and also allows for the existence of two structural breaks. We choose this first test because literature usually assumes that most macroeconomic variables we use are non-trending variables. We nevertheless challenge this assumption and do a robustness check of the results with the [Lee and Strazicich \(2003\)](#) -LS- two-break Lagrange Multiplier unit root test. This second test also includes breaks both under the null and alternative, but proposes two types of specifications of the deterministic terms (Model A with break in mean and Model C with break both in trend and mean). Both CMR and LS tests use a parametric autocorrelation correction so that determination of lag truncation is quite important (discussed in Appendix ?? for [Clemente et al. \(1998\)](#) test). We use lag truncation procedures that optimize the unit root test size and power: we use  $k(t)$  method used in [Perron and Vogelsang \(1992\)](#)

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<sup>10</sup>See Appendix ?? for test hypotheses and statistics

in the CMR test and pmax method for the LS test. In order to compare results, we use the Additive Outlier (AO) version of the CMR unit root test (allowing for an immediate change in deterministic terms), since the LS test is an AO test in all cases.

Table 2.3 summarizes CMR unit root test results on our variables of interest for the six CESEE countries (namely, industrial production, domestic inflation rates, policy rate, exchange rate annual variation). We do not reject the null hypothesis of all series having a unit root and at least one endogenous break date at 5% level. Variables' order of integration is robust to the LS unit root test if we consider Model A (results in Table 10) and to the lag truncation methods. Only exception lies with the Bulgarian exchange rate variation for which LS test rejects the unit root null hypothesis at 5% whatever the model considered. We therefore exclude the Bulgarian lev from the VECM analysis. The LS test, using Model C, rejects the null of unit root with two breaks in trend and levels for industrial production in three countries and for policy rates in Romania and Poland. We can conclude that both the CMR and LS tests do not reject the null of unit root with two breaks, either in levels or in levels and trends.

Regarding [Clemente et al. \(1998\)](#) structural breakpoints estimations, some general comments can be made. First, due to the start dates of our analysis (middle of the 1990s), the unit root estimates do not capture domestic systemic banking and currency crises from the transition decade. The speculative attacks against the Czech krona in May 1997 are not identified as a structural break. Only the systemic banking crisis in Croatia in 1998-1999 has potentially led structural breaks in exchange rate and policy rates in 2000, with a lag. Second, for all countries, most structural breaks dates can be related to monetary regime changes, EU membership or the Global Financial Crisis (mostly identified by the CMR unit root test). Third, some exchange rate and policy rate structural breaks can be linked to sudden stop episodes as identified by [Forbes and Warnock \(2012\)](#): April 1996 for Hungary, 2009 Q4-2010 Q1 for Romania, 2010 Q2-Q4 for Croatia. Fourth, both unit root tests roughly identify the same structural break dates for domestic policy rates.

For Central European countries (Poland, the Czech Republic and Hungary), first break date for all series is located at the end of the 1990s (between 1999 and 2001) and corresponds to the implementation of inflation-targeting monetary regimes. Second break date is either related to the GFC (2008 up to 2010), or between 2001 and 2004, which corresponds to the years preceding their EU membership in April 2004. For Southern Eastern European countries (Bulgaria, Romania and Croatia), endogenous break dates correspond to either the start of the inflation-targeting regime (eg Romania), the EU membership accession (eg Bulgaria for the nominal variables), or the years following the GFC (for all three countries, between 2009 and 2011).

Finally, for the Euro area, both policy rate and inflation rates exhibit break dates corresponding to the impact of the GFC (2009-2010), and another interesting break date either in 2001 or in 2006. This reflects the fact that the start date of the analysis

Table 2.3 – Results of [Clemente et al. \(1998\)](#) unit root test, Additive Outlier model

Country	Variable	Lag truncation	Optimal break point 1	Optimal break point 2	min t-Stat	
<b>Bulgaria</b> <b>2001:M1</b>	IPI	5	2004:M12	2008:M7	-2.54	
	$\Delta$ _CPI	21	2007:M10	2009:M4	-1.66	
	i	23	2007:M4	2009:M2	-1.85	
	$\Delta$ _e	24	2004:M3	2005:M7	-4.39	
<b>Croatia</b> <b>1997:M6</b>	IPI	4	2003:M11	2010:M7	-2.52	
	$\Delta$ _CPI	24	2008:M1	2009:M1	-1.48	
	i	13	2000:M6	2010:M2	-3.63	
	$\Delta$ _e	23	2000:M3	2008:M9	-4.48	
<b>Czech Republic</b> <b>1996:M1</b>	IPI	24	2003:M5	2014:M6	-3.21	
	$\Delta$ _CPI	2	2001:M11	2008:M12	-5.00	
	i	2	1998:M9	2002:M4	-3.14	
	$\Delta$ _e	2	2007:M1	2010:M1	-2.51	
<b>Hungary</b> <b>1994:M1</b>	IPI	22	1998:M12	2003:M6	-2.63	
	$\Delta$ _CPI	24	1997:M6	2001:M12	0.03	
	i	0	1999:M3	2005:M4	-2.89	
	$\Delta$ _e	24	1996:M4	1999:M6	-2.60	
<b>Poland</b> <b>1998:M3</b>	IPI	1	2003:M9	2009:M12	-3.71	
	$\Delta$ _CPI	12	2001:M12	2008:M3	-2.18	
	i	18	1999:M11	2001:M3	-1.15	
	$\Delta$ _e	12	2009:M3	2009:M7	-2.88	
<b>Romania</b> <b>2003:M1</b>	IPI	12	2006:M6	2012:M4	-2.77	
	$\Delta$ _CPI	12	2005:M11	2011:M10	-3.88	
	i	17	2005:M5	2010:M4	-0.94	
	$\Delta$ _e	12	2008:M2	2009:M8	-2.48	
<b>Euro area</b>	1994:M1	i*	18	1996:M11	2009:M5	-1.45
	1996:M1	i*	11	2001:M2	2009:M5	-2.28
	1998:M3	i*	13	2001:M2	2009:M8	-2.15
	2001:M1	i*	5	2006:M11	2009:M3	-3.07
	2003:M1	i*	1	2006:M9	2009:M3	-6.82
	2001:M1	$\Delta$ _CPI	16	2009:M2	2010:M4	-1.27
	2003:M1	$\Delta$ _CPI	16	2009:M2	2010:M4	-1.18

Notes: Start date of the analysis indicated under each country. Asymptotic critical values @ 1%/5%/10% = -5.96/-5.49/-5.24 for  $k > 5$ . The  $k(t)$  method for determining the lag truncation parameter is the one used in [Perron and Vogelsang \(1992\)](#), with a maximum lag of 24. Trimming parameter lambda has been chosen to 5% which is line with article recommendations to have largest data window possible.

determines which breaks are captured: since we want to determine global breaks more than local breaks, we will use the longest data span available.

### 2.3.4 Discussion of the structural breaks results

Endogenous determination of structural breaks within unit root tests depends on the type of modelled break (gradual or immediate), lag truncation, data trimming parameter and test statistics. As we have seen for the Euro area inflation, data length also determines whether global breaks or local breaks are captured by the analysis: the longer the data set, the higher the probability to catch "real" structural breaks. This may explain why we find structural break dates that differ from main economic events: for instance, even if the Czech currency crisis in May 1997 triggered institutional changes, its relative impact on the exchange rate variation is lower than the Global Financial Crisis one,

hence not captured by the unit root test procedure. Finally, the date estimates may be more or less accurate. For these reasons, structural breaks estimated endogenously by two different unit root tests may differ.

Moreover, it is difficult to compare structural breaks estimated within a unit root test procedure with structural breaks estimated within a structural breaks test. In the first case, the number of structural break dates is limited (in most unit root tests as mentioned above, one or two) and the retained dates are the ones for which the test statistic is minimum. In the second case, the number of structural dates is potentially higher (determined through model selection criteria), the time series is fully modelled and its parameters estimated. One interesting example is [Égert et al. \(2006\)](#): authors model macroeconomic series for ten CESEE countries using Bayesian methodology of [Wang and Zivot \(2000\)](#) that takes into account structural breaks in means, trend and volatility. Using monthly data from 1990 until 2004 (thus capturing the transition decade), they find structural break dates in line with major domestic economic crises and macroeconomic regime shifts.

For the empirical analysis, we use structural break dates estimated for policy rates since their dynamics drive our research question. There is also some form of consensus across unit root tests and models around the dates estimated by the CMR unit root test, so that we keep them. The break dates are unchanged across individual country models to allow comparability. The use of endogenous break dates is standard practice even though their use is discussed by [Trenkler et al. \(2008\)](#), that find unclear whether the nature of such breaks (either pure deterministic or change in dynamics) is sufficiently known to make the tests applicable.

## 2.4 Empirical strategy

### 2.4.1 Baseline and alternative models

Our multidimensional  $X_t$  process analyzed with the VECM with breaks consists of five variables of interest and the restricted trend term:

$$X_t = \{\log IP_t, \Delta CPI_t, i_t^*, \Delta e_t, i_t, tE_t\}' \quad (2.3)$$

With  $\log IP_t$  the domestic industrial production transformed in logarithm,  $\Delta CPI_t$  the annual customer prices inflation,  $i_t^*$  the Euro area policy rate,  $\Delta e_t$  the annual exchange rate variation against Euro,  $i$  the domestic policy rate and  $tE_t$  the deterministic term for each subsample.

We basically augment the closed economy model used in [Peersman and Smets \(2001\)](#) by adding Euro area policy rate as an endogenous variable. It is ordered third in the system because we do not want to normalize our cointegrating vectors on the variable

we want to test. By doing so, we do not impose exogeneity to this variable and allow to test for the foreign policy endogeneity in the system.

This model is the one used in [Peersman and Mojon \(2001\)](#) for a monetary policy VAR analysis that we follow in terms of variable ordering: domestic policy rate is ordered last, which means it is contemporaneously impacted by all other macroeconomic variables (output, inflation, Euro area policy rate and exchange rate). With the exchange rate ordered before the domestic policy rate, we assume the exchange rate has a contemporaneous impact on domestic monetary policy rate. With the Euro area policy rate ordered before exchange rate and policy rate, we assume Euro area monetary policy is not affected contemporaneously by domestic monetary policy nor exchange rate (which is in line with small open economy theory). Finally, domestic output and inflation are contemporaneously exogenous both to the Euro policy rate and to the domestic policy rate. We finally follow [Peersman and Smets \(2001\)](#) and do not include a money aggregate, because we assume the exchange rate monetary objective is stronger than the money aggregate one.

As exposed in Section 2.3, deterministic terms are included so that they correctly model the time series dynamics: we follow model  $H_l(r)$  in which both non-stationary time series and the cointegrating relations can include breaks in the linear trend term. More precisely, our specification includes: three sample dummies  $E_t^i$ , for  $i=1$  to 3, representing the periods between the two breaks, that are used to model breaks in levels and also linear trend breaks when they are multiplied by the deterministic trend term  $tE_t^i$  (so, 6 deterministic terms in total). Also, to make transition happen between the subperiods, [Johansen et al. \(2000\)](#) suggest conditioning the log-likelihood function upon the first  $k$  observations of each sample period (which has the effect of setting the first  $k$  residuals to zero), with the transition periods being extendable if necessary.  $k$  dummies are therefore included at the beginning of each sample period. All these deterministic dummies have to be included in order to avoid model misspecification, and particularly the transition dummies that capture the structural break outlier effect on the cointegrating relations.

In order to answer our research question, we estimate the following alternative VECMs:

- i) No breaks model: Baseline model without structural breaks

$$X_t = \{\log IP_t, \Delta CPI_t, i_t^*, \Delta e_t, i_t\}' \quad (2.4)$$

- ii) Inflation model: Baseline model augmented with Euro area inflation rate. Addition of European inflation models the double constraint in terms of inflation targets



(domestic and Euro area one).

$$X_t = \{\log IP_t, \Delta CPI_t, \Delta CPI_t^*, i_t^*, \Delta e_t, i_t, tE_t\}' \quad (2.5)$$

#### 2.4.2 Data overview

We use monthly data, seasonally adjusted and transformed into natural logarithm except for interest rates. Prices and exchange rates are expressed as annual (year-on-year) changes over monthly data. More precisely, domestic inflation rates are calculated as 12-month log differences between national Consumer Prices Indices, all items, after seasonal adjustment. Exchange rates variations are based on nominal exchange rates versus Euro (Appendix 2.I). Real activity is proxied by Industrial Production Indices (all items), that are taken in levels, seasonally adjusted and transformed into their natural logarithms (Appendix 2.H). Data are expressed in percentage points, except industrial production. For national data, we use data from National Central Banks (policy rates), European Central Bank (exchange rates), National Statistical Offices and IMF IFS databases (for consumer prices and industrial production, respectively).

We pay special attention to the choice of the domestic policy rate, since there have been changes and/or addition of monetary policy instruments over the whole period (for instance, the introduction of Central Bank deposit rates or the Open Market Operations reference rates). We therefore use the main monetary policy instrument over the most recent period. For inflation-targeting countries (Czech Republic, Hungary, Poland and Romania), we use main monetary policy rate, which may differ across countries. They can be yields on money market bills, repurchase agreement rates, discount rates or deposit rates. They reflect the development stage of the financial markets and monetary institutional framework of these economies. For exchange rate-targeting countries (Bulgaria, Croatia), we use base rate for Bulgaria and the 3-month Zibor rate for Croatia as a proxy for the policy rate. We do not include the exchange rate as variable for Bulgaria because of the fixed nature of the exchange rate regime (and the stationarity of the series). but we include it for Croatia.

For Euro area, we use Euro Over Night Index Average (EONIA) rate (19 countries) from the OECD database, for which data is available since 1994<sup>11</sup>. This choice is motivated by the data span that is longer and a good proxy for the ECB main policy rate<sup>12</sup>.

Regarding the beginning of the analysis, we use longest span of data available for each country. We end our analysis in December 2014 as common end date for all countries, so that the ECB Quantitative Easing period is not embedded into the data (it has officially started in 2015:M3).

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<sup>11</sup>From January 1999, EONIA was computed as a weighted average of overnight unsecured lending transactions in the European Union and the European Free Trade Area (EFTA) interbank market prior to 1st October 2019.

<sup>12</sup>Refinancing rate is available since January 1999. We have compared EONIA with the various Euro area policy rates in Appendix 2.J.

Table 2.4 – Data overview

Country	Analysis period	Number of observations
Bulgaria	2001:M1 - 2014:M12	168
Croatia	1997:M6 - 2014:M12	211
Czech Rep	1996:M1 - 2014:M12	228
Hungary	1994:M1 - 2014:M12	252
Poland	1999:M3 - 2014:M12	202
Romania	2003:M1 - 2014:M12	144
Data series	Frequency and fixing	Data source
Domestic policy rate	Monthly, EOP	NCBs
EONIA	Monthly, EOP	OECD
Shadow short rate	Monthly, EOP	Krippner (2015)
Industrial Production Index, NSA	Monthly, EOP	IMF IFS
National Consumer Price Index, NSA	Monthly, EOP; 1995=100	National Statistics Offices
Euro area Harmonized Consumer Price Index, NSA	Monthly, EOP; 2005=100	Eurostat
Nominal exchange rate against Euro	Monthly fixing	European Central Bank

### 2.4.3 Johansen cointegration rank test and VECM specification tests

In order to find the number of cointegrating relations between variables, we proceed with the [Johansen et al. \(2000\)](#) modified rank test (see Appendix ?? for presentation of hypotheses, test statistics, alternative rank tests and rank robustness checks). Cointegration rank test can be performed if VECM is well specified, which is tested as follows.

Johansen rank test is parametric and is as such sensitive to the number of lags embedded to control for error autocorrelation. Hence, we have to determine the relevant number of lags to whiten the residuals<sup>13</sup>. The maximum lag analysis is performed through estimation of the unrestricted VAR model (inclusive of a constant and a trend). We use two types of approaches to select the lag order: the minimal information criteria (particularly the Hannan-Quinn criteria if there is no consensus) and the computation of several autocorrelation tests on the residuals for the multivariate system (Portmanteau test, Beutsch-Godfrey test). Moreover, since Johansen rank test is based on a Maximum Likelihood Gaussian function, it assumes residuals follow a multivariate normal distribution. We therefore perform Jarque-Bera normality test on unrestricted VAR residuals. In order to minimize residuals' variance relative to the number of lags, we perform univariate and multivariate ARCH-LM tests. We report Johansen rank test results in Appendix 2.C as well as lags indicated by information criteria on the unrestricted VAR (so that the VECM lag will be equal to unrestricted VAR lag minus one).

<sup>13</sup>One also has to keep in mind that increased estimation uncertainty due to high lag orders can imply large size distortions of the rank test, as pointed out by [Gonzalo and Pitarakis \(2006\)](#) even for the case of no breaks and only one fitted autoregressive lag.

#### 2.4.4 Long-term restrictions, weak exogeneity and deterministic breaks tests

VECM estimation is done using an identifying normalization that is not unique (hence, that is not economically meaningful). In order to give economic sense to  $\beta$  parameters, we test restrictions (which is mathematically equivalent to over-identifying the cointegration space). The long-run restrictions are tested with a Wald test with a  $\chi^2(J)$  distribution, with  $J$  the number of linearly independent restrictions.

With  $\beta_{K^*-r}^*$  being a  $(K^* - r)$  matrix (the  $\beta$  estimators below the  $I_r$  identity matrix),  $R$  being a  $J \times (K^* - r)r$ -matrix and  $r$  being a  $J$ -dimensional vector,  $\text{vec}()$  the vectorization operator, we test the null hypothesis versus the alternative:

$$H0: R\text{vec}(\beta_{K^*-r}^*) = r \text{ versus } H1: R\text{vec}(\beta_{K^*-r}^*) \neq r \quad (2.6)$$

Given linear restriction test results, long-term relation is estimated again after exclusion of the variables that do not enter the cointegrating relation. As a basis for long-term analysis resulting from these restrictions, we use the Uncovered Interest Parity (UIP) that links the nominal exchange rate with short-term rate differential between two countries and the empirical Taylor monetary policy rule linking nominal interest rate setting to inflation and output, augmented with the exchange rate and Euro area monetary variables. Following notation from Section 2.3,  $\alpha$  (adjustment parameters, or loading coefficients) and  $\gamma$  parameter estimates (slopes of the cointegrating relations) have an asymptotic normal distribution and their t-ratios can be interpreted as usual.

- i) For  $\alpha$  estimates, t-ratios allow to test long-term weak exogeneity, conditional on cointegration parameters. A variable is weakly exogenous with respects to a given set of  $\beta$  parameters (i.e. a given long-term correction term) if not modelling the variable in the system does not incur information loss. Weak exogeneity test is important for our model since Euro area policy rate is included as an endogenous variable: it can be weakly exogenous for one or more error-correction terms, and its inclusion may lead other variables to be weakly exogenous relative to the  $\beta$  parameters of interest, too.
- ii) Restrictions on  $\gamma$  are sequentially tested with a joint Wald test per sub period as per [Johansen et al. \(2000\)](#). Linear restrictions on the slope for the entire process  $E_t$  can be tested as well per period. Authors advise to perform these two tests sequentially.

## 2.5 Results

Our table results (Tables 2.5 to 2.8) are grouped by model, with all countries reported in the same table to allow for comparative analysis. Break dates are indicated at the top of each table. These tables report long-term  $\hat{\beta}$ , short-term  $\hat{\alpha}$  and deterministic  $\hat{\gamma}$  estimates as well as their restriction tests as described in Subsection 2.4.4. We present error correction terms (ECT) for each model, inclusive of short-term dynamics and of the deterministic terms ( $tE_t$ ), in Appendices 2.D to 2.G. Following rank robustness checks as developed in Appendix 2.B, some cointegrated vectors are excluded and the rank of the VECM revised down. In some other cases, long-term restriction tests led to some cointegration vectors to be restricted: in this case they are not reported in tables but still in error correction terms graphs. All cointegration estimations are done with the JMulti software.

Johansen modified rank test results, reported in Appendix 2.C, indicate that for all models tested, most CESEE countries are best modelled with two-lag VECMs (Czech Republic, Poland, Bulgaria, Croatia). Romania VECMs embed one lag whereas Hungary VECMs embed no lag. With these lag orders, we have been controlling for low order error autocorrelation. On the other hand, heteroscedasticity has been rather well controlled for these lags as tested by univariate or multivariate ARCH-LM tests. Finally, univariate normality tests usually reject the normality hypothesis for policy rates, largely due to a kurtosis effect (same for the joint normality tests).

Regarding the interpretation of the coefficients of the cointegrating relations as long-run elasticities (or semielasticities), we rely on [Johansen \(2005\)](#) who does a counterfactual experiment using changes of current values to impact long-run values and shows that estimated coefficients can be interpreted as long-run elasticities. His analysis is based on the dynamics of a VECM, hence relying on a short-run/long-run dichotomy, as opposed to endogenous/exogenous variables<sup>14</sup>.

Due to identifying restrictions and variable ordering, we usually find two types of cointegrating relations which answer our research question. We first find long-term relations between domestic and foreign variables. When Euro area rate is restricted, we find cointegrating relations between domestic variables, which answers the question of the exchange rate importance in the conduct of monetary policy. We analyse both types of cointegrating relations sequentially.

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<sup>14</sup>Main reasons are firstly, variables have been transformed in logs or are already expressed in percent (necessary condition to interpret coefficients as elasticities or semielasticities, since variables do not have any numeraire anymore); secondly, because cointegrating relation has been identified and finally, because the desired long-run change needed to interpret coefficients as long-run elasticities is a vector ( $k$ ) in the space orthogonal to betas, and as such, multiplied by adequate  $\Gamma$ , will equal the short-run changes.

### 2.5.1 Baseline model

Estimation results are reported in Table 2.5. For this VECM, Johansen modified rank test does not reject at 5% three cointegrating relations for Bulgaria, Poland and Hungary and two long-term relations for the Czech Republic. For Romania and Croatia, one cointegrating relation between variables is not rejected at 5%. After rank robustness checks, some long-term relations have been restricted and are not reported (the first ECT for Bulgaria). Rank has been revised for the Czech Republic model (two cointegrating vectors instead of three). Three error correction terms out of thirteen can be considered as unit vectors (Bulgarian ECT2, Poland ECT1 and Romania ECT).

First interesting result is that structural break modelling is not rejected at 5% for any of the first EU joiners (namely the Central Eastern countries) and Bulgaria, but is fully rejected for Romania and on two subperiods over three for Croatia. Estimated  $\hat{\gamma}$  coefficients are particularly significant for the three Central countries (Hungary, Poland, and to a lesser extend, the Czech Republic) and with the expected negative sign. These results are in line with the longer data length used for Central Eastern European countries, but rather unexpected from this perspective for Croatia. One can nevertheless argue that this country has a rather stable exchange rate nominal target since 1997, which can explain the rejection of structural trend breaks in the cointegrating relation in a similar fashion as for Romania.

Second interesting result relates to the interdependence between domestic and Euro area monetary policies: domestic policy rate and other domestic variables are in a long-term relation with Euro area policy rate for three countries of interest: the Czech Republic, Hungary and Bulgaria. If we normalize the error correction term over the domestic policy rate, we find estimated  $\hat{\beta}_i^*$  range from 0.38 to 0.6, with the exception of Bulgaria for which we find an almost unitary relation between policy rates ( $\hat{\beta}_{CZK} = 0.61, \hat{\beta}_{BUL} = 1.13, \hat{\beta}_{HUF} = 0.78$ ). For these countries except Hungary, the Euro area policy rate  $i^*$  is weakly exogenous at 5% level, conditional on the estimated long-term parameters. More precisely, Euro area and domestic policy rates cointegrate within a Taylor rule augmented with Euro area policy rate for the Czech Republic (ECT1) and Bulgaria (ECT3). The related  $\hat{\alpha}$  are in favor of this interpretation: they have the expected sign<sup>15</sup> and their strong significance and levels (around 0.3) show that they lead the short-term adjustment of the cointegrating relation. For Hungary, policy rates cointegrate within a UIP type relationship (ECT3), even though estimated coefficients on interest rate differential are not equal to the UIP unity. We also do not reject the null of weak exogeneity for the domestic policy rate at 5%. These two results point towards a strong transmission of Euro area monetary policy to Hungary, possibly a policy dilemma, which is confirmed by the fact that Euro area policy rate is identified as endogenous.

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<sup>15</sup>Positive for policy rate since they have negative coefficients in the ECTs, positive for the exchange rate variation in the case of Hungary

Table 2.5 – Baseline VECM;  $X_t = \{\log IP_t, \Delta CPI_t, i_t^*, \Delta e_t, i_t, tE_t\}'$

	Czech Republic		Bulgaria		Poland		Romania		Hungary		Croatia	
Break date 1	1998 M9		2007 M4		1999 M11		2005 M5		1999 M3		2000 M6	
Break date 2	2002 M4		2009:M2		2001 M3		2010 M4		2005 M4		2010 M2	
Lags	2		1		2		1		0		2	
	ECT1	ECT2	ECT2	ECT3	ECT1	ECT2	ECT3	ECT1	ECT1	ECT2	ECT3	ECT1
$\beta_{IP}$	1	*	*	*	1	*	*	1	1	*	*	1
$\beta_{\Delta CPI}$	*	1.00	1.00	*	*	1.00	*	*	*	1.00	*	*
$\beta_{i^*}$	0.23	*	*	1.00	*	*	1.00	-0.011	*	*	1.00	-0.014
$\beta_{\Delta e}$	0.041	0.12	-	-	0.002	0.07	*	-0.006	0.038	0.809	0.538	-0.004
$\beta_i$	-0.380	-0.78	0.74	-0.88	0.02	-0.55	*	0.033	-0.087	-3.27	-1.37	*
$\gamma_{t1}$	*	*	0.081**	-0.002	0.043***	1.289***	0.231*	*	-0.024***	-0.008***	-0.005***	*
$\gamma_{t2}$	-0.00127	-0.095***	0.073***	0.014***	-0.01**	-0.109*	0.015	*	-0.415***	-0.124*	-0.148***	-0.002
$\gamma_{t3}$	-0.00230	-0.01**	0.016	0.004	-0.005***	-0.011	0.024***	*	-0.21***	-0.032	-0.052***	*
$\alpha_{IP}$	-0.009	<b>-0.004***</b>	0.001	0.003	-0.102	0.002	-0.003	<b>-0.148***</b>	<b>-0.498***</b>	-0.001	<b>0.037***</b>	<b>-0.33***</b>
$\alpha_{\Delta CPI}$	0.234	<b>-0.101***</b>	<b>-0.13***</b>	-0.036	0.743	-0.009	<b>0.058*</b>	-2.65	<b>0.732*</b>	-0.031	0.044	<b>2.48***</b>
$\alpha_{i^*}$	0.005	-0.011	<b>0.011**</b>	-0.016	<b>0.412**</b>	-0.013	<b>-0.039***</b>	<b>0.569**</b>	<b>0.287**</b>	<b>0.041***</b>	<b>-0.083***</b>	0.48
$\alpha_{\Delta e}$	-1.22	<b>-0.616***</b>	-	-	-4.12	-0.185	0.19	8.25	<b>-4.43**</b>	<b>-0.20*</b>	<b>0.508***</b>	4.57
$\alpha_i$	<b>0.297**</b>	-0.019	-0.016	<b>0.223***</b>	-0.132	<b>0.106***</b>	0.03	1.35	0.006	0.007	0.035	<b>5.96***</b>
$H_{l,1}^\gamma(r)$	0.93		0.000		0.000		0.874		0.000		0.81	
$H_{l,2}^\gamma(r)$	0.055		0.000		0.001		0.206		0.000		0	
$H_{l,3}^\gamma(r)$	0.010		0.046		0.000		0.539		0.000		0.38	
$H_0^{\Delta CPI}$	*	*	*	*	*	*	*	<b>0.39</b>				<b>0.73</b>
$H_0^{i^*}$	0.015	<b>0.377</b>	*	*	*	*	*	0.030	*	*	*	0.051
$H_0^{\Delta e}$	0.000	0.021	-	-	0	0.2599	<b>0.423</b>	0.000	0	0	0	0.052
$H_0^i$	0.000	0.055	0.040	0.000	0.005	0.0039	<b>0.267</b>	0.000				<b>0.526</b>
Joint	0.83				0.419				0.62-0.45		0.5235-0.4088	

Note: The star \* included in cointegrating relations means parameter has been restricted (either identification or long term restrictions).  $\beta$ s are estimated parameters of the restricted cointegrating vectors (or error correction terms - ECT-), with their associated long-run exclusion tests p-values ( $H_0^{\Delta CPI}$ ,  $H_0^{i^*}$ ,  $H_0^{\Delta e}$ ,  $H_0^i$ ).  $\gamma$ s are estimated parameters of the restricted linear trend by subperiod, with their associated joint exclusion tests p-values ( $H_{l,1}^\gamma(r)$ ,  $H_{l,2}^\gamma(r)$ ,  $H_{l,3}^\gamma(r)$ ).  $\alpha$ s are the loading coefficients defining the adjustment speed of the variables to the ECT (if significant, we reject the null of the variable being weakly exogenous conditional to the ECT). \*, \*\*, \*\*\* correspond to significance levels at 10%, 5% and 1% respectively.

On the other hand, Poland policy rate does not cointegrate with Euro area policy rate (all domestic variables have been restricted from the third error correction term, leading to a EONIA unit vector). If we consider the second error correction term, we can see that the monetary policy rule is probably well described by a Taylor rule augmented with the exchange rate variation and a strong weight on output but independent from the Euro area monetary policy, even though identifying restriction on industrial production does not allow us to precisely estimate the coefficients of the Taylor rule. Such a relation was found for the Czech Republic and Hungary (ECT2).

Finally, we cannot find a cointegrating relation for Croatia and Romania monetary variables and Euro area policy rates. This is because our model could not manage to identify a cointegrating relation between variables and only modelled a output unit vector (corroborated by the adjustment coefficients that are only significant for the IPI at 5% level). We do not validate this type of modelling for these two countries.

Third interesting result is that the exchange rate variation is never restricted at 5% level from any meaningful cointegrating relation (with low estimated coefficients for the Czech Republic and Poland, much higher for Hungary). Within a closed economy monetary policy rule as in ECT2 for Hungary and the Czech Republic, exchange rates adjust quite largely on the short term (alphas from -0.20 to -0.62), but the adjustment does not come from the same type of long-term relation. The Czech koruna adjusts from a disequilibrium in monetary policy whereas the Hungarian forint is influenced by international transmission of interest rates. Another interesting result is that exchange rate variation is weakly exogenous at 5% for Poland, which is in line with its free floating de facto exchange rate regime. (it is also the case for Croatia and Bulgaria, but as seen above, we don't validate the modelling for these two countries).

## 2.5.2 No breaks model

Estimation results are in Table 2.6. As in the baseline model, no breaks VECMs include a restricted linear trend and an unrestricted constant, thus allowing both stationary and non-stationary series to exhibit trends. For most cointegrating relations though, the inclusion of linear trend is rejected at 5%. Regarding the number of cointegrating vectors, for most countries except Romania and Hungary, Johansen rank test does not reject two cointegrating relations at 5% (instead of three when breaks were included). On the contrary, we cannot reject the null of no cointegrating relation for Croatia. As for the baseline model, we find several unit vectors (four in total), which means the rank test has misidentified the number of cointegrating relations by one. We found four Taylor-type monetary long-term relations; within a closed economy model for Poland and Hungary (ECT2) and within an open economy model for Bulgaria and Romania (ECT2).

Regarding the influence of Euro area monetary policy, first interesting result is that

Euro area policy rate is long-term restricted to zero for the Czech Republic at 5% and Hungarian policy rate as well. We therefore cannot find any Euro area monetary spillover from Euro area to these countries, which strongly differs from our baseline VECM results. On the other hand, we still find a long-term relationship between domestic and Euro area policy rates for Bulgaria ( $\hat{\beta}_{BUL} = 1.16/0.85$ ), and still no influence of Euro area policy rate in the cointegrating relations for Poland. We find some significant but small feedback from domestic monetary cointegrating vectors to the Euro area policy rate (Poland ECT2, Hungary ECT2), as in the baseline model. Overall, the Euro policy rate is weakly exogenous at 5% conditional on long-term parameters of economically-significant cointegrating vectors. Romania results are interesting because since the structural break modelling was rejected in the baseline model, the no breaks VECM is expected to bring better results. Romania second cointegrating vector can be interpreted as a domestic monetary policy augmented with the Euro area policy rate and the exchange rate variation, with a small weight on both and a large weight on domestic inflation (normalized on  $i$ , we find  $\hat{\beta}_e = 0.10$ ,  $\hat{\beta}_{i^*} = 0.42$  and  $\hat{\beta}_{CPI} = 1.20$ ) and a rather slow adjustment of the domestic rate to a long-term disequilibrium ( $\hat{\alpha}_i = 0.059$ )<sup>16</sup>. Regarding the exchange rate inclusion in the long-term relations, no-breaks modelling yields the same results as the structural breaks modelling because exchange rates are not long-term restricted to zero as per baseline VECM. We find the same long-term influence of exchange rate in domestic monetary policy for Hungary (ECT2) as in the baseline model ( $\hat{\beta}_e = 0.23$ ) and very strong adjustment to the error correction term.

### 2.5.3 Inflation model

The inclusion of Euro area inflation rate in our baseline VECM aims at testing whether the Maastricht inflation criterion has played a long-term role in the conduct of monetary policy of CESEE countries. If we first take a look at the number of cointegrating relations now found by the modified Johansen rank test in Appendix 2.C, we see that the inclusion of Euro area inflation rate in the system has reduced the number of cointegrating relations by one for Poland and Hungary. The other countries are not impacted in this respect by the inclusion of Euro area inflation. All estimation results are available in Table 2.7<sup>17</sup>. We have not estimated Romania model because Euro area inflation is stationary for the data sample considered (as shown in Table 2.3). After having initially estimated Bulgaria and Czech Republic VECMs with three cointegrating relations, we have finally re-estimated the VECMs with a rank of two, following rank robustness checks procedure.

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<sup>16</sup>First error correction term is difficult to interpret, since we find unexpected negative signs on  $i^*$  and  $e$ , but quite significant associated alphas for almost all variables.

<sup>17</sup>One can see that five cointegrating vectors out of nine can be considered as unit vectors - all first cointegrating vectors for each country



Table 2.6 – VECM without structural breaks;  $X_t = \{\log IP_t, \Delta CPI_t, i^*, \Delta e_t, i_t, t\}'$

	Czech Republic		Bulgaria		Poland		Romania		Hungary	
Break date 1	1998 M9		2007 M4		1999 M11		2005 M5		1999 M3	
Break date 2	2002 M4		2009:M2		2001 M3		2010 M4		2005 M4	
Lags	2		2		2		1	2	0	
	ECT1	ECT1	ECT2	ECT1	ECT2	ECT1	ECT2	ECT1	ECT2	ECT3
$\beta_{IP}$	1	1	*	1.000	*	1.000	*	1.000	*	*
$\beta_{\Delta CPI}$	-0.074	*	1.00	*	1.000	*	1.000	*	1.000	*
$\beta_{i^*}$	*	0.19	2.549	-0.038	*	-0.044	0.353	*	*	1.000
$\beta_{\Delta e}$	-0.005	-	-	0.0040	0.044	-0.003	0.088	0.018	0.252	0.209
$\beta_i$	0.084	-0.15	-2.987	-0.001	-0.623	-0.006	-0.83	0.006	-1.09	*
$\gamma_{t1}$	*	*	0.038**	-0.007***	*	-0.005***	*	-0.002***	-0.038***	*
$\alpha_{IP}$	-0.019	-0.023*	-0.001	-0.019	0.000	<b>-0.228**</b>	-0.001	<b>-0.32***</b>	-0.004	<b>0.027***</b>
$\alpha_{\Delta CPI}$	<b>1.75**</b>	<b>2.01***</b>	<b>-0.121***</b>	<b>2.22***</b>	<b>-0.059***</b>	2.06	<b>-0.09***</b>	<b>0.659**</b>	0.015	-0.047
$\alpha_{i^*}$	<b>0.543***</b>	<b>0.221*</b>	0.004	<b>0.584***</b>	<b>-0.017*</b>	<b>1.63***</b>	0.001	<b>0.27***</b>	<b>0.05***</b>	<b>-0.073***</b>
$\alpha_{\Delta e}$	-0.84	-	-	<b>-13.63**</b>	0.210	<b>7.82</b>	<b>0.245*</b>	-3.19	<b>-0.632***</b>	<b>0.67*</b>
$\alpha_i$	0.60	0.24	0.006	0.062	<b>0.066***</b>	<b>4.3***</b>	<b>0.059***</b>	0.22	0.02	<b>0.09</b>
$H_l^\gamma(r)$	0.838	0.834	0.004	0.00	0.37	0.000	0.62	0.307	0.018	0.54
$H_0^{\Delta CPI}$	0.00	*	*	*	*	*	*	*	*	*
$H_0^{i^*}$	<b>0.61</b>	0.000	0.000	0.139	<b>0.67</b>	0.000	0.112	*	*	*
$H_0^{\Delta e}$	0.00	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$H_0^i$	0.00	0.000	0.000	0.046	0.000	0.028	0.030	0.45	0.00	0.84
Joint	0.680	0.006		0.043	0.32		0.05	0.018	0.00	0.72

Note: The star \* included in cointegrating relations means parameter has been restricted (either identification or long term restrictions).  $\beta$ s are estimated parameters of the restricted cointegrating vectors (or error correction terms - ECT-), with their associated long-run exclusion tests p-values ( $H_0^{i^*}$ ,  $H_0^{\Delta e}$ ,  $H_0^i$ ).  $\gamma$ s are estimated parameters of the restricted linear trend by subperiod, with their associated joint exclusion tests p-values ( $H_{l,1}^\gamma(r)$ ,  $H_{l,2}^\gamma(r)$ ,  $H_{l,3}^\gamma(r)$ ).  $\alpha$ s are the loading coefficients defining the adjustment speed of the variables to the ECT (if significant, we reject the null of the variable being weakly exogenous conditional to the ECT). \*, \*\*, \*\*\* correspond to significance levels at 10%, 5% and 1% respectively.

Structural break modelling is overall validated, with nevertheless some subperiod restrictions to zero at 5% compared to the baseline model defined in Equation 2.3 (particularly for the Czech Republic). Estimated trends are also lower.

First interesting result is that Euro area inflation is not restricted at 5% from the long-run relationships between domestic variables for the Czech Republic and Bulgaria. Nevertheless, it is long-term fully restricted and weakly exogenous at 5% relative to long-term parameters for Poland and Hungary. Euro area policy rate impact is robust to the inclusion of Euro inflation for Bulgaria only: the variable is not restricted and enters the cointegrating relation ( $\beta_{i*}=0.79$ ). It is restricted on the long-term for Poland, Croatia and has a wrong sign in Hungary<sup>18</sup> cointegrating vectors. Finally, as mentioned above, the modelling of Croatia is highly perturbed by the inclusion of Euro area inflation, since the model ends up modelling a unit vector. We therefore believe that the inclusion of Euro Area inflation rate in the Baseline VECM is not justified for Poland, Croatia and Hungary.

Second interesting result is that we find a long-term relation between Euro area inflation and domestic inflation for the Czech Republic and Bulgaria, in the form of a inflation differential (both in their respective ECT2), with  $\beta_{\Delta CPI*} = -1.52$  and  $-0.78$  respectively<sup>19</sup>. Noticeably in the case of the Czech Republic, the exchange rate variation very strongly adjusts to this long-run equilibrium relation. Finally for Hungary, we find a long-term relationship in the form of a monetary policy rule in ECT2, with a strong weight on domestic inflation as in the no breaks VECM. For Hungary and the Czech Republic, the estimated coefficient on domestic inflation (when normalized over domestic policy rate) verifies the Taylor condition.

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<sup>18</sup>We did not restrict Euro area policy rate due to joint Wald test results

<sup>19</sup>The domestic policy rate is weakly exogenous at 5% for these two error-correction terms.

Table 2.7 – Inflation VECM;  $X_t = \{\log IP_t, \Delta CPI_t, \Delta CPI_t^*, i^*, \Delta e_t, i_t, tE_t\}'$

	Czech Republic		Bulgaria		Poland		Hungary		Croatia
Break dates	1998 M9 2002 M4		2007 M4 2009:M2		1999 M11 2001 M3		1999 M3 2005 M4		2000 M6 2010 M2
Lags	2		2		2		2		2
	ECT1	ECT2	ECT1	ECT2	ECT1	ECT2	ECT1	ECT2	ECT1
$\beta_{IP}$	1	*	1	*	1	*	1	*	1
$\beta_{\Delta CPI}$	*	<b>1.00</b>	*	<b>1.00</b>	*	1.00	*	1.00	0.01
$\beta_{\Delta CPI^*}$	*	<b>-1.24</b>	0.003	<b>-2.344</b>	*	*	*	*	-0.029
$\beta_{i^*}$	-0.05	-0.39	-0.007	2.354	<b>-0.02</b>	0.28	-0.06	*	-0.02
$\beta_{\Delta e}$	0.00	*	-	-	0.00	0.07	0.00	-0.04	0.00
$\beta_i$	-0.01	-0.81	0.022	-2.971	0.000	*	0.00	-1.01	*
t1	*	*	<b>-0.006***</b>	-0.008	<b>0.03***</b>	<b>1.31***</b>	<b>-0.013***</b>	<b>0.07***</b>	*
t2	*	*	*	*	-0.013***	0.11	<b>-0.006***</b>	0.01	<b>-0.003***</b>
t3	-0.003***	<b>-0.022***</b>	-0.0004	<b>0.036**</b>	<b>-0.006***</b>	<b>0.016*</b>	<b>0.000</b>	-0.004	*
$\alpha_{IP}$	-0.023	-0.001	<b>-0.254***</b>	0.0006	-0.04	-0.001	<b>-0.67**</b>	<b>-0.01***</b>	<b>-0.457***</b>
$\alpha_{\Delta CPI}$	<b>2.45***</b>	<b>-0.169***</b>	0.8	<b>-0.139***</b>	<b>2.65***</b>	<b>-0.049**</b>	-0.35	<b>-0.11***</b>	1.06
$\alpha_{\Delta CPI^*}$	<b>1.45***</b>	-0.02	-0.7	<b>0.0411***</b>	<b>1.23***</b>	-0.005	-0.03	<b>0.025***</b>	<b>1.2*</b>
$\alpha_{i^*}$	<b>0.98***</b>	-0.018	0.5	<b>0.019***</b>	<b>1.02***</b>	<b>-0.024***</b>	0.33	<b>0.01**</b>	0.55
$\alpha_{\Delta e}$	-5.7	<b>-0.958***</b>	-	-	<b>-18.3***</b>	-0.104	-1.66	-0.228	<b>6.6*</b>
$\alpha_i$	0.6	-0.02	0.8	0.016	0.81	<b>0.084***</b>	0.18	0.028	<b>7.07***</b>
$H_{i,1}^\gamma(r)$	0.43		0.0001		0		0.00		0.30
$H_{i,2}^\gamma(r)$	0.82		0.0868		0.00		0.00		0.0001
$H_{i,3}^\gamma(r)$	0.000		0.0265		0.00		0.00		0.97
$H_0^{\Delta CPI}$	*	*	*	*	*	*	*	*	0.019
$H_0^{\Delta CPI^*}$	0.51	0	0.019	0	0.26	0.91	0.28	0.67	0
$H_0^{i^*}$	0.015	0.006	0.000	0.000	0.03	0.14	0.00	0.05	0.057
$H_0^{\Delta e}$	0.000	0.749	-	-	0.000	0.00	0.00	0.00	0.10
$H_0^i$	0.000	0.44	0.000	0.000	0.06	0.866	0.000	0.017	0.21
H0 jointes	0.75		NR		i, CPI*=0.72		0.08		0.52

Note: The star \* included in cointegrating relations means parameter has been restricted (either identification or long term restrictions).  $\beta$ s are estimated parameters of the restricted cointegrating vectors (or error correction terms - ECT-), with their associated long-run exclusion tests p-values ( $H_0^{\Delta CPI}$ ,  $H_0^{\Delta CPI^*}$ ,  $H_0^{i^*}$ ,  $H_0^{\Delta e}$ ,  $H_0^i$ ).  $\gamma$ s are estimated parameters of the restricted linear trend by subperiod, with their associated joint exclusion tests p-values ( $H_{i,1}^\gamma(r)$ ,  $H_{i,2}^\gamma(r)$ ,  $H_{i,3}^\gamma(r)$ ).  $\alpha$ s are the loading coefficients defining the adjustment speed of the variables to the ECT (if significant, we reject the null of the variable being weakly exogenous conditional to the ECT). \*, \*\*, \*\*\* correspond to significance levels at 10%, 5% and 1% respectively.

#### 2.5.4 Robustness to ECB quantitative monetary policy

In this robustness analysis, we want to test whether the new types of monetary policies implemented in the Euro area have had an impact on the degree of monetary autonomy for CESEE countries. Instead of using the ECB policy rate EONIA proxy, we use the Euro area Shadow Short Rate (SSR) as a robustness measure of Euro area overall monetary policy stance over our initial time span. We use the SSR estimated by [Krippner \(2015\)](#): this shadow rate accounts for unconventional monetary policies and is not constrained by the Zero Lower Bound (ZLB) imposed by non-arbitrage conditions on nominal policy rates. As shown in Appendix 2.J, the Euro area SSR starts to be negative and to decorrelate from ECB policy rates and EONIA since 2011. From the literature review, we expect lower policy rate transmission, hence more monetary autonomy, since UMP impacts financial variables more than monetary variables.

We use the same VECM modelling framework (breaks in trends both in the cointegrating relations and in variables - Model 2.2) and estimate the baseline model 2.3.

One first interesting result is that the number of cointegrating relations as estimated by the rank test is lower than when we use conventional policy rate. We find indetermination from zero to one cointegrating relation for Croatia; no cointegrating relation for Romania; one cointegrating relation for the Czech Republic and Poland; three cointegrating relations for Bulgaria and Hungary (which are therefore not impacted by the change in the monetary policy variable from this perspective).

Nevertheless, for Croatia, the Czech Republic and Poland, we had to change the VECM modelling and use breaks in levels for variables, instead of trend breaks (by means of excluding the unrestricted deterministic terms  $E_t^i$  from the model). Model 2.2 does not manage to consistently estimate a single cointegrating relation because some non-stationary variables are trend-breaking while others are level-breaking. Most variables end up restricted because the  $E_t^i$  soak up most of the variables' information.

Our main results are as follow. Bulgaria and Hungary long-term monetary relations are robust to the use of Euro area SSR, with the same short-term adjustments. There is a noticeable increase in Euro area spillover for Hungary in ETC3 ( $\hat{\beta}_i^*$  from 0.78 to 3.03), with significant short-term adjustment. This result needs to be investigated further particularly in terms of level, but may reflect the predominance of the dilemma effect for this country over the trilemma (more transmission regardless of the exchange rate regime). Moreover, the exchange rate deviation from the long-term relation is accentuated by the short-term adjustment ( $\hat{\alpha}_i$  estimated at 0.56 instead of being negative), pointing towards a Fear of Floating phenomenon.

Table 2.8 – Shadow Short Rate VECM -  $X_t = \{\log IP_t, \Delta CPI_t, SSR_t, \Delta e_t, i_t, tE_t\}'$

	Bulgaria			Croatia	Czech Republic	Hungary			Poland	
Model	VECM (1) [logIP,CPI,i*,i,tEt]			Level breaks [logIP,CPI,i*,et,i,tEt]	Level breaks [logIP,CPI,i*,et,i,tEt]	VECM (1) [logIP,CPI,i*,et,i,tEt]			Level breaks [logIP,CPI,i*,et,i,tEt]	
Break dates	Endogenous 2007:M4 / 2009:M2			Endogenous 2005:M5 / 2010:M4	Endogenous 1998:M9 / 2002:M4	Endogenous 1999:M3/ 2005:M4			Endogenous 1999:M11 / 2001:M12	
Lags / Nb ECTs	1/3			4/1	2/1	2/3			3/1	
$\beta_{IP}$	1.00	*	*	1.00	1.00	1	*	*	1.00	
$\beta_{\Delta CPI}$	*	1.00	*	0.36	0.29	*	1	*	*	
$\beta_{i^*}$	*	*	1.00	-0.53	*	*	*	1.00	*	
$\beta_{\Delta e}$	-	-	-	0.56	0.17	0.00	0.28	0.24	0.07	
$\beta_i$	0.04	*	-1.13	-0.50	-0.67	*	-0.87	-0.32	-1.52	
$\gamma_{t1}$	<b>-0.01</b>	<b>0.00</b>	0.00	*	*	<b>-0.01</b>	<b>0.00</b>	<b>0.00</b>	*	
$\gamma_{t2}$	<b>0.05</b>	0.04	<b>0.07</b>	*	*	<b>0.165</b>	0.05	0.04	0.02	
$\gamma_{t3}$	-0.01	-0.02	<b>0.05</b>	<b>-0.03***</b>	-0.03	-0.074	<b>0.04</b>	<b>0.04</b>	<b>-0.12***</b>	
$\alpha_{IP}$	<b>-0.267</b>	<b>0.002</b>	0.001	<b>0.01*</b>	<b>0.01</b>	<b>-0.49***</b>	-0.01	<b>0.02</b>	<b>0.00</b>	
$\alpha_{\Delta CPI}$	2.948	<b>-0.138</b>	0.114	0.01	-0.08	-0.85*	<b>-0.10</b>	<b>0.11</b>	-0.01	
$\alpha_{i^*}$	-0.570	<b>0.020</b>	-0.030	<b>0.03*</b>	0.03	-0.14	0.02	<b>-0.04</b>	<b>0.01</b>	
$\alpha_{\Delta e}$	-	-	-	-0.08	<b>-0.54</b>	-4.03	<b>-0.59</b>	<b>0.56</b>	-0.01	
$\alpha_i$	<b>1.280</b>	0.008	<b>0.119</b>	<b>0.185*</b>	0.04	-0.25	0.02	<b>0.10</b>	0.01	
$H_{l,1}^\gamma(r)$		0.00		0.27	0.18		0.00		0.10	
$H_{l,2}^\gamma(r)$		0.04		0.18	0.27		0.00		0.03	
$H_{l,3}^\gamma(r)$		0.00		0.00	0.00		0.00		0.00	
$H_0^{\Delta CPI}$	*	*	*	0.00	0.00	*	*	*	0.77	
$H_0^{i^*}$	*	*	*	0.00	0.18	*	*	*	0.83	
$H_0^{\Delta e}$	-	-	-	0.08	0.11	0.00	0.00	0.00	0.00	
$H_0^i$	0.00	0.72	0.02	0.00	0.00	0.29	0.01	0.08	0.01	
H0 jointe				0.38	0.24	0.25			0.31	

Note: The star \* included in c of the restricted cointegrating  $\gamma$ s are estimated parameters loading coefficients defining the ECT). \*, \*\*, \*\*\* correspond

On the contrary, Euro area SSR is restricted from the long-term cointegrating relation for the Czech Republic, which differs strongly from the conventional monetary policy analysis. We find some form of domestic monetary policy rule, with a strong exchange rate short-term adjustment. Nevertheless, domestic policy rate adjustment is not significant, which casts a doubt on the interpretation of this relation. The Euro area SSR is also long-term restricted for Poland, which is in line with the conventional monetary policy analysis.

Finally, we have estimated the model for Croatia despite the relative rank indetermination. We find a monetary policy rule with large weights on domestic inflation, industrial production and exchange rate variation. Euro area SSR is not restricted but has an unexpected negative sign in the long term relation, which is rather implausible given the de facto stabilized arrangement.

## 2.6 Conclusion and further research

Testing monetary autonomy of CESEE countries in the context of EMU nominal convergence, using multivariate cointegration with structural breaks, has revealed conventional monetary interdependence between the Czech Republic, Bulgaria, Hungary and Romania and the Euro area. These interdependences are rather aligned in terms of amplitude with the exchange rate regime of CESEE countries: the less flexible the exchange rate regime (or the higher the degree of foreign exchange interventions, as for the Czech Republic for instance), the higher the monetary spillover from Euro area to CESEE countries. It may be interpreted as evidence of policy trilemma for these countries. Nevertheless, this spillover is seldom identified as coming from a UIP relationship: this result is interesting and validates the multivariate approach. Hungary is a special case given the large monetary spillover from the Euro area, pointing towards the existence of policy dilemma for this country. One exception lies with Croatia, which maintains a stabilized arrangement with the Euro and for which we have not managed to model any monetary relation with the Euro area, even in a no structural break framework. Finally, Euro area policy rate and inflation are in most cases weakly exogenous conditional on the long-term parameters: they are part of the long-term relations but do not adjust to them.

One of the main difficulties to overcome to proceed with this long-term analysis has been to correctly model the structural breaks inherent to the macroeconomic series of these countries. Structural break modelling has been appropriate for early EU joiners, which are Central and Eastern European countries and Bulgaria. For these countries, we choose to use invariant endogenous structural break dates that relate to main domestic economic or institutional events. On the other hand, structural break modelling is not suited for Croatia and Romania, even though we include one structural break date

linked to the GFC. One important implication for the Czech Republic and Hungary is that without structural break modelling, we don't find significant and large long-run Euro area policy rate spillover effect as we find in the structural breaks model.

In terms of macroeconomic policy recommendation, our results tend to show that the Czech Republic and Romania could lose both the exchange rate and the monetary policy rate instruments probably at a lower cost compared to Poland, since it is the most monetary independent country from CESEE countries. The importance of Euro area inflation pass-through has also been revealed for the Czech Republic and Bulgaria, which also points towards high level of nominal convergence for both countries. In Hungary, Euro area policy rate transmission is driven by the international transmission of interest rates through the exchange rate. We cannot conclude for Croatia on this aspect, apart from the fact that it is likely that country's high level of euroisation, without preliminary monetary integration, accounts for our lack of results.

To complement this research work, further research on monetary integration of CESEE countries using the cointegration framework with structural breaks, should analyze the 2006-2021 period that is characterized by two exogenous structural breaks, which are the GFC in 2008 and the start of the Quantitative Easing monetary policy in the Euro area in 2015. To do so, we plan to estimate CESEE countries' Shadow Short Rates and include some financial variables in the VECM, as identified by the Euro area UMP shock transmission literature. Another route for research is to use monetary conditions indices instead of using two policy instruments in the VECM.

## 2.A [Clemente et al. \(1998\)](#) unit root test

The unit root test tests the null hypothesis of a unit root with possibly one endogenous break in mean, against the alternative of no unit root with two endogenous breaks.

$$\begin{aligned} H0 : y_t &= y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + u_t \\ H1 : y_t &= \mu + d_1 DU_{1t} + d_2 DU_{2t} + e_t \end{aligned} \quad (7)$$

There is a two-step testing procedure for the Additive Outlier case: first estimate an auxiliary regression to get rid of the deterministic component of H1, which is:

$$y_t = \mu + d_1 DU_{1t} + d_2 DU_{2t} + \tilde{y}_t \quad (8)$$

then search for the minimum t-ratio for  $\rho$  being closest to the null hypothesis using the second specification:

$$\tilde{y}_t = \sum_{0 < i < k} \omega_{1t} \delta_1 DTB_{1t-i} + \sum_{0 < i < k} \omega_{2t} \delta_2 DTB_{2t-i} + \rho y_{t-1} + \sum_{0 < i < k} c_i \Delta y_{t-1} + e_t \quad (9)$$

We assess the sensitivity of the [Clemente et al. \(1998\)](#) unit root test in Table 9. We have compared the Additional Outlier (AO) and the Innovative Outlier (IO) methods and two lag truncation methods for the Industrial Production series. It is the only series in levels with policy rates, which allows us to test unit root test robustness to first differenced series as well. For the robustness of the lag truncation method, we use the partial autocorrelation function of the second-differenced series. With L the lag operator, the second-differenced series is calculated as follow:  $(1-L)\Delta X_t = X_t - 2X_{t-1} + X_{t-2}$ .

Main conclusions of the robustness analysis are:

i/ The unit root test on series in levels is robust to any type of innovation model because series display high level of partial autocorrelation. Both models roughly calculate the same endogenous break dates and lags.

ii/ The unit root test with IO model better captures the global endogenous break dates (such as the one related to the GFC) in first-differenced series, even when the number of lags to control series autocorrelation is low (see for instance the results for Romania, Bulgaria and Croatia). This results in the fact that we reject the null hypothesis of the presence of a unit root with possibly one break in mean more often when we use an Innovative Outlier model for first-differenced series.

iii/ The [Perron and Vogelsang \(1992\)](#) lag truncation method is largely robust for the determination of lags if we compare with the lags obtained from the partial autocorrelation analysis on second-differenced series.

iiii/ Finally, we can see the impact of lag parameters in the unit root test results. Critical values for k(t) at 5%= -5.49 ; at 10%= -5.24

NA: Not available because the algorithm cannot be modified precisely for such lag



Table 9 – Robustness of unit root test

Country	Variable	Model	Lag truncation method	Lag truncation	Optimal break point 1	Optimal break point 2	min T-Stat
Poland	IPI	AO	Perron and Vogelsang (1992)	1	2003:M9	2009:M12	-3.71
	IPI	IO	Perron and Vogelsang (1992)	24	2003:M2	2010:M1	-3.57
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	8	1999:M10	2002:M5	-3.49
	$\Delta IPI$	AO	Partial Auto Correlation	6	NA	NA	NA
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	8	2008:M1	2009:M1	-4.11
Czech Republic	IPI	AO	Perron and Vogelsang (1992)	24	2003:M5	2014:M6	-3.21
	IPI	IO	Perron and Vogelsang (1992)	22	2003:M6	2013:M6	-2.58
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	10	2008:M4	2009:M1	-6.19
	$\Delta IPI$	AO	Partial Auto Correlation	1	2008:M4	2009:M11	-16.75
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	10	2008:M5	2008:M12	<b>-7.45</b>
Hungary	IPI	AO	Perron and Vogelsang (1992)	22	1998:M12	2003:M6	-2.63
	IPI	IO	Perron and Vogelsang (1992)	21	1999:M1	2003:M7	-2.74
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	12	2008:M10	2009:M11	-3.38
	$\Delta IPI$	AO	Partial Auto Correlation	9	2008:M10	2009:M11	<b>-8.05</b>
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	12	2008:M11	2009:M12	-3.76
Romania	IPI	AO	Perron and Vogelsang (1992)	12	2006:M6	2012:M4	-2.77
	IPI	IO	Perron and Vogelsang (1992)	22	2005:M6	2010:M7	-2.00
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	9	2008:M8	2009:M1	-4.91
	$\Delta IPI$	AO	Partial Auto Correlation	6	NA	NA	NA
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	9	2008:M8	2008:M12	<b>-7.12</b>
Bulgaria	IPI	AO	Perron and Vogelsang (1992)	5	2004:M12	2008:M7	-2.54
	IPI	IO	Perron and Vogelsang (1992)	7	2002:M2	2010:M1	-3.79
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	11	2008:M7	2009:M3	-4.06
	$\Delta IPI$	AO	Partial Auto Correlation	5	2008:M7	2009:M3	<b>-7.40</b>
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	11	2008:M4	2008:M12	-4.83
Croatia	IPI	AO	Perron and Vogelsang (1992)	4	2003:M11	2010:M7	-2.52
	IPI	IO	Perron and Vogelsang (1992)	23	2002:M5	2011:M5	-3.02
	$\Delta IPI$	AO	Perron and Vogelsang (1992)	9	2000:M11	2008:M3	-5.64
	$\Delta IPI$	AO	Partial Auto Correlation	10	NA	NA	NA
	$\Delta IPI$	IO	Perron and Vogelsang (1992)	7	2000:M12	2008:M12	<b>-8.43</b>

Table 10 – Results of Lee and Strazicich (2003) unit root test

Country	Variable	Lag	Model A - BP1	Model A - BP2	stat	Lag	Model C - BP1	Model C - BP2	stat
Bulgaria 2001:M1	IPI	7	Apr-03	Feb-10	-2.31	7	May-07	Jan-09	-4.83
	CPI	12	Jan-06	Aug-08	-2.36	12	Feb-03	Apr-09	-4.53
	i	8	Jun-09	Sep-09	-3.38	8	Mar-07	Dec-10	-4.79
	e	13	Jun-03	Oct-04	-6.54	13	Apr-04	Sep-05	-9.45
Croatia 1997:M6	IPI	4	May-00	Dec-00	-1.77	9	Mar-00	May-98	-6.87
	CPI	12	Jan-05	Nov-07	-3.24	12	Sep-00	Oct-04	-3.95
	i	5	Apr-00	Sep-00	-3.49	5	Nov-00	Dec-07	-4.68
	e	12	Apr-01	Jun-01	-4.48	12	Dec-00	Jul-02	-6.30
Czech Republic 1996:M1	IPI	11	Nov-97	Aug-02	-3.29	11	Dec-99	Aug-08	-5.67
	CPI	12	Jun-98	Dec-98	-3.06	12	Apr-99	Nov-06	-4.24
	i	11	Apr-99	Jun-99	-3.17	11	Feb-00	Jun-02	-6.35
	e	12	Jul-99	Aug-11	-3.63	12	Aug-02	Dec-04	-4.92
Hungary 1994:M1	IPI	13	Nov-06	Dec-09	-2.88	13	Aug-08	Nov-10	-5.82
	CPI	12	Mar-96	May-98	-3.19	12	Dec-97	Jul-06	-4.34
	i	8	Oct-03	Sep-08	-3.46	8	Jul-96	Apr-03	-5.24
	e	12	Jul-99	May-10	-2.55	12	Jun-96	May-02	-4.67
Poland 1998:M3	IPI	11	Dec-99	Jun-02	-4.71	9	Jun-02	Mar-06	-5.54
	CPI	12	Jul-00	Mar-12	-1.25	12	Mar-02	May-11	-4.89
	i	10	Feb-01	May-01	-1.73	10	Jun-00	Apr-03	-7.15
	e	12	Jul-01	Nov-08	-3.30	12	Mar-02	Sep-04	-4.09
Romania 2003:M1	IPI	10	Feb-08	Jul-10	-2.94	10	Aug-08	Apr-13	-4.58
	CPI	14	Aug-07	Jun-10	-1.26	14	Aug-07	Aug-12	-4.77
	i	4	Jul-05	Jan-08	-3.97	4	Jul-05	Jan-08	-6.82
	e	13	Jul-07	Sep-09	-1.61	13	Sep-04	Jun-08	-4.56

Notes: Critical values for Model A: -4.54 / -3.84 / -3.50 at 1% / 5% / 10% respectively ; Critical values for Model C in Table 2 of article ; Trimming parameter= 10%

Dark grey: rejection of H0 at 1%; Orange: rejection of H0 at 5%; Light grey: Indeterminate because breakpoints are too close (critical values not calculated)

## 2.B Johansen et al. (2000) rank test, alternative tests and rank robustness checks

Johansen et al. (2000) shows that the cointegration rank with structural breaks can be tested by modifying the procedures suggested by Johansen (1995). The statistical analysis is hardly changed but new asymptotic distributions arise, described by response surface analysis. To construct the test statistic, the likelihood function is maximized using canonical correlation methods applied to cointegration analysis by Johansen (1995). Inference is based on squared sample canonical correlations  $\hat{\lambda}_i$  of  $\Delta X_t$  and  $(X'_{t-1}, tE'_t)'$ , corrected for  $\Delta X_{t-i}$ ,  $D_{j,t-i}$  and  $tE_t$ .

The Likelihood Ratio test statistic for the  $H_l(r)$  null hypothesis of at most  $r$  cointegrating relations against a general alternative  $H_l(p)$  has the following form:

$$\text{LR}\{H_l(r)/H_l(p)\} = -T \sum_{i=r+1}^p \log(1 - \hat{\lambda}_i) \quad (10)$$

In order to estimate the rank of  $\alpha\beta'$ , a sequential testing procedure is necessary. The asymptotic distribution of the test only depends on the relative length of the sample periods, not on their ordering. Since no analytical solution is derived, first two moments of the Gamma distribution are approximated by simulation. After the rank is determined, since there are no short-term constraint nor exogenous variables, model estimation is done with Johansen (1995) Reduced Rank Maximum Likelihood procedure. Estimates of  $\beta$  are the  $r$  linear combinations of the data which have the largest empirical correlations with the stationary process  $\Delta X_t$ .

Saikkonen and Lütkepohl (2000) have studied the Johansen et al. (2000) model and show that other tests may be advantageous in terms of local power if there is just a level shift. The modified Johansen test may suffer from a loss of power when using long lag lengths. It has also a tendency for size distortions, with over-rejection of a correct null hypothesis for a small number of observations of Data Generating Processes with one cointegrating relation. Alternative rank tests robust to structural breaks include Trenkler et al. (2008) and Lütkepohl et al. (2004).

The parametric nature of the rank test (i.e. lags used to whiten the residuals during the VECM specification) has to be counterbalanced with the rank robustness checks. We follow the procedure explained in Hendry and Juselius (2001). First, we test several lag lengths for the rank test. Second, the rank test may not discriminate near integrated from stationary processes, so that we can model near integrated variables in the VECM instead of stationary long-run relationships. To avoid this, on top of the rank test results, we need to check the following points in order to correctly determine the cointegration rank of the system (which is done on the unrestricted VECM):

- The t-values of the alpha coefficients: for the  $r^{\text{th}+1}$  cointegrating vector, if they are small (below 3), then there is not much gain in including this vector as a cointegrating relation in the model.
- The recursive graph of the trace statistic: it should increase linearly for the first  $r$  components but stay constant for the remainder.
- The graphs of the cointegrating relations  $\beta'_i X_t$ : if the graphs reveal non-stationary behavior of a cointegration relation, then the rank choice has to be reconsidered or the model specification reassessed.

- The economic interpretability of the results.

## 2.C Johansen modified rank test results

Croatia					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0.0139	<b>0</b>	<b>0.379</b>	0	0.0192
<b>1</b>	<b>0.1407</b>	1	0.698	<b>1</b>	<b>0.168</b>
2	0.5799	2	0.722	2	0.434
3	0.4954	3	0.692	3	0.653
4	0.5441	4	0.540	4	0.607
				5	0.756
<b>Lags</b>	<b>3</b>	Lags	3	Lags	<b>3</b>
Lags AIC	3	Lags AIC	3	Lags AIC	3
Lags HQ	2	Lags HQ	3	Lags HQ	1
Lags SIC	1	Lags SIC	2	Lags SIC	1

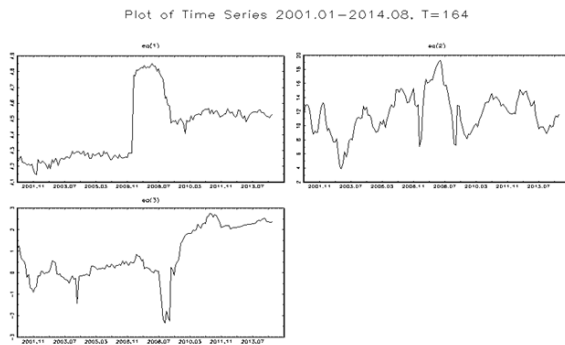
Table 11 – Johansen (2001) modified rank test results - continued

VECM 2.3 [logIP,CPI,i*,et,i,tEt]		VECM 2.4 [logIP,CPI,i*,et,i]		VECM 2.5 [logIP,CPI,CPI*,i*,et,i,tEt]	
<b>Czech Republic</b>					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0.000	0	0.028	0	0.000
1	0.005	<b>1</b>	<b>0.208</b>	1	0.001
2	0.035	2	0.794	2	0.017
<b>3</b>	<b>0.271</b>	3	0.8027	<b>3</b>	<b>0.080</b>
4	0.4806	4	0.9279	4	0.515
				5	0.937
Lags	3	Lags	3	Lags	3
Lags AIC	3	Lags AIC	3	Lags AIC	3
Lags HQ	2	Lags HQ	2	Lags HQ	1
Lags SIC	1	Lags SIC	1	Lags SIC	1
<b>Romania</b>					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0.016	0	0.001	0	0.047
<b>1</b>	<b>0.297</b>	1	0.037	<b>1</b>	<b>0.584</b>
2	0.7896	<b>2</b>	<b>0.3081</b>	2	0.9044
3	0.7518	3	0.3755	3	0.8642
4	0.6759	4	0.3242	4	0.7711
				5	0.6574
Lags	2	Lags	2	Lags	2
Lags AIC	2	Lags AIC	2	Lags AIC	10
Lags HQ	1	Lags HQ	1	Lags HQ	1
Lags SIC	1	Lags SIC	1	Lags SIC	1
<b>Poland</b>					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0.000	0	0.001	0	0
1	0.001	1	0.050	1	0.0008
2	0.046	<b>2</b>	<b>0.052</b>	<b>2</b>	<b>0.0704</b>
<b>3</b>	<b>0.140</b>	3	0.068	3	0.2863
4	0.175	4	0.069	4	0.5576
				5	0.7779
Lags (levels)	3	Lags (levels)	3	Lags (levels)	3
Lags AIC	3	Lags AIC	3	Lags AIC	10
Lags HQ	3	Lags HQ	3	Lags HQ	3
Lags SIC	2	Lags SIC	2	Lags SIC	1
<b>Bulgaria</b>					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0	0	0	0	0
1	0.005	1	0.024	1	0.000
2	0.032	<b>2</b>	<b>0.144</b>	2	0.011
<b>3</b>	<b>0.199</b>	3	0.169	<b>3</b>	<b>0.055</b>
				4	0.199
Lags	3	Lags	3	Lags	3
Lags AIC	3	Lags AIC	3	Lags AIC	3
Lags HQ	2	Lags HQ	2	Lags HQ	1
Lags SIC	1	Lags SIC	2	Lags SIC	1
<b>Hungary</b>					
H0 : r	p-value	H0 : r	p-value	H0 : r	p-value
0	0	0	0	0	0
1	0	1	0.000	1	0.005
2	0.023	2	0.014	<b>2</b>	<b>0.060</b>
<b>3</b>	<b>0.183</b>	<b>3</b>	<b>0.624</b>	3	0.266
4	0.411	4	0.818	4	0.549
				5	0.850
<b>Lags</b>	<b>1</b>	Lags	1	<b>Lags</b>	<b>3</b>
Lags AIC	3	Lags AIC	3	Lags AIC	2
Lags HQ	1	Lags HQ	1	Lags HQ	1
Lags SIC	1	Lags SIC	1	Lags SIC	1

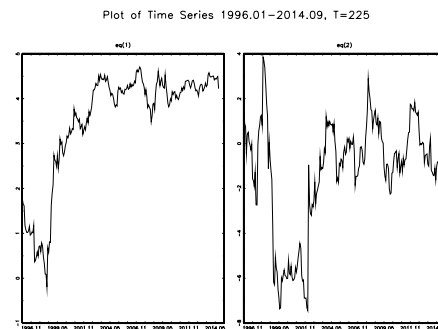
## 2.D Baseline VECM- Error correction terms by country

Figure 9 – Baseline VECM- Error correction terms

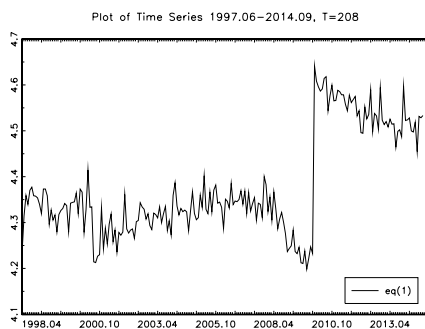
Bulgaria



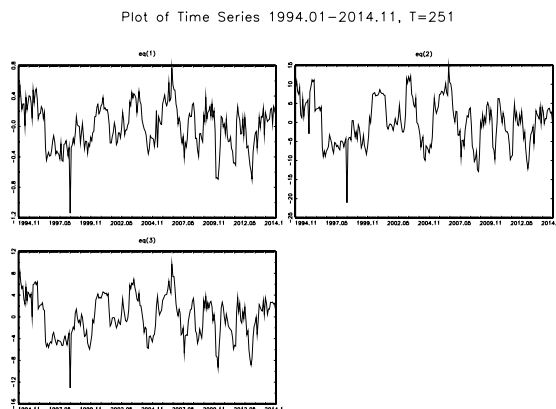
Czech Republic



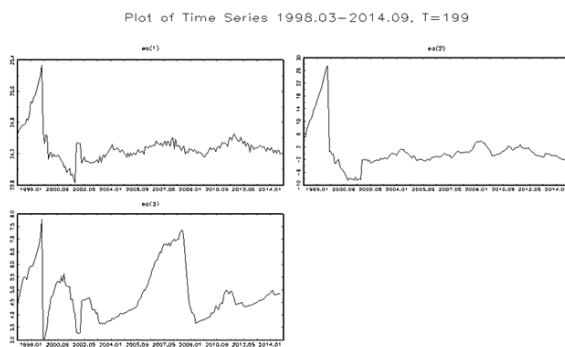
Croatia



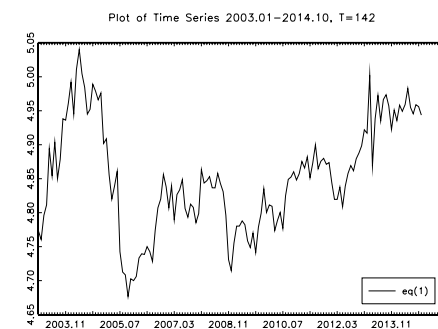
Hungary



Poland



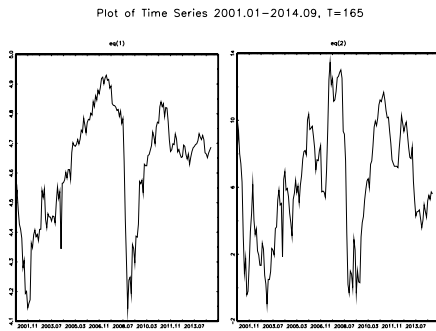
Romania



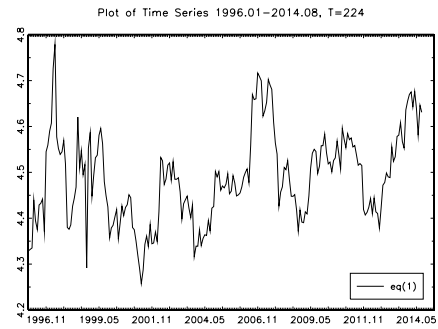
## 2.E No breaks VECM- Error correction terms by country

Figure 10 – No breaks VECM- Error correction terms

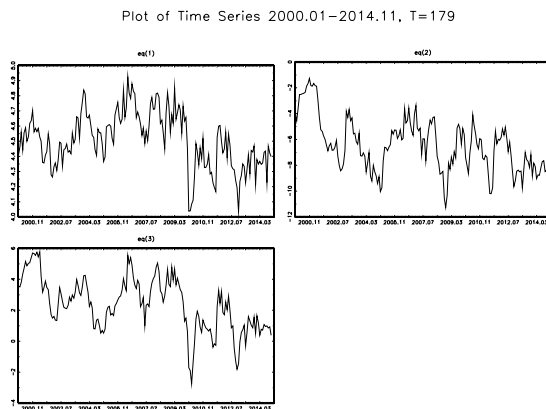
Bulgaria



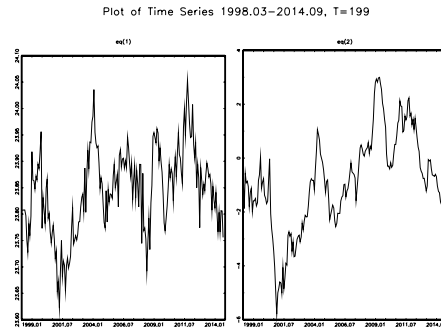
Czech Republic



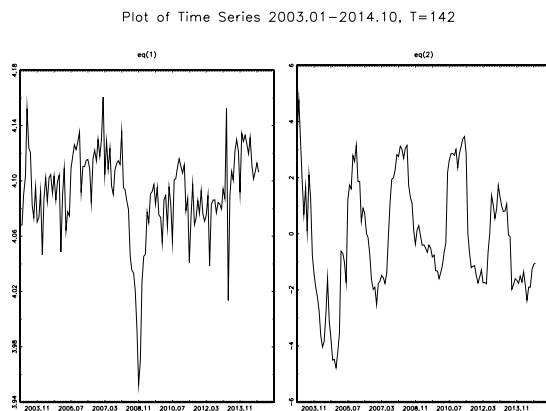
Hungary



Poland



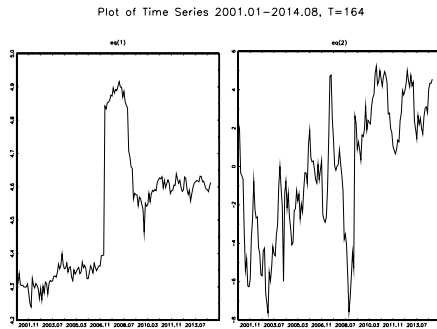
Romania



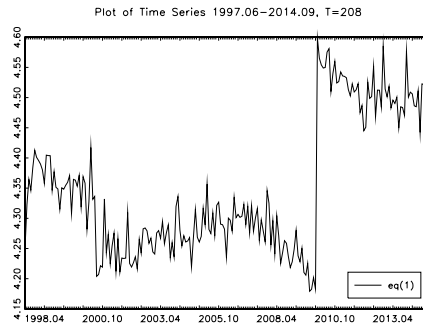
## 2.F Inflation VECM- Error correction terms by country

Figure 11 – Inflation VECM- Error correction terms

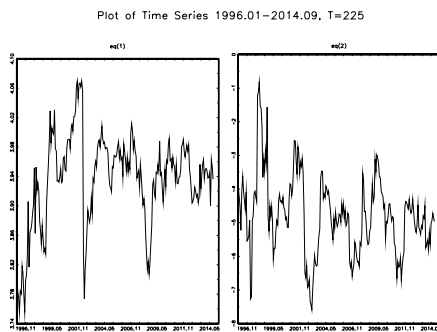
Bulgaria



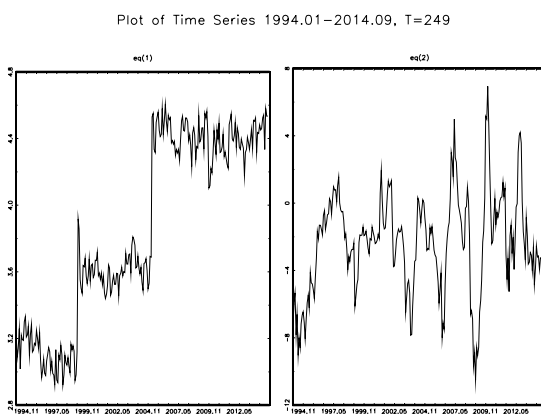
Croatia



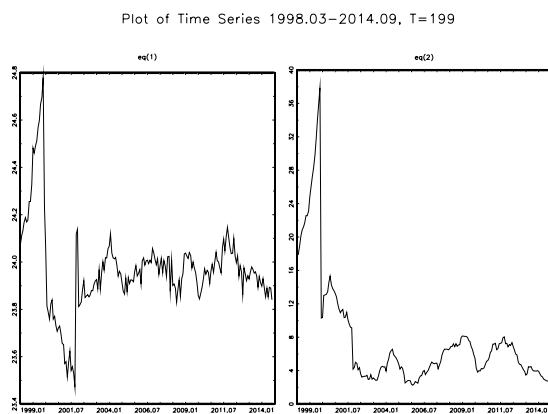
Czech Republic



Hungary



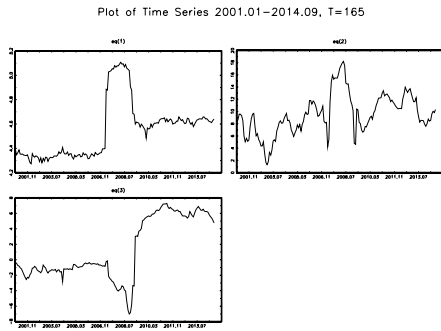
Poland



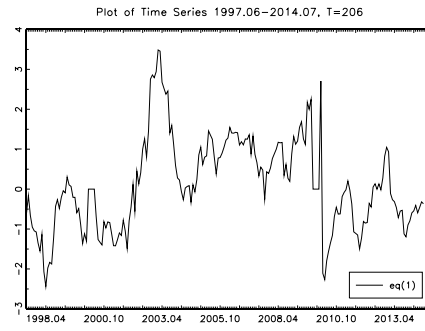
## 2.G Shadow Short Rate VECM- Error correction terms by country

Figure 12 – Shadow Short Rate VECM- Error correction terms

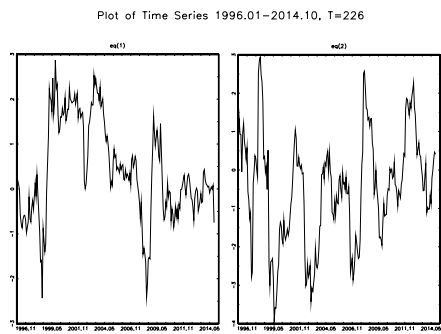
Bulgaria



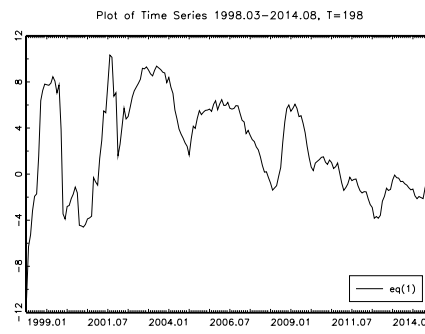
Croatia



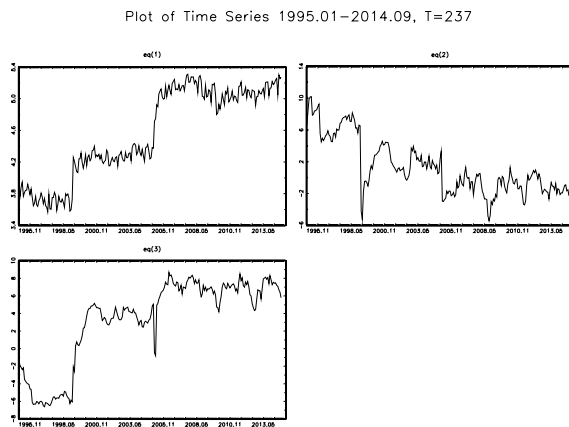
Czech Republic



Poland



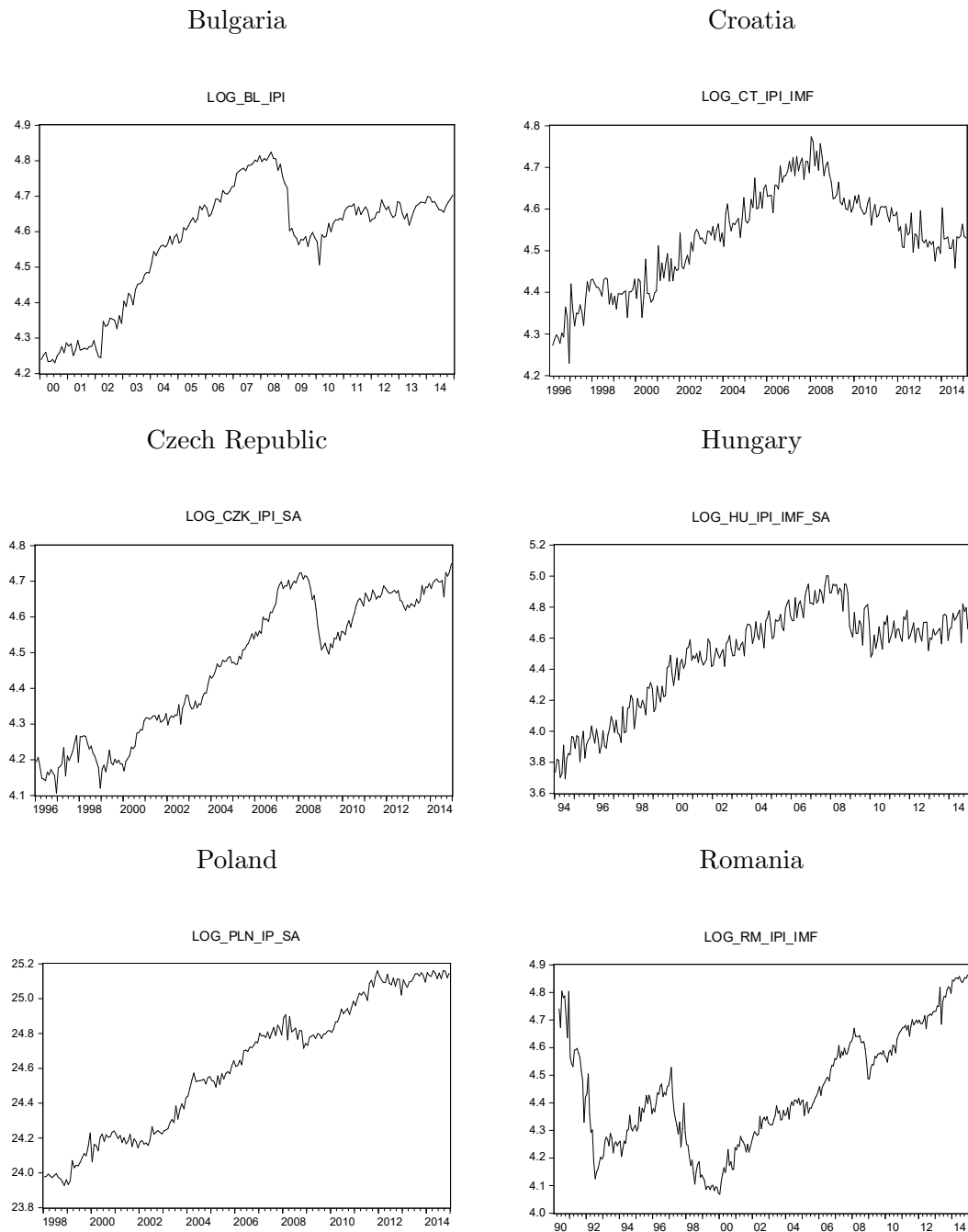
Hungary





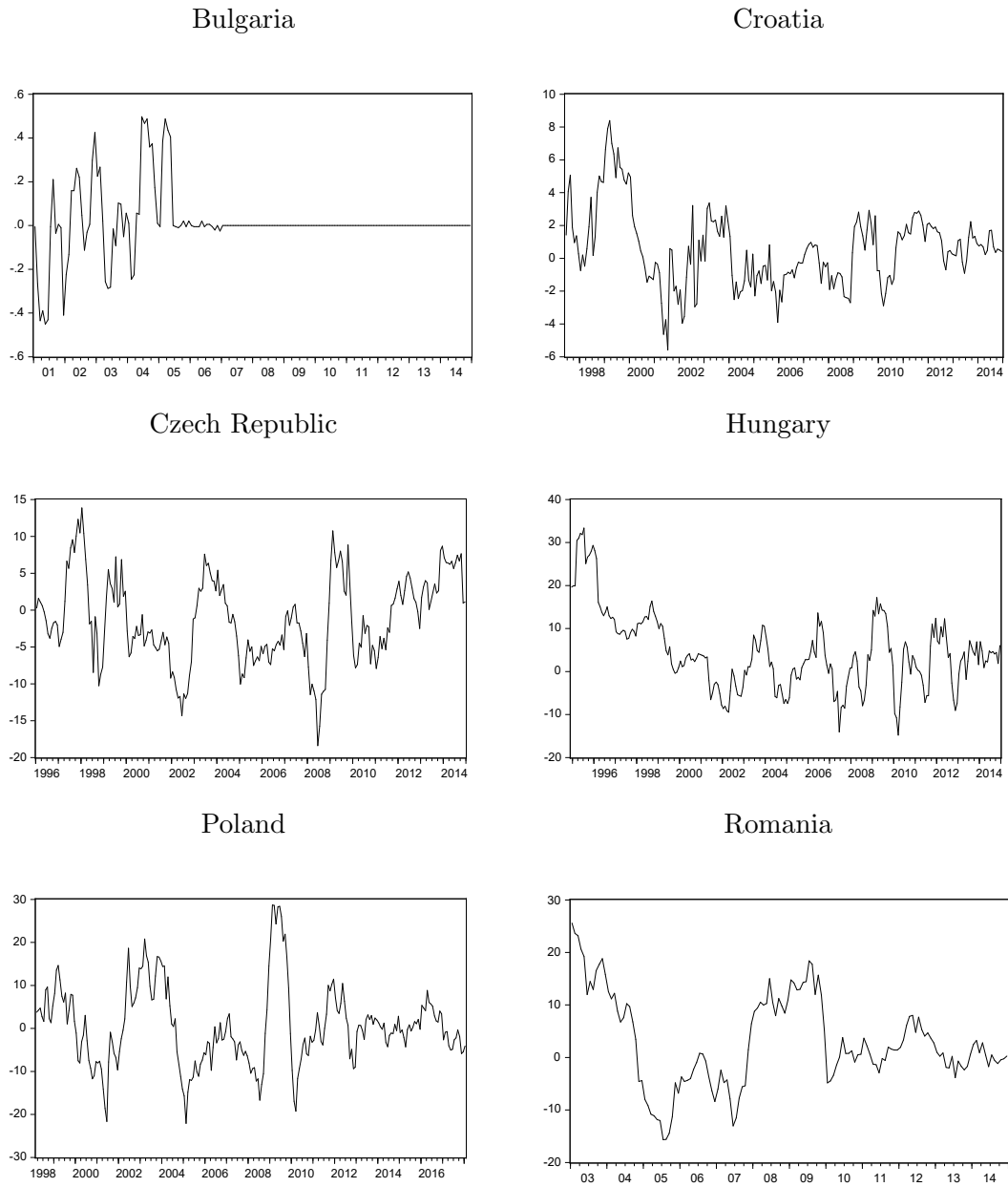
## 2.H Industrial Production series by country after seasonal adjustment and log transformation

Figure 13 – Industrial Production series



## 2.1 Exchange rates annual variation

Figure 14 – Exchange rates annual variation



## 2.J Euro area policy rates, Euro Interbank Offered Rate (EONIA) and Euro area Shadow Short Rate (Krippner, 2015)

Figure 15 – EONIA, Euro area policy and shadow short rates

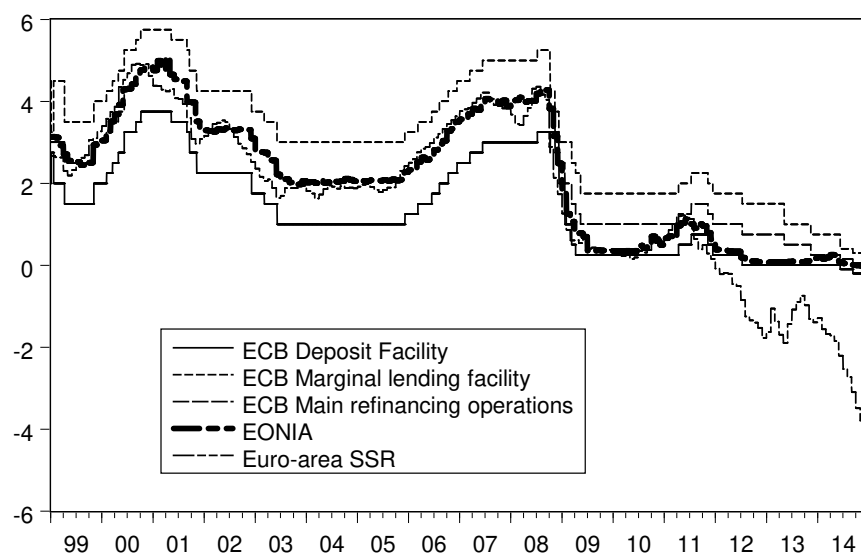


Table 12 – Euro area policy, SSR and interbank rates - Correlation matrix (1999:M1 - 2014:M12)

	ECB DE- POSIT FACIL- ITY	ECB MARGINAL LENDING	ECB_MRO	EONIA	EURO AREA SSR
ECB_DEPOSIT_FACILITY	1.000	0.940	0.978	0.977	0.860
ECB_MARGINAL_LENDING	0.940	1.000	0.988	0.951	0.935
ECB_MRO	0.978	0.988	1.000	0.973	0.920
EONIA	0.977	0.951	0.973	1.000	0.887
EURO_AREA_SSR	0.860	0.935	0.920	0.887	1.000

## Chapitre 3

Unilateral and bilateral risk sharing  
impacts of joining the Banking Union: Do  
individual or common correlated effects  
matter?

### 3.1 Introduction

There has been a long tradition of comparing the Economic and Monetary Union (EMU) with the United States of America (USA), particularly from American economists ([Jonung and Drea, 2010](#)). Initial comparative research has been based on Optimal Currency Area (OCA) criteria ([Mundell, 1961](#); [McKinnon, 1963](#)) and on the role of adjustment mechanisms in case of idiosyncratic demand shocks within a monetary union (labour mobility, wage flexibility, fiscal integration to list a few). Seminal papers include [Bayoumi and Eichengreen \(1992\)](#); [Bayoumi and Prasad \(1997\)](#) and their recent updates<sup>1</sup>.

The Global Financial Crisis (GFC) has revealed flaws in the EMU design and has subsequently revived financial developments of the OCA theory (the so called Mundell II theory, as explained in [Bordo et al. \(2011\)](#)). First strand of literature focuses on asymmetric shock amplification mechanism due to public debt overhang, which can lead to liquidity or sovereign debt crises, such as the Sovereign Debt Crisis (SDC) crisis in 2010-2012 ([Eichengreen, 2014](#); [Mongelli, 2008](#)). Second strand of literature analyses the role of financial integration in providing market-based adjustment mechanisms within a monetary union. This type of insurance from idiosyncratic risk, based on complete and unrestricted capital markets assumptions, is called private risk sharing.

In the post-GFC period for the Euro area, even though some empirical papers follow the traditional OCA approach and analyse the impact of macroeconomic imbalances on the EMU adjustment mechanisms ([Pierluigi and Sondermann, 2018](#)), there has been quite a few articles assessing risk sharing mechanisms and levels within the Euro area ([Ioannou and Schäfer \(2017\)](#) for a literature review), supporting the assumption of untapped risk sharing potential within the monetary union, particularly from credit and capital markets.

Additionally, one strand of literature has pointed out the importance of banking integration and supervision as an adjustment mechanism to sudden stop episodes in a monetary union ([Gros and Alcidi, 2015](#); [Mabbett and Schelkle, 2015](#)). These articles take examples from Euro area periphery Member States (Greece, Ireland, Italy, Portugal, Spain) that were hit by a sudden stop in capital inflows ([Calvo, 2005](#)) in the unfolding of the European SDC. Idiosyncratic sudden stops in capital inflows were rather unexpected in a monetary union and even large current account deficits were run during the 2000s in these countries without triggering first-generation currency crises.

These articles therefore relate to the literature emphasizing the role of gross capital inflows, particularly banking flows, resulting from the change in international investment position of foreign or domestic investors, in the building up of financial vulnerabilities, that can ultimately lead to banking, sovereign debt and Balance-of-Payments (BoP) crises. Where [Calvo \(1998\)](#) defines sudden stops with reference to net inflows (that offset the current account balance), or [Ghosh et al. \(2014\)](#) defines capital flows surges

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<sup>1</sup>This paradigm has been early criticized by [Frankel and Rose \(1998\)](#) that emphasize the endogeneity of OCA criteria, and further challenged by [De Grauwe and Mongelli \(2005\)](#); [Krugman \(1993\)](#).

with reference to net inflows (because net positions are important to assess a country's foreign currency exposure), [Forbes and Warnock \(2012\)](#) define surges, stops, flights and retrenchments, based on actual gross flows instead of current-account based proxies of net flows. [Milesi-Ferretti and Tille \(2011\)](#) also emphasize the importance of gross positions, because financial partners may not be net creditors.

The relevance of banking integration to foster risk sharing and to face financial idiosyncratic shocks seems to matter in the debate to address EMU incompleteness and asymmetries. In this context and as a response to the SDC, the European Commission announced the creation of the European Banking Union (EBU) in September 2012, with the objectives to break the link between Member States and their banks, to restore the credibility of the financial sector, to preserve tax payers' money and to make sure that banks serve society and the real economy. The EBU has four pillars: a Single Rulebook for financial institutions in the Single Market, common Supervision, common Resolution and common Deposit Insurance.

In this paper, we are interested in assessing to which extent the European Banking Union fosters private risk sharing in the European Union and can smooth idiosyncratic shocks (for instance, sudden stops). Specifically to Central, Eastern and South Eastern European countries (CESEE)<sup>2</sup>, our motivation is to analyze the impact of EBU membership on risk sharing, for the following reasons. First, EBU risk sharing impact is not discussed on the literature on EBU early participation, despite the potential for market-based adjustment mechanisms for these financially-integrated countries. Their banking systems are highly integrated with the Euro area and dominated by foreign banks (with 70% of total bank assets owned by Western parent banks). Second, idiosyncratic shocks have quite an impact for CESEE countries ([Huchet-Bourdon and Pentecôte, 2008](#)): it is therefore important from a policy perspective to understand better how much private risk sharing can help smooth these shocks.

Our research question is therefore to identify bilateral and unilateral EBU impact on risk sharing within the EU-25<sup>3</sup> countries. To answer this research question, we analyze international and regional risk sharing within a monetary union, as modelled or identified both in theoretical and empirical literature. We show that the operational pillars of the EBU should first enhance consumption smoothing through several cross-border banking mechanisms, second lower the risk sharing costs of unsmoothed idiosyncratic shocks and third re-balance the public and private channels' contributions to risk sharing. Then, our paper makes three main contributions to the empirical literature: first, we estimate bilateral risk sharing levels between EBU Member States countrypairs (dual membership) and EBU and CESEE countries' countrypairs (unilateral membership). We use a

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<sup>2</sup>Bulgaria, Croatia, the Czech Republic, Hungary, Poland and Roumania.

<sup>3</sup>EU-27 minus Denmark and Sweden

cross-country macroeconomic panel set up, characterized by a large annual time dimension (1978-2018) and by country pairs in the individual dimension (following [Cimadomo et al. \(2020\)](#) in the latter aspect). We perform two types of EBU identification, that account for unobserved heterogeneity with individual fixed effects for the first strategy, and for both heterogeneity and cross-section dependence with common correlated factors for the second strategy. We estimate overall level of risk sharing, conditional on the development of two financial channels : first, the savings channel through credit markets and EBU implementation, and second the international factor income channel, through bond and equity portfolio investments.

Because cross-border banking claims and foreign claims do not play the same role in terms of risk sharing depending on Member States considered, second contribution of this paper is therefore to use both Locational Banking Statistics (LBS) and Consolidated Banking Statistics (CBS) banking data to identify the difference in their respective contributions.

We are also interested in understanding the risk sharing spillover effects of the EBU on CESEE countries. Third contribution of this paper is therefore to estimate overall level of risk shared between the EBU Member States and CESEE countries, and the respective contribution of its international financial components, using a directional setting. We finally compare EBU risk sharing impacts on CESEE countries with those of the Vienna Initiatives, which are joint public and private informal initiatives that avoided systemic banking crises in the CESEE countries in 2008-2009 and in 2012-2013 (discussed in Section 3.4).

Our results are summarized in Figures 3.1, 3.2 and 3.3 and point towards an increasing level of risk sharing over time and a shift from credit to capital markets as positive contributors to bilateral risk sharing either at EU-25, EU-25 excluding CESEE countries or CESEE level.

This article is organized as follows: Section 3.2 defines the international and regional risk sharing frameworks and reviews the complete markets model, the welfare gains from risk sharing, the various risk sharing channels identified in the literature and the links between risk sharing and financial integration. Section 3.3 analyzes risk sharing benefits of EBU, starting from a review of its operational pillars. Section 3.4 discusses the links between CESEE countries and the EBU, together with the Vienna Initiatives. Section 3.5 details our empirical strategy and Section 3.6 discusses our results.

## 3.2 Risk sharing within a monetary union : literature review

Risk sharing has gathered interest in the debate to complete the EMU in the absence of federalism prospects ([Howarth and Quaglia, 2016b](#)). In the current EMU context, risk sharing refers to a cross-country insurance against idiosyncratic income shocks, through

market-based systems or public transnational transfers. But behind this definition lies the international risk sharing theory that has been expanding on strong microeconomic foundations, within general equilibrium models.

### 3.2.1 International consumption risk sharing

As emphasized by [Backus et al. \(1993\)](#) and [Lewis \(1999\)](#), [Scheinkman \(1984\)](#) first developed risk sharing implications, on consumption growth rates, of complete markets equilibrium of Arrow-Debreu economies, where agents can trade contingent claims (insurance contracts): positive consumption correlation with aggregate consumption is predicted. [Lewis \(1996\)](#) develops the risk sharing model, with the social planner's objective of maximizing utility over  $J$  countries, under the hypothesis of separable preferences between tradable goods and leisure<sup>4</sup>. Based on assumption of complete markets, first-order condition with respect to tradables implies that the ratio of current to future marginal utility of tradables consumption is equalized across countries at equilibrium.

Under iso-elasticity form of the utility function, the following risk sharing equation can be derived (using [Kose et al. \(2009\)](#) formalism), with  $E$  the expectations operator,  $\Delta c_{i,t}$  the real per capita consumption growth rate of country  $i$ ,  $C$  the common component (world per capita consumption growth rate),  $Z_{it}$  a vector of individual country factors:

$$E(\Delta c_{i,t} - C_t | Z_{it}) = 0 \quad (3.1)$$

Equation 3.1 shows that under perfect risk sharing assumption, consumption growth rates across countries (corrected for their common component) should be equal and independent from idiosyncratic variables. Finally, we can write the standard specification used in the empirical literature to test the null hypothesis of full risk sharing  $\beta = 0$ , using idiosyncratic output (real per capita growth rate) as the measure for country-specific variable on the right-hand side and  $\epsilon_{it}$  the error term:

$$\Delta c_{i,t} - C_t = \alpha + \beta_t(\Delta y_{i,t} - Y_t) + \epsilon_{it} \quad (3.2)$$

Early empirical applications, coming mainly from the international business cycle literature, have initially tested the null hypothesis of cross-country consumption correlation equality ([Backus et al., 1993](#); [Lewis, 1999](#)): empirical correlations of aggregate consumption fluctuations across countries are found much lower than theory predicts. The "consumption home bias" is a stylized fact and has been a puzzle in international macroeconomics; it has been solved when controlling for capital restrictions ([Lewis, 1999](#)) or for taste shocks in individual countries. Empirical research has later evolved towards testing full risk sharing null hypothesis as in Equation 3.2 ([Kose et al., 2009](#)) or assessing the levels of risk sharing by channel ([Asdrubali et al., 1996](#)), as we develop

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<sup>4</sup>Another contribution is [Cochrane \(1991\)](#) for the consumption insurance regressions, even though author develops a domestic consumption insurance model.



in Subsection 3.2.3.

### 3.2.2 Risk sharing, growth and welfare gains

Two important papers, also based on complete markets and portfolio decision from countries' representative agents, emphasize the growth benefits of international portfolio diversification, more largely financial integration.

[Obstfeld \(1994\)](#) develops a multi-country world economy where international assets can be traded, under isoelastic, Von Neumann-Morgenstern assumption of the expected utility functions. Countries diversify their portfolio between risky and non risky assets (through the use of the mutual-fund theorem) and maximize their intertemporal utilities<sup>5</sup>. From this maximization, in a two-country closed economy setting, he finds that optimal consumption is a constant proportion of wealth and derives a consumption-welfare ratio and a portfolio share, which is the proportion of wealth invested in the risky asset. Portfolio changes from risk-free assets (domestic bonds) to risky (international) assets result in steady-state welfare gains and increased per capita consumption growth, that are explicitly calculated, following the calibration over eight regions, for the 1960-1987 period. Financial integration effects on welfare are also found to be dependent on growth endogeneity assumptions.

[van Wincoop \(1994\)](#) also develops a comprehensive multi-economy model, with each country sharing the same VNM utility function and with several types of preferences tested. Only the risk associated with the national aggregate consumption streams is shared by government on behalf of individuals. After risk-sharing, government is allocated a proportion of the international stochastic consumption that it redistributes back to its agents. This allocation is a share of the optimal mutual fund, as in [Obstfeld \(1994\)](#), chosen as to maximize individuals' utility. He solves for equilibrium prices of a unit of country *i*'s stochastic consumption. He estimates welfare gains from international risk sharing for twenty OECD countries between 1970 and 1988 and finds an average welfare gain of 1.8% across countries<sup>6</sup>. This level is comparable to the total size of American securities market expressed as a proportion of tradables consumption.

### 3.2.3 Identification of risk sharing channels within a monetary union

After the initial focus on international risk sharing, there has been growing interest for interstate and interregional risk sharing models. This literature decomposes risk sharing into various channels, with strong emphasis put on income decomposition. First channel is international or regional factor income (that provides income insurance and operates through capital markets). Second channel is transnational or regional federal

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<sup>5</sup>Country *i*'s representative agent has a relative risk aversion coefficient, an intertemporal substitution elasticity and a rate of time preference.

<sup>6</sup>Welfare gains are defined in the paper as "the permanent relative increase in the expected level of consumption path that would lead to the same welfare improvement as can be achieved through international risk sharing"

transfers (that provides income smoothing and operates through the public transfer system). Third channel is savings adjustment by lending and borrowing, which smoothes consumption and operates through credit markets. [Asdrubali et al. \(1996\)](#) and [Sørensen and Yosha \(1998\)](#) are seminal examples of this methodological shift for the USA and for Europe respectively. Both models draw conclusions in terms of currency area optimality: the USA are an OCA since 75% of idiosyncratic shocks are smoothed, whereas the EMU is not an OCA since 60% of idiosyncratic shocks remain unsmoothed. These two seminal articles close the gap between Optimum Currency Areas and international risk sharing literature.

[Asdrubali et al. \(1996\)](#) study the channels of interstate risk sharing within the USA, during the 1963-1990 period, based on cross-sectional variance decomposition of shocks to Gross State Product (GSP). Their theoretical framework is that of complete markets ([Cochrane, 1991](#)), with GSP the tradable good. They decompose per capita GSP based on National Accounts identities with Equation 3.3 and derive the three aforementioned risk sharing channels: net factor income, net federal transfers and savings. With  $s_i$ ,  $dsi_i$ ,  $c_i$  per capita state i income, disposable state i income, state i consumption:

$$gsp_i = \frac{gsp_i}{s_i} \times \frac{s_i}{dsi_i} \times \frac{dsi_i}{c_i} \times c_i \quad (3.3)$$

Authors find that US federal states smooth 51% of their idiosyncratic risk via income insurance and federal transfers (13% by federal budget and 39% by capital markets), 23% of shocks via credit markets and 25% of idiosyncratic shocks remain unsmoothed. 62% of idiosyncratic risk is therefore shared through market institutions.

[Sørensen and Yosha \(1998\)](#) both develop a unifying theoretical framework and provide estimates of the level of risk sharing within the EMU<sup>7</sup>. Regarding private risk sharing channels, they make the distinction between income insurance (ex-ante mechanism of cross-border ownership of productive assets through capital markets, reflected in factor income) and consumption smoothing (ex-post mechanism of smoothing through credit markets, reflected in the savings channel). Authors assess risk sharing levels in the European Union and in OECD countries, between 1966 and 1990, extending further [Asdrubali et al. \(1996\)](#) methodology by estimating respective risk sharing contributions of factor income flows (from capital and labor), capital depreciation, international transfers and savings<sup>8</sup>. They find that 40% of shocks to GDP are smoothed through the savings channel.

[Kalemli-Ozcan et al. \(2004\)](#) extend these results for both the US and EU Member states by estimating factor income contribution to risk sharing over three subperiods

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<sup>7</sup>The definition of full risk sharing, derived from their aggregated model in which GDP is the tradable good, is that "risk is fully shared among countries if the consumption of a country comoves with world consumption, but does not comove with country specific shocks."

<sup>8</sup>They derive risk sharing channels from the following identities:  $GNP=GDP+\text{net factor income}$ ,  $NI=GNP-\text{capital depreciation}$ ,  $DNI=NI+\text{international transfers}$ ,  $C+G=DNI-\text{net savings}$ .

(1972–82, 1983–92 and 1993–2000): they estimate that the fraction of shocks smoothed through capital markets in the EU has become significant and reaches 10% in average. The proportion of US risk shared through capital markets has kept on increasing to reach 55% during the 1990s.

This type of empirical approach has been extensively used for the US and EU monetary unions (Duwicquet and Farvaque, 2013; European Central Bank, 2017; Hepp and von Hagen, 2011). Specifically for the Euro area, there has been a large policy interest in such framework (Ioannou and Schäfer, 2017), that renews the approach to monetary union incompleteness and is contemporaneous with the Banking Union implementation. In terms of methodology, interesting extensions include dynamic risk sharing (Asdrubali and Kim, 2004; Asdrubali et al., 2018; Poncela et al., 2016), counterfactual risk sharing analysis (Ferrari and Picco, 2014), long term and short term analysis of risk sharing within the Capital Markets Union using cointegration methods (Dufrenot et al., 2020).

### 3.2.4 Risk sharing benefits of a single currency and of financial integration

If identification and estimation of risk sharing channels has become one standard in the risk sharing literature, two other strands of literature are quite related to our research question and assess risk sharing benefits of a single currency on the one hand, and of financial integration on the other hand.

Regarding risk sharing between countries sharing a single currency, several theoretical contributions predict risk sharing benefits. Mundell (1972) emphasizes that credibly fixed exchange rates would enhance international portfolio diversification away from asymmetric shocks. McKinnon (2004) commented this contribution and argues that full international risk sharing is limited by the currency risk embedded in risk sharing instruments available in capital markets (bonds in nominal terms instead of real terms, and on financial intermediaries instead on the ultimate borrower). From a risk sharing perspective, the common currency is therefore much better than any type of common monetary standard based on a key currency. Starting also from Mundell (1972) contribution, Ching and Devereux (2000) formalize the consumption risk sharing benefits of a common currency within a two-country, two-period model. They find substantial additional risk sharing achieved (between 50% to 90%) which depends on the ratio of money to nominal consumption. As regards Emerging Markets countries that cannot trade national currency-denominated bonds, they cannot share risk together and do not benefit from floating exchange rate-linked indirect risk sharing effect. If they form a single currency union, authors find that there is no additional risk sharing from floating exchange rate regime compared to unilateral peg to a third large country.

In contrast with the above, literature on risk sharing benefits of financial integration tries to explain the puzzling lack of international or interregional risk sharing usually found in empirical studies (or at least the lack of consensus over risk sharing estimates),

notwithstanding the fact that most countries have followed a path of financial liberalization over the past decades. Two very recent contributions illustrate this fact for the EMU. Despite the launch of the European Banking Union and the Capital Markets Union in the EU, empirical research in [European Central Bank \(2020b\)](#), using an extended [Asdrubali et al. \(1996\)](#) methodology, finds an overall low risk sharing level of 15% within the EMU (with a 10% contribution from capital markets), rather unstable over time. They point out that the EBU should largely contribute to private risk sharing, mostly from cross-border bank consolidation. In contrast, [Dufrenot et al. \(2020\)](#) investigate the risk sharing impact of Capital Markets Union<sup>9</sup>. Based on long and short-term analysis and using a common factors model, they find a capital markets contribution to risk sharing of 70% over the 2000-2018 period, which is much larger than previous empirical papers.

Two important contributions therefore estimate financial integration impact on consumption risk sharing using specifications based on Equation 3.2, augmented with interaction terms between GDP and a de jure or de facto financial integration measure. [Kalemli-Ozcan and Manganelli \(2008\)](#) investigate the links between banking integration and risk sharing within a monetary union, namely the Euro area. They calculate four measures of bilateral banking integration based on BIS gross banking flows in assets and liabilities (either scaled by population or not). First, they find that on average, consumption risk sharing is 38% across their panel of EU countries over the 1978-2007 period. Second, banking integration increases consumption risk sharing by an additional 17%. [Kose et al. \(2009\)](#) estimate consumption risk sharing benefits of financial integration over two panels of 21 industrial and 58 Developing and Emerging countries, using six different de jure or de facto financial integration indices over both a large 1960-2004 sample and the 1987-2004 globalization period. They find de jure measures are not associated with risk sharing improvement. Moreover, only industrialized countries have risk sharing benefits from their increase in Net Foreign Assets position, and mostly during the globalization period. Finally, for Emerging countries, debt stocks have a 15% dissmoothing impact on consumption risk.

This section has highlighted the main risk sharing channels and benefits in various models. Given the importance of or the potential for market-based (or private) risk sharing channels to weather idiosyncratic output shocks and to complete the EMU, we now turn to the expected risk sharing benefits of the EBU.

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<sup>9</sup>To do so, they refine decomposition of factor income flows, with primary income being the sum of Foreign Direct Investment, Portfolio Investment, Other investment, Other primary income and Compensation of Employees incomes, and further decomposition of savings into households, non-financial corporations and government contributions.

### 3.3 Risk sharing benefits of Banking Union: theory and facts

Since the EBU has been officially launched in 2012, the related literature is recent and has initially focused on its institutional design. Academic research analysed three pillars of the European Banking Union (common Supervision, Resolution and European Deposit Insurance Scheme -EDIS-), often conducted as a comparison with the USA or a fiscal union (Acharya et al., 2012; Alphandéry et al., 2013). This implied less articles (compared to pre-EMU literature in the 1990s), assessing macroeconomic impact of the EBU.

We therefore first focus on the two operational EBU Pillars, which are Common Supervision and Resolution; second, we review their risk sharing effects, more precisely the Supervision Pillar through banking integration and the Resolution pillar through risk sharing reallocation between public and private channels. We finally highlight the smaller risk sharing costs induced by an efficient Banking Union in case of idiosyncratic financial shocks.

#### 3.3.1 Origins and principles of the two operational Pillars

The creation of the European Banking Union in 2012 has followed the Global Financial Crisis and the European Sovereign Debt Crisis, that have both highlighted structural weaknesses in EMU design (Eichengreen, 2014; Pisani-Ferry, 2012).

In terms of supervision, before the EBU, European banking system was an addition of national banking systems, with some internationally-shared prudential rules (through Bank of International Settlements actions and Single Rulebook) but without EU-level formal coordination, with the exception of European System of Central Banks (ESCB).

In terms of resolution, no common bank resolution mechanism existed, which led to notoriously large bank domestic bailouts during the GFC (such as Dexia and Fortis in Belgium, Royal Bank of Scotland and Lloyds in the UK, Icelandic and Irish banks). According to Maurer and Grussenmeyer (2015), the financial needs for government bailouts in the Euro area for the whole period 2008-2013 have been estimated at 5.1% of GDP<sup>10</sup>, with very large cross-country variations<sup>11</sup>. Total bailout costs amounted to EUR 500 billion spent mostly from 2008 to 2010, expressed in terms of 2013 GDP. Another study from the European Commission (2018) estimated that financial assistance<sup>12</sup> provided to EU banks during the 2008-2017 period amounted to EUR 5.12 trillion, which represents 33% of EU 2017 GDP (with EUR 3 trillion guarantees).

With the EBU implementation, several supranational mechanisms or pillars have been created, whose role are to provide common supervisory rules, financial assistance

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<sup>10</sup>Overall intervention costs are split between net acquisitions of financial assets (3.4%) and cumulated deficits (1.7%).

<sup>11</sup>Ireland (37.3%), Greece (24.8%), Slovenia (14.2%), Cyprus (10.5%), Portugal (10.4%), Germany (8.8%), the Netherlands (6.1%), Luxembourg (5.7%), Latvia (5.0%), Spain (4.9%) and Belgium (3.9%).

<sup>12</sup>In the form of recapitalizations, impaired asset measures, guarantees and other liquidity measures.

to distressed financial institutions and eventually to mutualize losses at EBU level instead of bearing the burden at national level<sup>13</sup>.

The Single Supervisory Mechanism (SSM) is the first pillar of European Banking Union, launched in December 2012 and fully operational in November 2014. The European Central Bank (ECB) is responsible for European banking supervision in collaboration with the National Supervisory Authorities (NSA) of each country. Direct ECB supervision concerns 128 banks holding 80% of Euro area banks assets, but ECB can step in and supervise any of the 6000 banks if necessary (Howarth and Quaglia, 2016b).

The Single Resolution Mechanism (SRM) is the second pillar of the European Banking Union. It has been created in July 2014 and is based on both the Single Resolution Board (SRB) and the Single Resolution Fund (SRF) (operational since January 2016). The SRF has been established over a period of eight years and is financed by risk-weighted contributions by banks, with a target of EUR 55 billion in 2024 or 1% of all guaranteed deposits. It aims at providing financial assistance through several tools such as direct recapitalization, but conditional to private sector bail-in of minimum 8% of liabilities and to a maximum contribution of 5% of liabilities.

The EBU Resolution architecture of the EBU operates under the Bank Recovery and Resolution Directive (BRRD), with main objectives being financial stability and the public's interest in triggering resolution. The resolution of a bank occurs when the authorities determine that the bank is Failing Or Likely To Fail (FOLTF). There exists a "No Creditor Worse Off" test to insure no creditor will be worse off in resolution than insolvency. It should be noted that there is no harmonized insolvency regime at EU level, which is a serious impediment for small host countries to join the EBU.

### 3.3.2 Risk sharing impacts of Common Supervision

With the implementation of harmonized prudential standards, common Supervision impacts the whole European banking system functioning and as such is expected to have various impacts on consumption smoothing. Depending on the cross-border banking channels considered, the risk sharing impact may be positive, negative or undetermined by the literature:

- First, cross-border banking integration may have positive or negative consumption smoothing impact, depending on whether interbank or retail banking flows are considered. In a theoretical contribution, Hoffmann et al. (2018) focus on the impact of banking integration nature on risk sharing. They make the distinction between banking direct integration (with real sector borrowing from foreign banks) and indirect integra-

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<sup>13</sup>Even before the EBU, the post-GFC public bailout context led to the creation of the European Financial Stability Facility (EFSF) in May 2010, which provided loan assistance to distressed countries (Ireland, Portugal and Greece, Cyprus). The GFC was followed by the Sovereign Debt Crisis and the creation of the European Stability Mechanism (ESM) that was established in September 2012 as a permanent financing facility to replace the EFSF.

tion (interbank lending). Within a DSGE model, they find that banking integration increases procyclicality of firms' profits in response to idiosyncratic productivity shocks. They also find that real cross-border lending, as opposed to interbank lending, is the only form of integration leading to risk sharing patterns.

- Second, cross-border banking consolidation (through mergers and acquisitions - M&A- ) may have a differentiated risk sharing impact depending whether we consider income insurance or consumption smoothing. For income insurance, the risk-sharing mechanism operates as follows: an increased share of foreign-owned bank sector assets translates into loan portfolio diversification and subsequent insulation of the domestic banking sector from idiosyncratic shocks. There may also have an increase of cross-border lending and borrowing in some recipient countries and a decrease in some others. An empirical contribution from [Demanyuk et al. \(2008\)](#) corroborates these assumptions. They investigate both income and consumption risk sharing impact of cross-border ownership within the EMU and non-EMU EU members, using data on domestic and foreign assets acquired through M&A deals. They find that first, neither domestic or foreign consolidation has systematic effects on consumption risk sharing; second, banking consolidation in the 2000s has been associated with an improvement in income risk sharing within the EMU; third, foreign ownership is associated with income dissmoothing effect for New Member States, in which foreign banking presence is dominant.

Banking consolidation may nevertheless be dictated by regulatory considerations more than regional portfolio diversification. [Fontan et al. \(2019\)](#) take the example of Nordea, a Nordic banking group that was headed from Sweden (not a EBU member). Nordea's managers were seeking to restructure the bank, including via mergers, with the objective to change consolidating supervisory responsibility of the Swedish FSA. By acquiring a license in Finland, they were able to redomicile the company and change from FSA to the SSM as supervisory authority.

- Third, the form of cross-border banking expansion also matters in terms of financial stability and eventually, risk sharing patterns. Cross-border banking expansion through branches fosters local domestic funding model, whereas the reliance on external sources of funding can lead to bank lending channel contraction and liquidity shock contagion to Emerging countries through global banks, as evidenced by [Cetorelli and Goldberg \(2011\)](#)<sup>14</sup>. Before EU implementation and despite the existence of passporting regime, initial EU banking expansion has been through subsidiaries (which are fully owned by parent company, with home country being the regulatory supervisor). Under the EBU, there now exists a specific supervisory regime for significant branches, whose consequence is to foster banking consolidation and avoid regulatory arbitrage. Specifically to the funding model, the Banking Union, with the Single Rulebook and the Single Supervisory

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<sup>14</sup>They describe the bank balance-sheet channels of a international liquidity shock: transmission from parent bank to Emerging countries both through direct cross-border credit and local lending contraction through subsidiaries (because they fund the parent company with intragroup operations) and also a direct transmission from parent bank to domestic bank counterparties through interbank credit contraction.

Mechanism, has taken measures to improve bank Liquidity Coverage Ratio (LCR) and regulatory capital and promotes liquidity management at a group level.

- Finally, the Supervision Pillar should also foster public-private coordination (through common regulator for large EBU banking groups, ECB and NSA coordination within a formal decision-making body and common rules for burden sharing). [Belke and Gros \(2015\)](#) compare the US and the EU adjustment mechanisms to financial crises and emphasize that public-private coordination mechanism is essential because otherwise, cross-border banking can amplify financial crises (shock-propagating mechanism). National supervisors should allow internationally-active banks to maintain their exposure into host countries, while banks should be able to cope with major losses. They also take the example of the Vienna Initiative which helped limiting losses for parent banks in coordination with the IMF.

The informal public/private cooperation experience of the Vienna Initiative (VI) 1 efficiently avoided idiosyncratic financial crises in the CESEE countries. It prevented large banks from deleveraging their liquidity and banking positions in the CESEE countries when the GFC unfolded. This informal policy intervention led to banking lending channel moderation. [Cetorelli and Goldberg \(2011\)](#) estimate the growth rate of consolidated foreign claims<sup>15</sup> in Emerging countries before and after the GFC depending on variables reflecting bank's vulnerability to US dollar funding and the participation of source countries in the VI 1. They find that foreign claims have been significantly and positively impacted by this informal institutional cooperation.

### 3.3.3 Risk sharing reallocation between public and private channels with common Resolution

The implementation of EBU Resolution Pillar constitutes an important change from public, unconditional bailing-out rules that prevailed in the EU before the GFC (with informal coordination), to supranational, conditional bailing-out rules with public-private formal cooperation and bailing-in rules. As opposed to bailing out (by the public sector), bailing in refers to the banking loss absorption by the private sector. Bailing-in rules are a key aspect of the EBU, particularly for small host countries like CESEE countries.

This shift should theoretically have an impact on the allocation of risk sharing within channels. The Resolution Pillar of the EBU has presumably a positive impact on income smoothing through the public channel within the EU, with supranational institutions handling systemic banks bailouts instead of domestic government. Nevertheless, this shift is still difficult to assess because even though there have been several idiosyncratic banking crises since the implementation of the EBU, as of today, the SRF has not bailed out any bank. One exception in the literature, relating to EFSF/ESM mechanisms though, is [Cimadomo et al. \(2020\)](#), in line with [Fratzcher and Imbs \(2007\)](#). They study risk sharing effects of financial integration in the Euro area and particularly

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<sup>15</sup>17 source countries and 94 destination countries.



from financial stability funds established by the Banking Union. They estimate bilateral consumption risk sharing specifications based on the difference between per capita consumption growth between two countries in the same currency area and add EFSF and ESM variables. They find that public financial assistance contributes quite significantly and positively to consumption smoothing in the Euro area. Overall level of risk sharing is around 40% and has increased since the GFC.

Several banks have nevertheless triggered SRB's resolution decisions. Banking resolution took place under the Bank Recovery and Resolution Directive (BRRD), except for Cyprus. As indicated previously, bailing-in rules applied before bailing-out (with losses distributed to all creditors, not only capital holders). Noticeably in Spain and Latvia, these banking crises have not triggered a sudden stop episode if we refer to [Forbes and Warnock \(2020\)](#) crisis database:

- Cyprus (March 2013): it was the first bank bailing-in after the GFC. Restructuring of Cyprus Popular Bank and Bank of Cyprus consisted in bailing-in of unsecured depositors, shareholders and bondholders. Financial assistance was also provided through the EFSF/ESM.
- Bulgaria (June 2014): Bulgaria suffered two bank runs and the fourth largest domestic bank, Corpcom defaulted.
- Spain (2017): After July 2012 recapitalization and restructuring of the banking sector, the ECB declared that Banco Popolare was "Failing Or Likely To Fail" and triggered resolution, that was conducted by Spanish regulator FROB.
- Latvia (August 2019): It was the first post-GFC local bank default. The ECB assessed that AS PNB Banka was "Failing Or Likely To fail" and triggered resolution.

### 3.3.4 Smaller risk sharing costs in case of idiosyncratic financial shocks

Large risk sharing costs can be associated with unsmoothed idiosyncratic financial shocks. [Sørensen et al. \(2014\)](#) for instance assess the risk sharing impact of the Sovereign Debt Crisis on PIIGS<sup>16</sup> countries. Authors found that risk sharing plunged in 2010, after a big 73% smoothing effect in 2008-2009: positive government savings dis-smoothed 38% of GDP shocks, whereas private savings provided 57% of consumption smoothing.

Without supranational framework such as the Banking Union, international banking<sup>17</sup> wholesale activity, resulting from a complex combination of factors<sup>18</sup> can trigger idiosyncratic shocks (such as banking crises or sudden stops of capital inflows), even within a monetary union. This hypothesis is supported by the existence of a bank risk-taking channel of monetary policy in the USA ([Bruno and Shin, 2015a](#)) and the

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<sup>16</sup>Acronym standing for Portugal, Ireland, Italy, Greece and Spain.

<sup>17</sup>A global bank is a bank with active operations in multiple countries. They finance cross-border lending to regional banks ([Bruno and Shin, 2015b](#)).

<sup>18</sup>Global interconnectedness, foreign ownership, centralized funding business models, links to sovereign risk, amongst others.

existence of a bank lending channel in the EU (Cetorelli and Goldberg, 2011)<sup>19</sup>. Hence, the Banking Union as a common supervisor, by fostering the emergence of big European regional banks, operating under the same regulation, with domestic and stable sources of funding, can strengthen EU banking systems and as such limit the occurrence of idiosyncratic financial shocks and act as a shock-absorbing mechanism.

More precisely, cross-border banking integration and consolidation facilitate both global and idiosyncratic financial shocks' smoothing. The comparative case study literature between the EMU Member States and the American States is quite interesting in highlighting that during the GFC, the diversified nature of the US banking system (both local, federal and international banks) facilitated burden sharing (loss absorption between public and private sectors) and has been a key adjustment mechanism for several US States. They also emphasize the role of an integrated banking system, without the vicious circle between banks and sovereign debt, in smoothing the effects of financial crises on local banking systems.

Belke and Gros (2015) highlight the importance of foreign banks for loss absorption, particularly in the Baltic states in Europe and in the USA (the "private" pillar of the banking union). They compare Ireland and Nevada's BoP adjustment to the GFC based on their banking systems. They find that the presence of foreign, i.e. "out-of-state" banks in Nevada provided a very tangible insurance against local financial shocks, even though a large proportion of losses were born at the federal level. At federal level, authors estimate loss absorption from internationally active banks could be twice as the one from official banking union institutions (FDIC and Government-Sponsored Enterprises (GSE)). Goodhart and Lee (2013) compare Arizona, Spain and Latvia and suggest that when local banking system is focused on public debt and local economy, macroeconomic shock impact is amplified, all the more if the State is a member of a monetary union, without independent monetary and exchange rate policies. Belke and Gros (2015) study Latvia vs Nevada, Spain versus Florida adjustments to the GFC. They emphasize the interaction between Member States' government debt and national banks in Europe, as opposed to the USA where interaction between individual States and banks is limited. They conclude that the Banking Union can play a decisive role in the EMU but it has to be cumulative with a minor role of public sector debt.

### 3.4 CESEE countries and the EBU

The case of Central Eastern and South Eastern EU Members is very interesting in this respect because these non-Euro EU members are exceptionally financially integrated with the EU since their banking systems are dominated by foreign banks (70% of all

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<sup>19</sup>They provide empirical evidence that bank balance sheet management model (centralized or decentralized) has an impact on liquidity shock transmission from international to domestic.

bank assets owned by Western parent banks, see [Claessens and Van Horen \(2015\)](#)). Despite this context and the fact that most of CESEE countries are in the final stage of EMU accession (but have not adopted the Euro yet), the cost/benefit ratio has been in favor of opting out the EBU for most CESEE countries. Only Bulgaria and Croatia have applied to the SSM, through "close cooperation" with the ECB (in 2018 and 2019). Nevertheless, as was the case for their European Union membership (for which the effects of potential membership began to materialize since the negotiation talks started), one can assume that EBU effects have already started to materialize as well in the region, at least the ones in relation with Supervision. We first develop main institutional reasons for opting in or out in Subsection 3.4.1. Second, we show in Subsection 3.4.2 that CESEE countries have experienced the benefits of multilateral action before the implementation of the EBU, that managed to prevent systemic banking crises and sudden stops during the GFC. We finally give some insight on how these countries deal with idiosyncratic shocks outside the EBU in Subsection 3.4.3.

### 3.4.1 Opting in or out the European Banking Union

Opting in or out the Banking Union has been an academic debate since 2012 ([Acharya et al., 2012](#); [Darvas and Wolff, 2013](#); [De Haas et al., 2012](#); [Fontan et al., 2019](#); [Hüttl and Schoenmaker, 2016](#)). As explained in [Darvas and Wolff \(2013\)](#); [Fontan et al. \(2019\)](#) amongst others, in terms of banking supervision and resolution, CESEE countries differ from European Banking Union Member States (that are home countries for large European banking groups) because they are small host countries with the following constraints:

- presence of two supervisory authorities with diverging interests (between home country of multinational groups and in the country hosting a subsidiary)
- subsequent complex banking crisis management
- home-host coordination about burden of bank resolution (in bank resolution, the primary responsibility of national authorities is towards domestic tax payers, ignoring cross-border externalities).

Main reasons for opting out can be summarized as follows: CESEE countries lose some regulatory and supervision power and do not capture the main benefit of the EBU, which is the access to bank recapitalization mechanism through the Single Resolution Fund. Moreover, the risk of unilateral ring-fencing measures by national authorities (for instance, limiting intra-group funding) is not circumvented by common supervision. CESEE countries also fear that ECB will devote less attention to the supervision of a small country's financial system than a national supervisor.

Main benefits of participation to Single Supervisory Mechanism for CESEE countries can be summarized as follows. First, it improves the supervision of cross-border banking

groups (no more supervisory arbitrage). Second, host countries get supervisory information on parent banks and can better address international credit booms (otherwise, it is difficult to limit subsidiary lending). Lastly, it avoids possible competitive distortions (for instance, bail in clauses in Danish bank resolution legislation).

All these points have to be put in perspective with some form of banking nationalism that has taken place for several years in Hungary, Poland and Romania (and to a certain extent in the Czech Republic). Noticeably, there has been some re-nationalisation or domestication for formerly foreign-owned banks in recent years ([European Investment Bank, 2019](#); [Mérő and Piroska, 2016](#)). Host countries also resist banking consolidation in the absence of EDIS, which leads to national ring-fencing policies of capital and liquidity.

### 3.4.2 The Vienna Initiatives landmarks

The Vienna Initiatives 1 and 2.0 (initiated in November 2008 until January 2010; and from January 2012 to January 2013, respectively) are examples of international cooperation between EU home and CESEE host countries, that acted as an adjustment mechanism and avoided sudden stop crises in most countries. This new type of cooperation between private sector and public institutions has been called "new multilateralism" by the IMF. Both VIs prevented beggar-thy-neighbor regulatory behavior towards states outside the Euro area ([Biondi and del Barrio Arleo, 2019](#)).

Largely due to the foreign ownership of their banking sectors, risks of massive banking deleveraging materialized in the region during the initial liquidity crisis phase of the GFC. As analyzed by [Pistor \(2012\)](#), the Vienna Initiative 1 has been a solution to a collective action problem for banks. Both public and private sectors (European multinational banking groups, International Financial Institutions<sup>20</sup>, central banks and home country supervisors from Austria, Belgium, France, Germany, Greece, Italy and Sweden) created at the end of 2008 an informal coordination forum to help maintain exposure, adequate liquidity and capital levels in bank foreign subsidiaries. Subsequent roll-over commitment letters were signed by 17 European parent banks for 5 countries (Bosnia-Herzegovina, Hungary, Latvia, Romania, Serbia) for the duration of the ECB/IMF support programmes and a Joint IFI Action Plan was launched in February 2009 that gave liquidity assistance to banking groups.

The Vienna Initiative 2.0 was relaunched in the unfolding of the Sovereign Debt Crisis, in order to avoid negative spillovers from banking supervisory changes in host countries (particularly, the increase of the Core Tier 1 capital requirement by EU, Austrian and Swedish authorities). Following the January 2012 Vienna meeting, a consultation with stakeholders was launched. Five host countries (Bulgaria, Croatia, Czech Republic, Hungary, Poland) and five home countries (Austria, Belgium, France, Italy, Sweden) were visited by an EBRD-IMF team. Consultations led to the adoption of the "Basic Principles for Home-Host Authority Coordination" in March 2012. A second Joint IFI

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<sup>20</sup>IMF, EBRD, EIB and the World Bank Group, the ECB and CEBS.

Action Plan for Growth in Central and Eastern Europe was also launched in November 2012, to counterbalance the cross-border deleveraging process impacts on real economy.

To our knowledge, Vienna Initiatives' impacts on risk sharing at EU level have not been estimated, but several empirical articles have analyzed whether Vienna Initiative 1 has supported lending in CESEE countries and have found a stabilizing impact: [Cetorelli and Goldberg \(2011\)](#) show that foreign claims have been stable by origin countries that have been VI participants. [De Haas et al. \(2012\)](#) show a selection effect in VI banks, that were big banking groups, less capitalized and with higher level of NPLs, that could negatively impact the VI effects. They also find a stabilizing effect of VI 1 by estimating panel specifications on micro-data, with annual gross nominal credit growth in Emerging Europe as dependent variable<sup>21</sup>. They show banks that would finally sign VI commitment letters in 2009 saw a relatively sharp decline in credit growth in 2008 (an additional 9 percentage points). In 2009, compared with non-VI foreign banks, credit growth of foreign banks that were part of the VI was about 10 percentage points higher. [De Haas et al. \(2015\)](#) estimate difference-in-differences regressions to assess VI impact on credit growth during 2009-2011, associated with propensity-score matching procedures to measure the selection bias aforementioned on a sample that includes foreign bank subsidiaries in the five Vienna countries. Their results confirm VI has been successful in moderating the deleveraging process in these countries.

To our knowledge, Vienna Initiative 2 impact on lending has not been formally estimated in the empirical literature. This may be due to the fact that the VI 2 has coincided with orderly credit deleveraging in the region.

Given the effectiveness of Vienna Initiatives in circumventing cross-border banking issues, CESEE countries' participation to the EBU, as is possible for non-Euro EU Members States, may have been perceived as a second best choice, all the more because of effective relationships and cooperation built over time with home countries supervisors—such as Austria and Italy.

### 3.4.3 Dealing with idiosyncratic shocks outside the EBU

The empirical literature is scarce in this respect, particularly on banking crises such as the one undergone by Bulgaria in June 2014<sup>22</sup>.

On the other hand, several articles focus on the difference of adjustment between Euro area members and non-Euro EU members. In this respect, [Mabbett and Schelkle \(2015\)](#) compare GFC adjustment from several EU countries under various exchange rates regimes, namely Hungary, Latvia and Greece. They show that liquidity and sub-

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<sup>21</sup>Larger scope than the 6 CESEE EU members.

<sup>22</sup>It consisted in two bank runs on KTB and Fibank and a default, with total cost of 3 GDP points born by Bulgarian State.

sequent solvency crises were managed quite differently for Greece (liquidity injections from the ECB, that finally turned into macroeconomic imbalances, sudden stops and sovereign debt crisis) and Hungary and Latvia (official external lending and banking cooperation supporting successful stabilization). [Gros and Alcidi \(2015\)](#) compare two groups of EU countries (BELL -Bulgaria, Estonia, Latvia and Lithuania- and GIIPS countries) and find that the GFC adjustment has been much sharper but shorter outside the Euro area, due to three factors: reduced availability of credit, different choices of fiscal policy and the role of foreign banks as loss absorbers.

We now turn to our empirical strategy, that will focus on identifying risk sharing impacts of the EBU, particularly from Common Supervision and its impact on cross-border banking integration, and from policy impact of EBU implementation (as was possibly the case for the Vienna Initiatives).

### 3.5 Empirical strategy

Our empirical strategy aims at first, identifying Banking Union impact on risk sharing at Euro area level ; second, testing whether Banking Union implementation has modified risk sharing at a larger European Union level, by including CESEE countries in our panel; third, comparing EBU impact on risk sharing levels with those of Vienna Initiatives 1 and 2, particularly for CESEE countries.

#### 3.5.1 Choice of bilateral risk sharing model

In line with [Fratzscher and Imbs \(2007\)](#); [Cimadomo et al. \(2020\)](#), we use a bilateral risk sharing model and estimate specifications based on extension of Equation 3.2, that we discuss in Subsection 3.5.6.

Our focus is gross risk sharing level (as opposed to net risk sharing) based on individual units made of two countries that mutualize a proportion of their idiosyncratic risk from country  $i$  to country  $j$  on the one hand, and from country  $j$  to country  $i$  in the other hand. This approach is in line with the growing literature emphasizing the role of gross capital flows (and their subsequent stocks) in the development of financial imbalances, particularly since [Forbes and Warnock \(2012\)](#). Our estimates based on gross positions account for bilateral financial interdependence and assess risk sharing with a high degree of granularity.

This approach has also been motivated by the availability of bilateral macro banking data, that allow direct identification of EBU effects on banking loans' volumes. More structural EBU impacts on banking sector (consolidation, asset detention) materialize over the long run whereas the time dimension of our panel after EBU announcement is only nine years. Moreover, bilateral data (be them banking or portfolio) are reported between all EU Member States, including CESEE countries, over a large time span (since 1977 or 1990), which allows the inclusion of our countries of interest in the analysis.

The use of bilateral data also allows improvement in terms of asymptotic properties of the estimator (efficiency gain), because the number of observations is much larger compared to a standard macroeconomic panel with two dimensions only (time and individual countries).

Finally, we use gross bilateral data that are directional, with two observations by country pair: country  $i$  (origin or home country) having outstanding claims or assets in country  $j$  (destination or host country) and symmetrically, country  $j$  (this time, origin or home country) having outstanding claims or assets in country  $i$  (this time, destination or host country). Hence, we can identify differential impact of Banking Union depending on whether countries considered are origin or destination countries. Bilateral data have several characteristics: they may not be reported by all Euro area/European Union members; bilateral series may have different starting dates and reporting countries may not have relationships with all counterparty countries. These features translate into an unbalanced panel.

### 3.5.2 Variables

To identify Banking Union impact on risk sharing, we use two types of variables: first, institutional bilateral or unilateral dummy variables; second, time-varying bilateral variable relative to consumption smoothing through credit markets. These variables, together with the bilateral variable relative to capital markets, allow to estimate the level of private risk sharing achieved through financial channels, act as controls and allow for indirect identification of EBU impact on other channels (factor income and credit markets). Table 3.1 gives an overview of the main variables described above, while Tables 2.2 in Appendix give an exhaustive view of all variables (definitions, calculations and sources). More precisely:

For the direct EBU channel, we use an institutional bilateral dummy variable, reflecting EBU common membership after the announcement of the European Banking Union creation in 2012. This policy variable dummy is therefore equal to 1 for EBU Members for years equal or after 2012 (*BU\_BILAT*). To differentiate unilateral and bilateral Banking Union institutional effects, following Larch et al. (2018), we also use a unilateral dummy variable, taking the value of 1 if either origin country  $i$  or destination country  $j$  has joined the Banking Union, but not both (*BU\_UNI*). Therefore, both institutional dummies are independent and do not suffer from colinearity issue for interpretation.

To capture unilateral and bilateral effects of the EBU, we interact these dummy variables with the GDP growth differential (*VARIA.GDP*), which is the main explanatory variable for bilateral risk sharing (*INT\_GDP\_BU\_UNI*; *INT\_GDP\_BU\_BILAT*). Given the fact that CESEE countries are the only non-EBU members in our panel and that we can differentiate them as destination/host countries because of the bilateral nature of our data, we are able to test whether the European Banking Union has led to

greater risk sharing from EBU members towards the CESEE countries.

For the credit and capital markets channels, we use bilateral variables on outstanding cross-border banking claims and on portfolio investment. These bilateral variables, also interacted with GDP growth differential variable, directly identify the additional level of private risk sharing achieved through the international factor income and credit market channels (respectively *INT\_GDP\_BANKING* for the interaction between GDP differential and banking claims and *INT\_GDP\_PORTFOLIO* for the interaction between GDP differential and portfolio claims).

In order to compare Banking Union and Vienna Initiatives impact on risk sharing, we use dummy variables to capture country pairs that were Vienna Initiative 1 and Vienna Initiative 2 participants, (*VIENNA\_1*, *VIENNA\_2* and *INT\_GDP\_VIENNA\_1*, *INT\_GDP\_VIENNA\_2* when interacted with GDP differential). Strictly speaking as seen in Section 3.4, Vienna Initiatives have not brought together only home countries but main stakeholders involved in banking in the CESEE region.

Finally, we control for global and regional shocks, because our focus is private risk sharing capacities to absorb idiosyncratic shocks: we use two time dummies, one in 2009 to account for the GFC (systemic banking crisis) and one in 2011 to account for the European debt crisis (*DUM\_GFC* and *DUM\_SOVEREIGN*, respectively). We also control for individual country sudden stop events, based on [Forbes and Warnock \(2012\)](#) and [Forbes and Warnock \(2020\)](#) databases. Finally, we control for individual country systemic banking crises, using [Laeven and Valencia \(2018\)](#). Non-systemic banking crises within the scope of Bank Recovery and Resolution Directive are not included in this database.

### 3.5.3 Data presentation and discussion

Regarding bilateral banking data, we use Locational Banking Statistics (LBS) from the IMF. As highlighted in BIS (2015), LBS give information about geographical breakdown of banks' counterparties, because it follows the locational/residence principle (which is the principle for Balance of Payments). It includes intragroup positions, which means lending to subsidiaries and affiliates. These data capture the evolution of cross-border banking claims to the real and financial sector: nevertheless, they may not reflect the whole activity of foreign banks in CESEE countries. That is why we extend the analysis to the Consolidated Banking Statistics (CBS) also maintained by the IMF that reflect worldwide consolidated positions of internationally-active banks and excludes intragroup positions. CBS are based on the residence country of the ultimate risk borrower. Benchmark measure is foreign claims on a immediate counterparty basis, which are the sum of international claims and local claims in local currency by foreign banks. Banks from 31 countries report to the CBS, whereas LBS gather 45 reporting countries. Our approach is in line with the analysis of [Milesi-Ferretti et al. \(2010\)](#), who make a comparison between the two aforementioned BIS databases. They emphasize the fact



Table 3.1 – Variables overview

Variables	Description	Impact on risk sharing	Data source
<b>Dependent and main explanatory</b>			
Consumption per capita annual growth differential <i>VARIA_CONS</i>	Constant price final consumption per capita annual growth of Country i - Constant price final consumption per capita annual growth of Country j household	Dependent	Penn World Table Version 9.1
GDP per capita annual growth differential <i>VARIA_GDP</i>	Constant price GDP per capita annual growth of Country i - Constant price GDP per capita annual growth of Country j	Main explanatory	Penn World Table Version 9.1
<b>Bilateral variables</b>			
Cross-border outstanding banking claims annual growth rate <i>VARIA_BANKING_LBS</i>	Country i reporting banks' outstanding claims vis-à-vis all sectors in Country j Current USD million; Annual averaging of quarterly raw data; no currency adjustment, annual log return	Positive	BIS Locational Banking Statistics
Banking foreign claims annual growth rate <i>VARIA_BANKING_CBS</i>	Country i reporting banks' foreign claims in Country j Current USD million; Annual averaging of quarterly raw data; no currency adjustment, annual log return	Positive	BIS Consolidated Banking Statistics
Portfolio investment annual growth rate <i>VARIA_PORTFOLIO</i>	Country i's total portfolio assets in Country j Current USD million; Annual; annual log return	Positive	IMF Coordinated Portfolio Investment Survey
<b>Dummy variables</b>			
Banking Union - bilateral <i>BU_BILAT</i>	Policy variable dummy equal to 1 for country pair of EBU members after 2012	Positive	Authors' calculations
Banking Union - unilateral <i>BU_UNI</i>	Policy variable dummy equal to 1 if one country of country pair is part of the EBU after 2012	Positive	Authors' calculations
Vienna Initiative 1 <i>VIENNA_1</i>	Policy variable dummy equal to 1 for country pair of Vienna Initiative 1 participants in 2009	Positive	Authors' calculations
Vienna Initiative 2 <i>VIENNA_2</i>	Policy variable dummy equal to 1 for country pair of Vienna Initiative 2 participants in 2012	Positive	Authors' calculations
<b>Global controls</b>			
Global Financial Crisis <i>DUM_GFC</i>	Global systemic banking crisis dummy in 2008/2009	Negative	Authors' calculations
European Sovereign Debt Crisis <i>DUM_SOVEREIGN</i>	Regional sovereign debt crisis in 2011/2012	Negative	Authors' calculations
<b>Domestic controls</b>			
Systemic banking crisis <i>BANKING_CRISIS</i>	Country i/j systemic banking crisis dummy.	Negative	<a href="#">Laeven and Valencia (2018)</a>
Sudden stop crisis <i>SS_CRISIS</i>	Country i/j sudden stop of capital flows	Negative (less foreign capital)	<a href="#">Forbes and Warnock (2012, 2020)</a>
<b>Interaction variables</b>			
<i>INT_GDP_BANKING_LBS</i>	$VARIA\_GDP * VARIA\_BANKING\_LBS$		Author's calculation
<i>INT_GDP_BANKING_CBS</i>	$VARIA\_GDP * VARIA\_BANKING\_CBS$		Author's calculation
<i>INT_GDP_PORTFOLIO</i>	$VARIA\_GDP * VARIA\_PORTFOLIO$		Author's calculation
<i>INT_GDP_BU_BILAT</i>	$VARIA\_GDP * BU\_BILAT$		Author's calculation
<i>INT_GDP_BU_UNI</i>	$VARIA\_GDP * BU\_UNI$		Author's calculation
<i>INT_GDP_VIENNA1</i>	$VARIA\_GDP * VIENNA1$		Author's calculation
<i>INT_GDP_VIENNA2</i>	$VARIA\_GDP * VIENNA2$		Author's calculation
<i>INT_GDP_EU_exCESEE</i>	$VARIA\_GDP * 1(\text{Country pair} = \text{EU excluding CESEE Members})$		Author's calculation
<i>INT_GDP_CESEE</i>	$VARIA\_GDP * 1(\text{Country pair made of one EU CESEE and one EUexCESEE Member})$		Author's calculation

that LBS underweight European banks' exposure to CESEE countries, because they do not reflect local claims in local currency (report only banks' international positions in CESEE countries)<sup>23</sup>.

In order to extend our LBS panel dataset, we use both outstanding claims from EU reporting countries and outstanding liabilities against all non-reporting EU counterparty countries, that we transform into outstanding claims on non-reporting EU to reporting EU countries. Hence the database captures most EU cross-border banking claims, with the exception of intra-non reporting EU countries claims (for instance, intra-CESEE, intra-Baltic, Baltic-CESEE claims are not captured)<sup>24</sup>. We also use annual averages of quarterly data.

For bilateral portfolio investment positions, we use the Coordinated Portfolio Investment Survey database from the IMF. Annual (or semiannual) data is available for the 2000-2019 period, resulting a smaller dataset compared to LBS. We use "total assets", in current US dollars, which category is comprised of both equity and bond holdings.

We have compared several sources for real GDP data, for the following reasons: real GDP is the main explanatory variable in risk sharing specifications; our panel of countries includes both Euro area (advanced economies) and CESEE (Emerging countries except the Czech Republic) if we refer to IMF classification, which means very different price dynamics between the two groups; our analysis is a long-term one and requires robust data for years in the 1980s and 1990s. We use National Accounts, constant price GDP in constant US Dollars from the revised version of the Penn World Table. Using a common currency such as a constant US dollar or Purchase-Power-Parity (PPP) are corrections for exchange rate or tradeable/nontradable goods price difference movements, which both allow country aggregations and international comparison<sup>25</sup>. The Penn World Table (used in its earlier version [Lewis \(1996\)](#)) provides a series of Real GDP at constant 2011 national prices, in 2011 US dollars. Data length is quite interesting (starting in 1950 for developed countries), even though we do not have updates for 2018 and 2019.

Discrepancies between IMF and World Bank's constant price GDP series for CESEE countries in early years of our analysis prevented us from using either series (see illustrating graphs for Bulgaria in Annex 3.C, which had a large currency crisis in 1997, which led to a currency board for the Lev). Moreover, World Bank World Development Index GDP series usually start in 1990 for CESEE countries, whereas IMF series start in 1980.

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<sup>23</sup>See [McGuire and von Peter \(2016\)](#) for more details.

<sup>24</sup>Claims between country pairs based on BGR, CZE, HUN, HRV, POL, ROU, SWE, EU Special cases -DNK (opt out), GBR (Brexit)- CYP, Slovenia, Malta, Slovakia, Latvia, Estonia, Lituania).

<sup>25</sup>Since we do not aggregate countries and mainly use first-differenced (growth) series, we could have used constant Local Currency Unit (LCU) series, as is standardly reported by both IMF in the calculation of the real GDP series of the IMF World Economic Outlook database and the World Bank for their GDP growth indicator.

### 3.5.4 Panel dataset

For the Locational Banking Statistics dataset, the individual dimension  $N$  comprises 406 country pairs, based on 17 origin countries (11 Euro area reporting countries -EU joiners before 2004 except Portugal- and the 6 CESEE countries) and 25 counterparty countries (EU-27 excluding Denmark and Sweden). Time dimension starts from 1978 to 2018, with annual data: average number of observations per group is 31 for banking claims and 16 for portfolio investment. Our panel dataset is unbalanced, with maximum number of common pooled observations being 8946, and minimum being 6068. If we use the 1990-2018 period, maximum number of observations is 7672. Descriptive statistics for the 1990-2018 sample are in Table 22.

For the Consolidated Banking Statistics dataset, the individual dimension  $N$  comprises 228 country pairs, based on 11 origin countries (11 Euro area reporting countries -EU joiners before 2004- except Luxemburg) and 25 counterparty countries (EU-27 excluding Denmark and Sweden). Time dimension starts from 1984 to 2019, with annual data: average number of observations per group is 24 for foreign claims. Our panel dataset is unbalanced, with a maximum number of common pooled observations of 4440.

### 3.5.5 Data transformation and unit root testing

We first calculate output and consumption per capita real series by dividing constant 2011 US dollars series with population of the relevant year. We then take natural logarithm of per capita real series, banking and portfolio claims (both in current USD) to insure second-order stationarity of the series. It is all the more important because we use both macroeconomic and financial data, which do not have the same levels of variance.

We perform unit root testing of these transformed series in levels, using [Pesaran \(2003\)](#) panel unit root test, which is a second generation test robust to cross-sectional dependence. More precisely, we test real consumption and GDP differentials by country pair; banking and portfolios claims by country pair (level and first difference to confirm integration order of our series of interest). It is an extension of the ADF test, so two tests are performed (with constant and trend and with constant only). We cannot perform the test on an unbalanced dataset with gaps; moreover, a sufficient number of observations in the individual dimension has to be reached to insure consistency of the test statistic. We therefore had to restrict some groups. In some cases, we could not even manage to calculate the test statistics; nevertheless, given the results we obtain on Portfolio Investment variable, we are quite confident that first-differencing our variables has solved the panel unit root issue for estimation.

We also include the results of cross-sectional independence test for the variables of

interest in the first and second columns (CD test of Pesaran (2004) and p-values). All results are in Table 21.

### 3.5.6 Double identification with individual fixed effects and multifactor error models

We perform two types of EBU identification. The first identification strategy captures unobserved individual heterogeneity with fixed effects (after rejecting the individual random effects model). We have performed a Hausman (1978) specification test that is robust to cross-section error dependence (described in Annex 3.A) and we reject the null hypothesis of individual random effects at 5% for our specification. On the one hand, this strategy allows us to add and interpret observed bilateral and individual control variables (be them time-varying variables or dummies as we develop in Subsection 3.5.2). On the other hand, the setting only partially controls unobserved heterogeneity because there is no modelling of common unobserved heterogeneity. However, it is quite important for large<sup>26</sup> macroeconomic panels to model such common shocks, because it allows to deal with error dependence between panel units. It is all the more the case because sample countries are part of the EMU and most of them share the same currency, which means they are presumably hit by the same global shocks, even though they do not respond homogeneously. Therefore, a second cross-independence specification test on residuals from the fixed effects model rejected the null and led us to consider a multifactor residual model as a second identification strategy.

Regarding the fixed effects model, building from Equation 3.1, our bilateral specification has the following form (for each countrypair  $ij$ , made of origin country  $i$  and destination country  $j$ , and time  $t$ ):

$$\begin{aligned} \Delta c_{i,t} - \Delta c_{j,t} = & \alpha_{ij} + \mu_t + \beta_0(\Delta y_{i,t} - \Delta y_{j,t}) + \theta_0(\Delta y_{i,t} - \Delta y_{j,t})G_{ij}D_t \\ & + \theta_1(\Delta y_{i,t} - \Delta y_{j,t})(1 - G_{ij}D_t) + \gamma'(\Delta x_{ij,t}) + \beta'(\Delta x_{ij,t})(\Delta y_{i,t} - \Delta y_{j,t}) + \delta'Z_{i,t} + \omega'O_{j,t} + \epsilon_{ij,t} \end{aligned} \quad (3.4)$$

In line with theoretical models developed in Section 3.2 and with small letters denoting variables taken as logs,  $\Delta c_{i,t} - \Delta c_{j,t}$  is the real household consumption growth differential between origin country  $i$  and destination country  $j$ ,  $\Delta y_{i,t} - \Delta y_{j,t}$  is the real GDP growth differential between same country pair.  $G_{ij}D_t$  is the dummy variable capturing the EBU impact<sup>27</sup>.  $(1 - G_{ij})D_t$  is the dummy variable capturing the unilateral impact of the EBU.  $\Delta x_{ij,t}$  is a  $k$ -dimensional vector of financial bilateral variables taken in their log differences, included both in interaction with the GDP differential between origin country  $i$  and destination country  $j$  to estimate the impact of financial integration on risk sharing<sup>28</sup> and as control variables, with  $\beta$  and  $\gamma$  their  $k$ -dimensional parameter

<sup>26</sup>Time dimension  $T$  is fixed or tends to infinity, individual dimension  $N$  tends to infinity.

<sup>27</sup>It is the product of the post EBU implementation period time dummy  $D_t$  and the EBU dual membership dummy  $G_{ij}$ . More details are given on these dummy variables in the next subsection.

<sup>28</sup>We have tested several measures, either in log difference ( $\Delta \log X_{ij,t}$ ) or as dispersion from their two

vectors.  $Z_{i,t}$  and  $O_{j,t}$  are two vectors of country i and country j individual controls, with  $\delta$  and  $\omega$  their respective vectors of parameters.  $\epsilon_{ij,t}$  are the disturbances of the process, independently and identically distributed (iid), with zero mean and constant variance.  $1 - \sum_{l=0}^k \beta_l$  reflects the level of total risk sharing achieved within our panel, with  $\beta$  the k-dimensional vector of parameters of financial integration's indirect effects on risk sharing. Our time-invariant countrypair fixed effects  $\alpha_{ij}$  account for unobserved heterogeneity between a pair of countries. At economic level, this heterogeneity has to do with historical (war, sibling countries) and cultural (religion, language) links between countries, together with geographical distance. Time fixed effects  $\mu_t$  joint null hypothesis is tested with a Wald test and is rejected at all standard significance levels.

Regarding the multifactor error model, our specification has the following form (for each country pair ij made of origin country i and destination country j, time t,  $X_{ij,t}$  the vector of explanatory variables):

$$\Delta c_{i,t} - \Delta c_{j,t} = \alpha + X_{ij,t} \beta_{ij} + \epsilon_{ij,t} \quad (3.5)$$

$$\epsilon_{ij,t} = \lambda'_{ij} f_t + u_{ij,t} \quad (3.6)$$

$$X_{ij,t} = A'_{ij} d_t + \Lambda'_{ij} f_t + e_{ij,t} \quad (3.7)$$

$$X_{ij,t} = \{ \Delta y_{i,t} - \Delta y_{j,t}, (\Delta y_{i,t} - \Delta y_{j,t}) G_{ij} D_t, (\Delta y_{i,t} - \Delta y_{j,t}) (1 - G_{ij} D_t), (\Delta y_{i,t} - \Delta y_{j,t}) \}' \quad (3.8)$$

Unobserved heterogeneity is not captured anymore by fixed individual and time effects in Equations 3.5, 3.6 and 3.7. It is captured by heterogeneous slope coefficients  $\beta_{ij}$  and a m-dimensional vector of unobserved common factors  $f_t$  that are part of the error terms of the individual processes  $\epsilon_{ij,t}$  (Equation 3.6) and of individual-specific variables  $X_{ij,t}$  (Equation 3.7; vector of variables in 3.8). Since idiosyncratic shocks and individual-specific regressors are cross-sectionally dependent through the common factors, the model relaxes the independence hypothesis between variables and errors. In Equation 3.6, for each country pair ij, unobserved common factors vector is multiplied by a m-dimensional vector of heterogeneous factor loadings  $\lambda_{ij}$ , which capture time-variant heterogeneity across sections.  $u_{ij,t}$  are the idiosyncratic errors, identically and independently distributed, with zero mean and constant variance.  $e_{ij,t}$  are the specific components of  $X_{ij,t}$  distributed independently from the common effects and across i.

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year-average (results available on demand). Lower risk sharing may be linked with financial integration instability, hence the interest of using dispersion measure.

### 3.5.7 Estimators

Estimators for linear panel regressions are in practice corrected to deal with error heteroscedasticity and autocorrelation (in the time dimension) and with intra-group, "within" correlation (corrected by means of error clustering).<sup>29</sup> In our case, we have bilateral data where individuals are country pairs, which implies by construction correlation between individuals, called cross-sectional dependence. Even in panel data with a standard individual (not bilateral) dimension, spatial dependence or common factors of errors may be observed when cross-sections samples are not random, which is typically the case for macroeconomic panels like ours. We test the null hypothesis of cross-sectional independence with [Pesaran \(2004\)](#) test, suited for our unbalanced panel. Performed on our fixed effects specification, we reject the null hypothesis of cross-section independence on any standard level of significance, meaning that regression residuals are cross-sectionally dependent.

To estimate the fixed effects model, we therefore use the Within estimator with [Driscoll and Kraay \(1998\)](#) standard errors and covariance matrix correction which is robust to very general forms of cross-sectional and temporal dependence. The error structure is assumed to be heteroscedastic, autocorrelated up to four lags and possibly correlated between country pairs. It is an extension of the non-parametric Newey-West heteroscedasticity and autocorrelation standard errors correction, that is robust to spatial dependence. Driscoll and Kraay estimator is suited for panels where time dimension  $T > 20-25$ , whereas there is no limitation on the individual dimension  $N$ . [Vogelsang \(2012\)](#) highlights that this covariance estimator may not be consistent in the presence of time fixed effects.

To estimate the multifactor residual model, we use the Common Correlated Effects-Mean Group (CCEMG) estimator from [Pesaran \(2006\)](#) that deals with unobserved common factors between individuals<sup>30</sup>. Equation 3.5 is augmented with cross-section averages of endogenous and exogenous variables (Equations 3.9 and 3.10) that are approximations for unobserved common factors. The estimation procedure is based on Ordinary Least Squares applied to this augmented auxiliary regression. Firstly, individual slope coefficients  $\hat{\beta}_{ij}$  of the processes are estimated by OLS; then the CCEMG estimator is estimated as the average of the individual CCE estimators (Equation 3.10). With same notations as previously:

$$Y_{ij,t} = \alpha + \beta'_{ij} X_{ij,t} + \delta_t \overline{Y_{ij,t}} + \kappa_t \overline{X_{ij,t}} + \epsilon_{ij,t} \quad (3.9)$$

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<sup>29</sup>See [White \(1980\)](#) for correction of standard error heteroscedasticity; [Newey and West \(1986\)](#) for autocorrelation and heteroscedasticity correction; [Arellano \(1987\)](#) for panel cluster-robust standard errors.

<sup>30</sup>We use Stata functions `xtscc` developed by [Hoechle \(2007\)](#) and `xtdcce2` developed by [Ditzen \(2018\)](#) for the Driscoll and Kray within estimator and CCEMG estimator, respectively.

$$\overline{Y_{ij,t}} = \frac{1}{N} \sum_{ij=1}^N Y_{ij,t}; \quad \overline{X_{ij,t}} = \frac{1}{N} \sum_{ij=1}^N X_{ij,t}; \quad \hat{\beta}_{CCEMG} = \frac{1}{N} \sum_{ij=1}^N \hat{\beta}_{ij} \quad (3.10)$$

Colinearity issues may specifically arise from the cross-section averages, which impact the choice of matrix inversion methodology for estimator calculation. If case  $XX'$  matrix is not full rank, the generalized inverse matrix is used. We do not have colinearity issue of individual or interaction regressors (as indicated by Variance Inflation Factor analysis in Annex 3.B for Equations 1 and 2 from Table 3.2). Furthermore, we do not include interaction terms based on Banking Union dummy variables as cross-section average regressors, to avoid colinearity at individual level.

### 3.6 Bilateral and unilateral risk sharing impact of joining the Banking Union: empirical findings

In this section we provide four sets of results. First, we analyze consumption risk sharing on a panel comprised of twenty-five European Union countries that are both origin and destination countries. Second, we provide a directional risk sharing analysis on CESEE countries (based on bilateral links with eleven reporting European Union Member States). Third, we do a sensitivity analysis of these two first sets of results to first, the exclusion of the Communism period from our data sample (1978-1989) and second, the inclusion of Austria as reporting country because it is a very important financial partner for CESEE countries. Our fourth set of results analyzes consumption risk sharing based on Consolidated Banking Statistics (CBS) data.

Before commenting the results, some general remarks can be made :

- [Pesaran \(2015\)](#) cross-sectional weak dependence test is performed on residuals as a specification test. In most equations, we do not reject the null hypothesis of cross-sectional weak dependence of residuals at standard 5% significance level, which means the addition of cross-section averages has effectively solved the cross-sectional dependence issue.

- Our specifications are parsimonious in terms of variables included in order to keep the CCEMG estimator consistent (particularly when we include the portfolio investment variable or use CBS data).

#### 3.6.1 Risk sharing analysis with financial integration within the EU

In this subsection, we first analyze consumption risk sharing levels over the 1979-2018 period, decomposed over the savings channel by using the Locational Banking Statistics cross-border banking claims. We embrace a very long period of the European Union

construction, with average time dimension of 32 years. Given our specifications, to have a minimum degree of freedom for the CCEMG estimator, around one third of all countrypairs are excluded from the panel sample (from 406 countrypairs to 265). Austria, Spain and Italy are partially excluded as reporting countries, because they have started to report their positions to the BIS in 2007 for Austria and in 2014 for Italy and Spain.

On this panel comprised of 265 countrypairs, Table 3.2 gives the following results based on the CCEMG estimation:

- Equation 1 estimates show a significant average unallocated risk sharing level of 37%. We also find positive, large and significant bilateral effect of cross-border banking to risk sharing (increasing risk sharing by 18 percentage points in average). Both estimates are robust to various cross-section averages (Table 3.18). Hence, we find an average 55% consumption risk sharing over the 1979-2018 period for countries with bilateral credit linkages.

- Equation 2 identifies two group effects over the full period: first, we estimate the average idiosyncratic risk level shared between countrypairs of European Union countries excluding CESEE countries (*INT\_GDP\_EUexCESEE*) and countrypairs made of one EU Member and one CESEE country (*INT\_GDP\_CESEE*). EU excluding CESEE members' countrypairs significantly share 57% of risk while "mixed" countrypairs significantly and negatively contribute to total risk sharing by almost 21 percentage points. If we add the risk sharing contribution of credit markets integration, we find a 75% risk sharing level between EU excluding CESEE Member States. This result is in line with the overall risk sharing level of 65% estimated in [Dufrenot et al. \(2020\)](#), with a CCEMG cointegration methodology and over the 2000-2014 period on a sample of 13 Euro area countries, with savings channel accounting for 40% to 60% of risk shared. [Cimadomo et al. \(2020\)](#), with bilateral risk sharing specifications over the 2001-2017 period, finds an overall risk sharing level of 45%, with an insignificant impact of cross-border banking on risk sharing. Second, we estimate the EBU participation additional effect by group: we find a floor impact of EBU on risk sharing since 2012. More precisely, bilateral membership does not significantly contribute to overall risk sharing, but unilateral membership negatively contributes to risk sharing by 5 percentage points. We have tested the null of parameter equality on both groups' effects and we reject the null at 5% for both.

- Equation 3 estimates the Vienna Initiative 1 impact on average risk shared between VI participants: we do not find a significant impact of Vienna Initiative 1 on average risk shared between VI participants. This result may reflect the fact Italy and Austria are excluded from the panel as reporting countries, whereas they are two of the seven home countries (amongst Belgium, France, Germany, Italy, Greece, Sweden, Austria) participating in Vienna Initiative 1. Equation 6 is a robustness estimate of VI1 impact with a more parsimonious specification allowing to include Austria in the panel (with number of individuals equal to 309): no significant impact is found neither.



- Equation 4 allows to compare the Vienna Initiative 2 impact on average risk sharing : as for the EBU negative unilateral impact found in Equation 3, Vienna Initiative 2 also has a significant negative impact on average risk sharing between participant Member States of 6 percentage points. We test the null of parameter equality between EBU unilateral effect and VI2 in Equation 5 and we do not reject the null at standard significance level, meaning that effects of both are indistinguishable.

Table 3.2 – EU-25: Risk sharing impacts of European Banking Union, credit markets integration and Vienna Initiatives (1979-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIA_GDP	0.635*** (30.86)		0.637*** (30.82)	0.637*** (32.10)	0.626*** (31.96)	0.681*** (16.95)
INT_GDP_BANKING_LBS	-0.177*** (-3.76)	-0.177*** (-3.76)	-0.200*** (-4.11)	-0.185*** (-3.81)	-0.179*** (-4.03)	-0.174 (-1.36)
INT_GDP_BU_UNI	0.0528*** (2.63)	0.0528*** (2.63)	0.0529*** (2.62)		0.0540*** (2.70)	
INT_GDP_BU_BILAT	0.00945 (0.38)	0.00945 (0.38)	0.00915 (0.36)	0.0113 (0.44)		
INT_GDP_EUexCESEE		0.427*** (17.09)				
INT_GDP_CESEE		0.208*** (9.57)				
INT_GDP_VIENNA1			-0.0255 (-1.58)	-0.0174 (-1.07)		-0.0692 (-0.89)
INT_GDP_VIENNA2				0.0635** (2.04)	0.0349 (1.29)	
VARIA_BANKING_LBS	-0.00137 (-1.10)	-0.00137 (-1.10)	-0.00136 (-1.09)	-0.00128 (-1.03)	-0.00197 (-1.62)	0.00342 (0.96)
Constant	0.000515 (0.90)	0.000515 (0.90)	0.000509 (0.89)	0.000461 (0.80)	0.000348 (0.60)	-0.000444 (-0.51)
Observations	7843	7843	7843	7843	7843	8284
Nb groups	265	265	265	265	265	309
Average T dim	32.48	32.48	32.48	32.48	32.48	31.28
Nb MG regressors	1590	1855	1855	1855	1590	1545
R <sup>2</sup>	0.398	0.398	0.397	0.407	0.408	0.402
CD stat	-1.806	-1.806	-1.997	-1.979	-2.007	-1.869
CD p-value	0.0709	0.0709	0.0458	0.0478	0.0447	0.0616

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression. Nb MG regressors: number of variables in Mean Group regression.

Average T dim: average number of observations per group in regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals. CD p-value: p-value of CD test.

As a second step, we analyze the indirect impact of EBU on risk sharing through banking integration in Table 3.3, for which we find some evidence. Results from Equation 1 and 2 show that indirect impact of EBU on outstanding cross-border banking claims (modelled through an interaction variable either unilateral or bilateral - *INT\_GDP\_BUUNI\_BANKING*, *INT\_GDP\_BUBILAT\_BANKING*), is not significant at 5%. When we restrict the cross-border banking growth control variable in Equation 3 (that was insignificant), we can include both interaction variables and get a better correction of cross-section dependence as indicated by the CD test p-value (0.11 versus 0.05). In this case, there is a negative risk sharing impact of not being a EBU Member through banking integration (by 13 percentage points), significant at 10%. If we exclude interaction terms accounting for EBU direct risk sharing impact in Equation 4, this effect is not significant anymore.

Table 3.3 – EU-25: EBU risk sharing impact through banking integration (1979-2018)

	(1)	(2)	(3)	(4)
VARIA_GDP	0.658*** (28.06)	0.631*** (29.08)	0.697*** (41.23)	0.647*** (33.97)
VARIA_BANKING_LBS	-0.00146 (-0.86)	-0.00179 (-1.38)		-0.00196 (-1.53)
INT_GDP_BANKING_LBS	-0.163*** (-3.26)	-0.185*** (-3.70)	-0.158*** (-3.71)	-0.190*** (-3.88)
INT_GDP_BU_BILAT	0.0374 (0.70)	0.00945 (0.38)	-0.0424* (-1.67)	
INT_GDP_BU_UNI	0.0528*** (2.63)	0.0762*** (2.61)	0.00207 (0.10)	
INT_GDP_BUBILAT_BANKING	-0.234 (-1.39)		-0.111 (-0.92)	-0.119 (-0.94)
INT_GDP_BUUNI_BANKING		-0.0217 (-0.35)	0.137* (1.73)	0.0107 (0.20)
Constant	0.000395 (0.55)	0.000450 (0.75)	0.000628 (1.30)	0.000208 (0.35)
Observations	7843	7843	7843	7854
Nb groups	265	265	265	266
Average T dim	32.48	32.48	32.48	32.45
Nb MG regressors	1855	1855	1855	1596
R <sup>2</sup>	0.391	0.392	0.391	0.405
CD stat	-1.634	-1.906	-1.577	-1.456
CD p-value	0.102	0.0567	0.115	0.145

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

As a third step, we turn to consumption risk sharing specification in Table 3.4, with the addition of portfolio investment both as a control and an interaction variable with GDP. The latter identifies the impact of capital markets integration on consumption risk sharing, but it mechanically decreases the average time dimension of our panel because

data series start in 2001. This has implications in terms of estimator consistency in some cases (hence the need for parsimony). We therefore choose to restrict control variables, because they are not significant at 5% and their inclusion translates into a loss of 56 groups (as shown in Equation 1). On the same country sample as in Tables 3.2 and 3.3, Equations 2 and 3 show that on the 2002-2018 period, unallocated average risk sharing level stands between 50 and 56%. Equation 3 shows that consumption risk sharing benefits from portfolio investment, capital markets integration (+17 additional percentage points), but this effect is counterbalanced by a negative risk sharing impact of EBU bilateral membership (minus 11 percentage points). Nevertheless, contrary to capital markets integration, the Banking Union impact is sensitive to the countries sample (Equation 4).

Table 3.4 – EU-25: Risk sharing impacts of European Banking Union and financial channels -credit and capital markets- (2002-2018)

	(1)	(2)	(3)	(4)
VARIA.GDP	0.456*** (10.40)	0.501*** (11.69)	0.434*** (13.84)	0.497*** (17.29)
INT.GDP_BANKING_LBS	-0.132 (-0.90)	-0.105 (-1.18)	0.0268 (0.26)	0.0456 (0.63)
INT.GDP_PORTFOLIO	0.122 (0.84)	-0.111 (-0.87)	-0.172** (-2.18)	-0.239*** (-4.08)
INT.GDP_BU_UNI		-0.0343 (-0.98)		0.0132 (0.67)
INT.GDP_BU_BILAT			0.116*** (2.65)	0.0322 (0.79)
VARIA.BANKING_LBS	-0.00866** (-2.06)			
VARIA.PORTFOLIO	0.00331 (1.06)			
Constant	-0.00322* (-1.96)	0.00119 (1.51)	0.00107 (1.16)	0.00103 (1.18)
Observations	3311	3895	3895	3495
Nb groups	212	268	268	228
Average T dim	15.66	14.89	14.89	15.45
Nb MG regressors	1272	1340	1340	1368
R <sup>2</sup>	0.176	0.266	0.243	0.253
CD stat	1.092	1.060	0.579	-0.810
CD p-value	0.275	0.289	0.563	0.418

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

If we now turn to the two-way fixed effects model in Tables 3.5 and 3.6 (with the exception of Equation 3 for which we exclude time fixed effects to only include controls for the Global Financial Crisis and the Sovereign Debt Crisis), there is no residual group unobserved heterogeneity to identify EBU with group and time dummies. EBU countrypairs share the same level of risk as mixed countrypairs (27 percentage points versus 31 percentages points in Equation 2; we do not reject the null hypothesis of parameter equality -p-value=0.62). We also conducted tests for parameter equality be-

tween unilateral and bilateral BU effects on risk sharing in all four first equations in Table 3.5 and we do not reject the equality hypothesis at any significant level. We also do not find any significant risk sharing contribution of the credit and capital markets integration, even though we use the full time and individual dimensions of the panel (8565 observations for 401 groups). We therefore question the unobserved heterogeneity modelling with individual fixed effects, all the more since cross-sectional independence test on residuals is rejected. We keep the common factors model for the next subsections.

Table 3.5 – Two-way fixed effects model - Within estimator DK standard errors correction

	(1)	(2)	(3)	(4)
VARIA_GDP	0.718*** (16.30)		0.718*** (16.40)	0.751*** (13.29)
INT_GDP_EUexCESEE		0.737*** (11.59)		
INT_GDP_CESEE		0.697*** (14.08)		
INT_GDP_BU_UNI	-0.338*** (-2.93)	-0.320** (-2.47)	-0.338*** (-2.94)	-0.395*** (-2.98)
INT_GDP_BU_BILAT	-0.419*** (-3.64)	-0.436*** (-3.80)	-0.419*** (-3.64)	-0.453*** (-3.52)
INT_GDP_BANKING_LBS	-0.0164 (-1.22)	-0.0161 (-1.25)	-0.0155 (-1.17)	-0.0120 (-0.87)
INT_GDP_PORTFOLIO				-0.00581 (-0.43)
DUM_GFC			0.00163*** (4.49)	
DUM_SOVEREIGN			0.000226 (0.71)	
varia_banking	-0.00109 (-1.39)	-0.00113 (-1.56)	-0.00103 (-1.36)	-0.000493 (-0.58)
VARIA_PORTFOLIO				0.000403 (0.86)
Constant	0.000696 (1.61)	0.000776* (1.69)	-0.000422* (-1.79)	0.000866 (1.28)
Observations	8565	8565	8565	4335
Nb groups	401	401	401	377

Table 3.6 – Two-way fixed effects model - Within estimator with DK standard errors correction - Idiosyncratic and global shocks controls

	(1)	(2)	(3)	(4)
varia_gdp_log_return	0.730*** (15.98)		0.731*** (16.07)	0.767*** (13.88)
INT_GDP_EBU		0.755*** (12.53)		
INT_GDP_EUexEBU		0.704*** (14.75)		
INT_GDP_BU_UNLLN	-0.357*** (-3.31)	-0.333*** (-2.78)	-0.357*** (-3.32)	-0.417*** (-3.42)
INT_GDP_BU_BILAT_LN	-0.434*** (-3.84)	-0.455*** (-4.10)	-0.434*** (-3.83)	-0.466*** (-3.76)
INT_GDP_BANKING_LN	-0.0159 (-1.18)	-0.0154 (-1.23)	-0.0154 (-1.14)	-0.0159 (-1.05)
INT_GDP_PORTFOLIO				-0.0152 (-1.20)
SS_Forbes_O	0.00826*** (3.73)	0.00832*** (3.79)	0.00752*** (3.44)	0.00878** (2.53)
SS_Forbes_D	-0.00551*** (-2.75)	-0.00552*** (-2.84)	-0.00599*** (-2.97)	-0.00664** (-2.67)
banking_crisis_dum_o	0.000683 (0.18)	0.000647 (0.17)	0.000892 (0.24)	0.00477 (1.33)
banking_crisis_dum_d	-0.000340 (-0.09)	-0.000229 (-0.07)	-0.000156 (-0.04)	-0.00446 (-0.90)
DUM_GFC			0.000329 (0.63)	0.000604 (0.94)
DUM_SOVEREIGN			0.000119 (0.37)	0.000356 (0.46)
Observations	8456	8456	8456	4335
Nb groups	401	401	401	377

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.6.2 Risk sharing between CESEE countries and EBU Member States

We estimate panel regressions on a subset of the initial dataset because we exclude all EU-19 countries as destination countries. The number of groups considered is therefore much lower (in average, 50), with nevertheless the same average time dimension (31 years in the risk sharing model with credit markets and EBU only, 15 when we include portfolio investments) as in the previous subsection results. In terms of countries, Spain, Italy and Austria are excluded as origin countries because of too few observations in the time dimension; some countrypairs with one country being Greece or the Netherlands are also partially excluded. This subset allows us to perform a directional risk sharing analysis, depending on whether CESEE countries are origin or destination countries (O and D in result tables, respectively)<sup>31</sup>. As in Subsection 3.6.1, we use all variables for the cross-section averages for estimations on the LBS dataset and we restrict insignificant control variables at 5% when estimating regressions on the LBS/CPIS dataset.

- In terms of total risk sharing level on the 1979-2018 period (i.e. shared between all countries, without subgroup effects, in Table 3.7), we find an average of 31% and 45% of risk shared when CESEE countries are origin and destination countries, respectively. These levels are lower than the average 55% level of risk sharing found in the previous subsection's risk sharing model ("EU-25" model).

- In terms of total risk sharing level on the 2002-2018 period (i.e. shared between all countries, without subgroup effects, in Table 3.8) we find an average of 40% and 56% of risk shared when CESEE countries are origin and destination countries, respectively. This level is still lower than the average 63% level of risk sharing found in the EU-25 risk-sharing model, but CESEE countries are closing the risk sharing gap by 10 percentage points. On both periods, we can conclude that there is an average 15 percentage points difference in risk shared if we consider bilateral flows between EU-25 and between EBU Member States and CESEE countries only.

- In terms of risk sharing allocation through channels in these two tables, first striking result is that cross-border banking growth impact on risk sharing is not significant at any standard level (despite credit growth control) which is a difference compared to our EU-25 risk sharing model conclusions. On the contrary, we find a robust portfolio investment growth impact on risk sharing, but only when CESEE countries are destination countries. When CESEE countries are origin countries, risk sharing does not operate through this channel as well. When CESEE countries are destination countries, we find a risk sharing operating channel through the EBU, even though identification in Equation 2, Table 3.7 is likely to be a structural break. Average risk shared from CESEE countries to EBU Members is significantly and positively impacted by 20 percentage points by the implementation of the European Banking Union.

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<sup>31</sup>This analysis has been made possible by the initial extension of the database, by transformation of the outstanding liabilities in outstanding claims as explained in Section 3.5.3.

Table 3.7 – CESEE-6: EBU, banking integration and Vienna Initiatives risk sharing directional impacts (1978-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIA_GDP	0.539*** (4.28)	0.762*** (7.68)	0.556*** (11.55)	0.663*** (9.72)	0.562*** (10.56)	0.650*** (10.36)
VARIA_BANKING_LBS	-0.0104 (-0.59)	-0.00539* (-1.92)	-0.000274 (-0.03)	-0.00139 (-0.61)	-0.0000840 (-0.01)	-0.00147 (-0.64)
INT_GDP_BANKING_LBS	-0.0739 (-0.18)	0.327 (1.05)	0.153 (0.68)	0.201 (0.76)	0.317 (1.43)	0.0939 (0.56)
INT_GDP_BU_UNI	-0.124 (-0.83)	-0.194* (-1.73)				
INT_GDP_VIENNA1			0.0917 (1.41)	0.109** (2.45)		
INT_GDP_VIENNA2					0.0812 (0.71)	0.154 (1.28)
Constant	0.000693 (0.34)	-0.00397 (-1.58)	0.000352 (0.28)	-0.00279 (-1.62)	0.00235 (1.61)	-0.00211 (-1.24)
Observations	1351	1326	1351	1326	1351	1326
Origin/Destination	D	O	D	O	D	O
Nb groups	51	51	51	51	51	51
Average T dim	31.00	30.79	31.00	30.79	31.00	30.79
Nb MG regressors	255	255	255	255	255	255
R2	0.238	0.264	0.271	0.298	0.274	0.298
CD stat	-0.385	1.183	-1.016	0.636	-0.743	-0.138
CD p-value	0.701	0.237	0.310	0.525	0.458	0.890

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals. CD p-value: p-value of CD test.

Table 3.8 – CESEE-6: EBU, capital and credit markets integration risk sharing directional impacts (2002-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIA_GDP	0.419*** (2.62)	0.661*** (6.62)	0.424*** (7.30)	0.553*** (5.44)	0.444*** (7.10)	0.575*** (5.74)
INT_GDP_BANKING_LBS	-0.0229 (-0.13)	-0.0741 (-0.81)	0.0299 (0.16)	0.0156 (0.14)	0.0479 (0.32)	-0.0485 (-0.42)
INT_GDP_PORTFOLIO	-0.247** (-2.17)	0.0116 (0.10)	-0.178** (-1.98)	0.0199 (0.18)	-0.0962 (-0.70)	-0.000800 (-0.01)
INT_GDP_BU_UNI	-0.00930 (-0.05)	-0.215** (-2.14)				
INT_GDP_VIENNA1			0.116 (1.57)	0.0443 (0.46)		
INT_GDP_VIENNA2					0.204* (1.80)	-0.0177 (-0.09)
Constant	0.00407* (1.77)	-0.00133 (-0.70)	0.00317 (1.10)	-0.00455** (-2.22)	0.00268 (1.21)	-0.00369 (-1.65)
Observations	691	522	691	522	691	522
Origin/Destination	D	O	D	O	D	O
Nb groups	48	37	48	37	48	37
Average T dim	14.82	14.54	14.82	14.54	14.82	14.54
Nb MG regressors	240	185	240	185	240	185
R <sup>2</sup>	0.262	0.256	0.291	0.311	0.300	0.313
CD stat	4.293	-0.628	1.942	-1.018	2.502	-1.442
CD p-value	0.0000176	0.530	0.0521	0.309	0.0124	0.149

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals. CD p-value: p-value of CD test.

- Finally, Vienna Initiative 1 and 2 estimates differ from those of the EU-25 model and depend on the period considered: in the 1979-2018 model, Vienna Initiative 1 is significant with a negative contribution to risk sharing from CESEE to EBU countries, whereas Vienna Initiative 2 is not significant whatever the direction (versus a significant and negative contribution of 6 percentage points). We believe this is because these variables are closer to time dummies because of the smaller subset (in which case VI1 captures the GFC effect). In the 2002-2018 model in Table 3.8, we find a large Vienna Initiative 2 negative impact of 20 percentage points, but significant at 10% only.

### 3.6.3 Sensitivity analysis: Post-Communist period and Austria

In this subsection, we focus on two potential issues affecting our initial results. First, data on CESEE countries between 1978 and 1989 are subject to caution because even though data were reported by Western countries at this time, CESEE countries were still Socialist economies. We therefore reduce our time dimension and estimate Table 3.2 on 1990-2017 subsample: 1416 observations are not used. Average level of risk shared within the EU-25 is 39% of total idiosyncratic risk (very close to full sample estimate of 37%), with still a positive average contribution from credit markets of 11%.

Table 3.9 – EU-25: Risk sharing patterns without the Communist period (1990-2018)

	(1)	(2)	(3)	(4)	(5)
VARIA_GDP	0.611*** (26.77)		0.609*** (28.06)	0.604*** (27.60)	0.683*** (12.79)
VARIA_BANKING_LBS	-0.00148 (-0.98)	-0.00148 (-0.98)	-0.00156 (-1.05)	-0.00239 (-1.61)	0.00477 (1.26)
INT_GDP_BANKING_LBS	-0.108** (-2.05)	-0.108** (-2.05)	-0.110** (-2.08)	-0.122** (-2.50)	-0.182 (-1.19)
INT_GDP_BU_UNI	-0.0131 (-0.65)	-0.0131 (-0.65)		-0.0112 (-0.56)	
INT_GDP_BU_BILAT	0.0119 (0.44)	0.0119 (0.44)	0.00816 (0.30)		
INT_GDP_EUexCESEE		0.404*** (16.15)			
INT_GDP_CESEE		0.207*** (9.00)			
INT_GDP_VIENNA1			-0.0158 (-1.04)		-0.106 (-0.93)
INT_GDP_VIENNA2				0.0329 (0.94)	
Constant	0.000598 (1.01)	0.000598 (1.01)	0.000527 (0.88)	0.000454 (0.74)	-0.000807 (-0.69)
Observations	6427	6427	6427	6427	6857
Nb groups	265	265	265	265	308
Average T dim	25.20	25.20	25.20	25.20	24.25
Nb MG regressors	1590	1855	1590	1590	1540
R2	0.343	0.343	0.351	0.355	0.350
CD stat	-2.011	-2.011	-2.131	-2.040	-2.051
CD p-value	0.0443	0.0443	0.0331	0.0414	0.0402

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

Main difference is that there is no Banking Union group effect on consumption risk sharing anymore: being a countrypair of Banking Union members or a mixed countrypair does not make a difference in terms of risk sharing (both terms are not significant at 5%). The Communist period included in initial analysis may therefore explain the difference in risk sharing patterns between mixed countrypairs and Banking Union countrypairs. The Vienna Initiative 2 result is not robust to the sample change (Equation 4). Results nevertheless suffer from some residual cross-section dependence as indicated by the test p-values.

We also performed the same sensitivity analysis for Tables 3.4 and 3.7. For EBU banking integration impact on risk sharing (Table 3.10), we find that it is significant and quite high for EBU members (around 30%), which is rather expected since our sample focuses more on the globalization period, characterized in the EU with a large increase in banking flows (Equation 3). It is robust across equations, which was not quite so for the negative banking integration impact on risk shared between EBU Members and CESEE countries in Table 3.3 (Equation 3). Equation 4 shows that without credit growth control, risk sharing impact of banking integration is not identified correctly ( $-0.08$ , not significant at 5% anymore). From this sensitivity analysis, we can conclude that EBU banking integration impact on risk sharing depends on the period considered: if we consider the globalization period, risk sharing impact is positive for EBU Members and insignificant for CESEE countries. If we consider the larger data sample inclusive of the 1980s, then EBU banking integration impact on risk sharing becomes negative for CESEE countries and insignificant for EBU Members.

Table 3.10 – EU-25: EBU risk sharing impact through banking integration (1990-2018)

	(1)	(2)	(3)	(4)
VARIA_GDP	0.634*** (24.82)	0.607*** (25.39)	0.618*** (29.20)	0.695*** (35.46)
VARIA_BANKING_LBS	-0.00142 (-0.74)	-0.00178 (-1.15)	-0.00186 (-1.23)	
INT_GDP_BANKING_LBS	-0.0928 (-1.60)	-0.122** (-2.16)	-0.123** (-2.18)	-0.0837 (-1.57)
INT_GDP_BU_BILAT	0.0254 (0.46)	0.0119 (0.44)		-0.0578** (-2.04)
INT_GDP_BU_UNI	-0.0131 (-0.65)	0.0147 (0.49)		-0.0436* (-1.88)
INT_GDP_BUBILAT_BANKING	-0.303* (-1.73)		-0.282** (-2.20)	-0.161 (-1.09)
INT_GDP_BUUNI_BANKING		0.0454 (0.65)	0.0814 (1.43)	0.176** (2.01)
Constant	0.000480 (0.65)	0.000535 (0.86)	0.000244 (0.40)	0.000638 (1.18)
Observations	6427	6427	6438	6427
Nb groups	265	265	266	265
Average T dim	25.20	25.20	25.18	25.20
Nb MG regressors	1855	1855	1596	1855
R2	0.334	0.336	0.348	0.341



CD stat	-1.940	-2.107	-1.783	-0.893
CD p-value	0.0523	0.0351	0.0746	0.372

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

Finally, directional analysis for CESEE countries in Table 3.11 is rather unchanged in terms of risk shared with CESEE countries as origin or destination countries (31 and 45 percentage points, respectively). Risk sharing from CESEE countries to EBU Members has benefited from EBU implementation since 2012 by 20 percentage points (Equation 2): this result is therefore robust to the two different data samples. Only Vienna Initiative 1 result from Table 3.7 is not robust, but it was significant at 10% only.

Table 3.11 – CESEE-6: EBU, banking integration and Vienna Initiatives risk sharing directional impacts (1990-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIA_GDP	0.529*** (4.17)	0.752*** (7.31)	0.545*** (10.57)	0.645*** (8.83)	0.540*** (9.72)	0.625*** (9.36)
VARIA_BANKING_LBS	-0.00926 (-0.52)	-0.00706** (-2.18)	0.00125 (0.13)	-0.00303 (-1.06)	0.00159 (0.19)	-0.00359 (-1.21)
INT_GDP_BANKING_LBS	-0.133 (-0.31)	0.333 (1.06)	0.135 (0.60)	0.199 (0.74)	0.299 (1.34)	0.106 (0.59)
INT_GDP_BU_UNI	-0.123 (-0.84)	-0.222** (-2.01)				
INT_GDP_VIENNA1			0.0107 (0.15)	0.0656 (1.21)		
INT_GDP_VIENNA2					0.160 (1.36)	0.191 (1.24)
Constant	0.000909 (0.41)	-0.00354 (-1.20)	0.000733 (0.43)	-0.00276 (-1.18)	0.00261 (1.40)	-0.00186 (-0.78)
Observations	1109	1097	1109	1097	1109	1097
Destination/Origin	D	O	D	O	D	O
Nb groups	51	51	51	51	51	51
Average T dim	23.75	23.77	23.75	23.77	23.75	23.77
Nb MG regressors	255	255	255	255	255	255
R2	0.408	0.473	0.432	0.500	0.435	0.497
CD stat	0.704	1.415	-0.0911	1.048	0.0892	0.307
CD p-value	0.481	0.157	0.927	0.295	0.929	0.759

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

Second potential issue relates to the initial exclusion of Austria as a reporting country from our data sample. As mentioned previously, the CCEMG estimator algorithm excludes some countrypairs to have sufficient degree of freedom, depending on the number of variables included. Given our initial specifications, this resulted in Austria exclusion as a reporting country, because Austria has started reporting banking claims in 2007

only. This could be an issue when analyzing CESEE countries, because Austria used to have very large outstanding cross-border claims in CESEE countries, in volumes. We then reduce the number of explanatory variables so that Austria as origin country is included in the panel: number of groups is now 308 (to be compared with 265 in Subsection 3.6.1). We also do a joint sensitivity analysis by excluding the Communism period from our data sample (in Table 3.13).

Table 3.12 indicates an average risk sharing level of 35% within the EU-25, in line with previous results. The savings channel's contribution to risk sharing becomes undetermined: depending on specifications, it is significant when we don't control for credit growth or significant at 10% only. We find a significant and negative bilateral EBU membership impact on risk sharing (Equation 2, by 7 percentage points), which could also be interpreted as a consequence of the Great Retrenchment of banking flows after the SDC. Vienna Initiatives 1 and 2 are not significant at 5%, whatever the period considered. Table 3.13, Equation 1 identifies a positive unilateral impact of EBU of 7 percentage points. From this sensitivity analysis, we can conclude that the inclusion of Austria does not change the average consumption risk shared within the EU-25, but it impacts the allocation of risk sharing within channels, particularly the savings and the EBU channels.

Table 3.12 – EU-25: Risk sharing patterns with the inclusion of Austria (1979-2018)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIA_GDP	0.670*** (17.00)	0.618*** (18.26)		0.700*** (13.25)	0.634*** (18.22)	0.754*** (16.21)	0.677*** (28.85)
VARIA_BANKING_LBS	-0.00236 (-0.29)	0.00462* (1.69)	0.00236 (0.96)	0.00498 (1.34)	-0.000739 (-0.26)		
INT_GDP_BANKING_LBS	-0.515* (-1.72)	-0.0390 (-0.32)	-0.157* (-1.86)	-0.234 (-1.54)	0.0160 (0.12)	-0.290** (-2.26)	-0.0439 (-0.68)
INT_GDP_BU_UNI	-0.0194 (-0.65)					-0.0608** (-2.23)	
INT_GDP_BU_BILAT		0.0739** (2.37)					-0.0351 (-1.51)
INT_GDP_EUexCESEE			0.426*** (17.35)				
INT_GDP_CESEE			0.228*** (10.48)				
INT_GDP_VIENNA1				-0.104 (-0.91)		-0.0981 (-1.05)	
INT_GDP_VIENNA2					0.141 (1.18)		0.0398 (1.50)
Constant	-0.0000845 (-0.08)	0.000450 (0.60)	0.000146 (0.21)	-0.000855 (-0.73)	0.000595 (0.76)	-0.000117 (-0.12)	0.000593 (1.02)
Observations	8273	8273	8273	8273	8273	8273	8273
Nb groups	308	308	308	308	308	308	308
Average T dim	31.31	31.31	31.31	31.31	31.31	31.31	31.31
Nb MG regressors	1540	1540	1540	1540	1540	1540	1540
R2	0.397	0.397	0.408	0.407	0.407	0.403	0.398
CD stat	-1.745	-2.077	-2.096	-1.823	-2.025	-1.994	-2.098
CD p-value	0.0810	0.0378	0.0361	0.0684	0.0429	0.0461	0.0359

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals. CD p-value: p-value of CD test.

Table 3.13 – EU-25: Risk sharing patterns with the inclusion of Austria (1990-2018)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIA_GDP	0.655*** (16.31)	0.597*** (17.22)		0.683*** (12.79)	0.615*** (17.27)	0.757*** (16.08)	0.674*** (27.29)
VARIA_BANKING_LBS	-0.00250 (-0.31)	0.00450 (1.59)	0.00208 (0.82)	0.00477 (1.26)	-0.00110 (-0.38)		
INT_GDP_BANKING	-0.467 (-1.56)	0.0242 (0.19)	-0.105 (-1.22)	-0.182 (-1.19)	0.0716 (0.55)	-0.226* (-1.75)	0.0361 (0.54)
INT_GDP_BU_UNI	-0.0737** (-2.55)					-0.102*** (-3.66)	
INT_GDP_BU_BILAT		0.0775** (2.40)					-0.0329 (-1.31)
INT_GDP_EUexCESEE			0.411*** (16.75)				
INT_GDP_CESEE			0.225*** (10.07)				
INT_GDP_VIENNA1				-0.106 (-0.93)		-0.102 (-1.09)	
INT_GDP_VIENNA2					0.133 (1.10)		0.0377 (1.34)
Constant	-0.0000259 (-0.02)	0.000493 (0.64)	0.000213 (0.30)	-0.000807 (-0.69)	0.000658 (0.81)	-0.0000580 (-0.06)	0.000591 (0.95)
Observations	6857	6857	6857	6857	6857	6857	6857
Nb groups	308	308	308	308	308	308	308
Average T dim	24.25	24.25	24.25	24.25	24.25	24.25	24.25
Nb MG regressors	1540	1540	1540	1540	1540	1540	1540
R2	0.343	0.338	0.352	0.350	0.350	0.355	0.350
CD stat	-2.005	-2.409	-2.318	-2.051	-2.247	-1.672	-1.714
CD p-value	0.0449	0.0160	0.0204	0.0402	0.0247	0.0944	0.0865

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals. CD p-value: p-value of CD test.

### 3.6.4 Risk sharing model with Consolidated foreign banking claims

CBS data are foreign claims of banks headquartered in reporting countries, on an immediate counterparty basis. CBS foreign claims can be split between international claims (cross-border claims booked from all offices plus locally booked claims in foreign currencies booked in host countries) and local claims in local currencies (claims booked by banks' foreign affiliates denominated in the local currency of the host country vis-à-vis counterparties in the same host country).

Time dimension is lower than for LBS data (with 28 years of data by counterparty in average). Moreover, we cannot extend the database by switching liabilities positions to claims, because Consolidated Banking Statistics do not report liabilities. Hence we have a lower number of countrypairs (groups) in our panel dataset. Only Ireland is excluded from the panel because of too few observations in the time dimension, so that we effectively capture main financial partners such as Austria.

If we start with the EU-25 risk sharing model in Table 3.14, which is estimated on 184 groups over an average duration of 24 years, we find an average level of 43% risk sharing. The null of EU excluding CESEE and CESEE group effects' equality is rejected

at 5%. In terms of risk sharing channels, first striking result is that foreign claims growth impact on risk sharing is not significant at any standard level, which differs from our conclusions on the EU-25 risk sharing model in Table 3.2. We also find a significant and negative EBU bilateral membership impact on risk sharing in Equations 2 and 3 (11%). But if we replace the EBU bilateral impact variable by the Vienna Initiative 2 variable as in Equation 4, the EBU variable is not significant anymore. We can conclude that it is a Vienna Initiative 2 negative impact that is identified. We also find a significant and negative impact of EBU unilateral membership of 3 percent points, in line with the EU-25 results on a larger dataset. Results are robust to the exclusion of the Communist period.

Table 3.14 – EU-25: Risk sharing model with banking market integration (EBU and Consolidated Banking Statistics)

	(1)	(2)	(3)	(4)
VARIA_GDP	0.484*** (11.44)		0.572*** (21.11)	
VARIA_BANKING_CBS	-0.00324 (-1.09)	-0.00102 (-0.47)	-0.000864 (-0.40)	-0.000791 (-0.37)
INT_GDP_BANKING_CBS	0.0525 (0.58)	-0.00848 (-0.11)	-0.119 (-1.31)	-0.114 (-1.21)
INT_GDP_BU_UNI	0.0281* (1.94)	0.0378*** (2.63)	0.0366** (2.54)	
INT_GDP_BU_BILAT	0.141*** (3.03)	0.134*** (3.81)	0.0895** (2.50)	0.0584 (1.55)
INT_GDP_EUexCESEE		0.365*** (14.21)		0.380*** (14.57)
INT_GDP_CEESEE		0.186*** (6.46)		0.190*** (6.52)
INT_GDP_VIENNA1			-0.0862 (-1.44)	-0.0934 (-1.45)
INT_GDP_VIENNA2				0.102* (1.88)
Constant	0.000950 (0.83)	0.00126 (1.59)	0.00112 (1.40)	0.000813 (1.05)
Observations	4286	4099	4099	4087
Nb groups	201	184	184	183
Average T dim	23.78	24.36	24.36	24.39
Nb MG regressors	1206	1288	1288	1464
R <sup>2</sup>	0.434	0.440	0.438	0.442
CD stat	1.192	1.330	1.181	1.536
CD p-value	0.233	0.184	0.238	0.125

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

If we now consider the EU-25 risk sharing model with banking and capital markets variables in Table 3.15, despite a smaller number of countrypairs (173 versus 183), we find an average level of risk shared across the groups of 58%. We find a robust significant and quite high portfolio investment growth impact on risk sharing (28%) compared as the one in Table 3.4. We do not find any significant impact of banking integration through foreign claims on risk sharing. Both EBU impacts are significant and negative. Most results of this model are robust to a change in banking claims measure.

Table 3.15 – EU-25: Risk sharing model with foreign claims and capital markets (2002-2018)

	(1)	(2)	(3)	(4)
VARIA_GDP	0.587*** (9.23)	0.472*** (13.99)	0.467*** (7.96)	0.398*** (10.10)
INT_GDP_BANKING_CBS	-0.110 (-0.58)	-0.0162 (-0.17)	0.0543 (0.64)	0.0738 (0.79)
INT_GDP_PORTFOLIO	-0.634** (-2.55)	-0.225** (-2.13)	-0.377** (-2.46)	-0.288*** (-2.75)
INT_GDP_BU_UNI		0.0623*** (3.04)		0.0584*** (2.97)
INT_GDP_BU_BILAT			0.133* (1.75)	0.206*** (4.65)
VARIA_PORTFOLIO	0.00883** (2.00)			
VARIA_BANKING_CBS	0.00131 (0.40)			
Constant	-0.00129 (-0.75)	0.00186 (1.31)	0.00428 (1.21)	0.00190 (1.57)
Observations	1455	2614	2614	2584
Nb groups	93	173	173	170
Average T dim	15.68	15.28	15.28	15.34
Nb MG regressors	558	865	865	1020
R <sup>2</sup>	0.169	0.226	0.201	0.201
CD stat	2.320	-1.380	0.232	0.104
CD p-value	0.0204	0.168	0.817	0.917

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of variables in Mean Group regression

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test.

If we finally consider the CESEE/EBU risk sharing model in Table 3.16, which is the most likely to be impacted by this change of banking claims, we find a significant, large and negative risk sharing impact of foreign banking claims on the 1984-2018 period (16%) and an unchanged large and positive contribution from capital markets integration (additional 30% of idiosyncratic risk shared). This banking integration negative effect disappears in the shorter dataset (Equations 5 to 7). Vienna Initiative 1 and 2 impacts are found significant and negative, with very large negative effect of Vienna Initiative 2.

Table 3.16 – CESEE-6: Risk sharing model with CBS foreign claims and capital markets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIA_GDP	0.725*** (14.16)	0.739*** (15.45)	0.739*** (15.54)	0.733*** (15.10)	0.469*** (4.80)	0.536*** (8.93)	0.493*** (8.57)
INT_GDP_BANKING_CBS	0.194** (2.34)	0.158** (2.06)	0.157** (2.05)	0.163** (2.11)	0.116 (0.91)	0.163 (1.52)	0.146 (1.35)
INT_GDP_BU_UNI	0.0748 (1.32)				0.165 (1.57)		
INT_GDP_VIENNA1		0.0841* (1.89)		0.0811* (1.86)		0.0204 (0.20)	
INT_GDP_VIENNA2			0.229** (2.10)	0.229** (2.10)			0.309* (1.94)
INT_GDP_PORTFOLIO					-0.410*** (-3.67)	-0.330*** (-3.29)	-0.313*** (-3.00)
Constant	-0.000737 (-0.39)	-0.00128 (-0.68)	-0.000987 (-0.52)	-0.00120 (-0.63)	0.00545 (1.46)	0.000122 (0.05)	0.00178 (0.75)
Observations	1242	1242	1242	1242	588	588	588
Nb groups	48	48	48	48	38	38	38
Average T dim	28.09	28.09	28.09	28.09	15.54	15.54	15.54
Nb MG regressors	192	192	192	240	190	190	190
R <sup>2</sup>	0.516	0.517	0.517	0.514	0.225	0.258	0.253
CD stat	0.0928	0.0578	0.218	0.143	-0.943	-1.169	-1.015
CD p-value	0.926	0.954	0.827	0.886	0.346	0.243	0.310

We summarize all our results with three grouped histograms that give the estimated channels of bilateral consumption risk sharing within EU-25, the EBU Member States and the CESEE-6 and EBU Members.

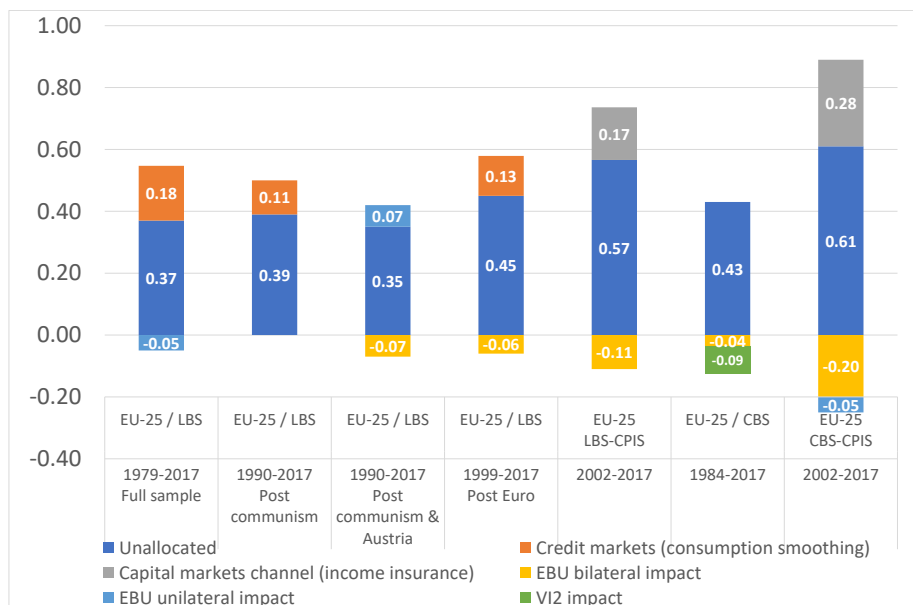


Figure 3.1 – Bilateral risk sharing channels within the EU-25

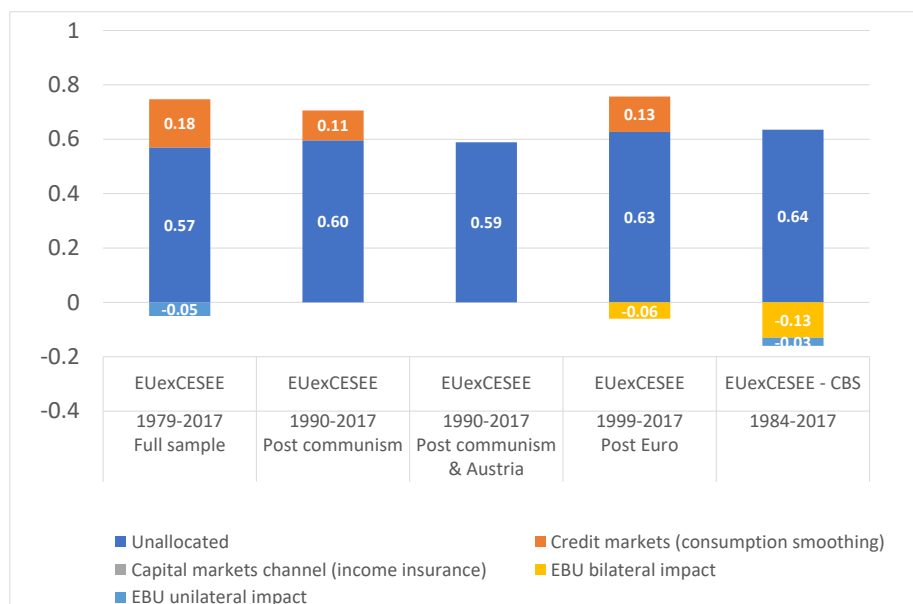


Figure 3.2 – Bilateral risk sharing channels within the EU-25 excluding CESEE countries

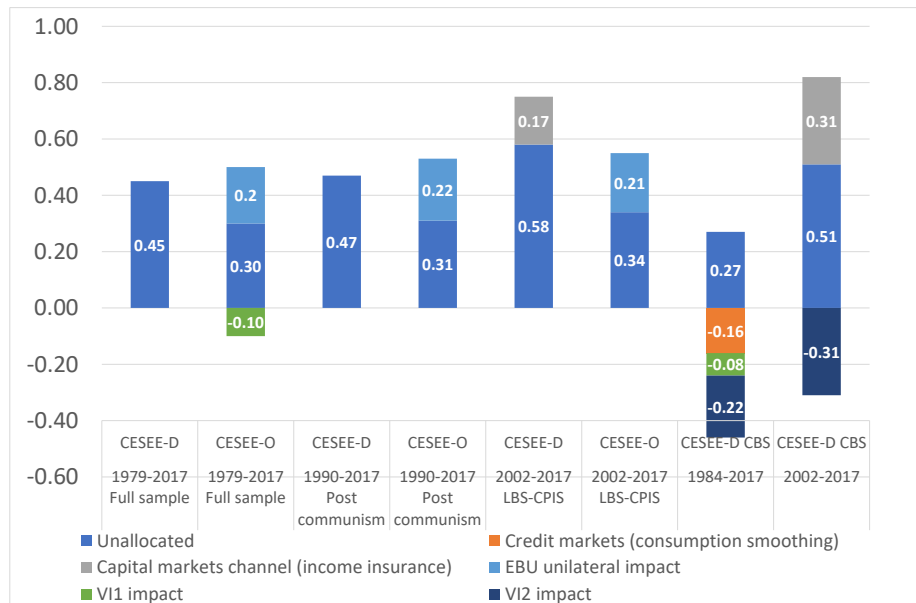


Figure 3.3 – Bilateral risk sharing channels between CESEE-6 and EU-25 excluding CESEE-6

### 3.6.5 Robustness

#### 3.6.5.1 Structural break impact

Structural breaks such as the Euro implementation in 1999 for the Euro area members occurred before the EBU implementation. Nevertheless, we estimated the risk sharing specifications both over the full time period and over a shorter period that excludes the potential structural break event. For the European Union countries, we have estimated the specifications over the 1999-2018 subperiods on the same sample of countrypairs (265).

Results for the 1999-2018 period are reported in Table 3.17, with Common Correlated Effects- Mean Group estimates in Equations 1 and 2 and Driscoll Kray estimates in Equations 3 and 4 respectively. When we estimate the panel regression with the CCEMG estimator, both the total level of risk sharing and the credit markets channel are robust to the shorter time length (circa 60% of risk shared within the EU-25).

Table 3.17 – Robustness to Euro official launch in 1999

Estimator	(1) CCEMG	(2) CCEMG	(3) DK	(4) DK
VARIA_GDP	0.551*** (20.41)		0.767*** (13.01)	
INT_GDP_EUexCESEE		0.373*** (13.62)		0.798*** (11.38)
INT_GDP_CESEE		0.175*** (8.08)		0.685*** (7.81)
INT_GDP_BANKING	-0.129* (-1.87)	-0.126* (-1.82)	-0.00378 (-0.32)	-0.00269 (-0.24)
INT_GDP_BU_UNI	0.0240 (1.34)	0.0274 (1.52)	-0.417*** (-3.23)	-0.353** (-2.54)
INT_GDP_BU_BILAT	0.0653** (2.25)	0.0677** (2.32)	-0.463*** (-3.51)	-0.491*** (-3.31)
VARIA_BANKING_LBS	-0.00242 (-1.30)	-0.00258 (-1.38)	-0.000142 (-0.19)	-0.000262 (-0.42)
Constant	0.000129 (0.21)	0.000157 (0.25)	0.000207 (1.59)	0.000127 (0.87)
Observations	4792	4781	5284	5284
Nb of groups	265	264	401	401
CD p-value	0.0839	0.0829		

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.6.5.2 Common factors approximation by cross-section averages

Regarding the CCEMG estimator, we test several types of cross-section averaging for Equation 1, Table 3.2. By construction, real GDP and consumption per capita differentials by countrypair have opposite sign. Moreover, the extension of LBS dataset has enhanced data symmetry because we used outstanding liabilities from Country *i* to non-reporting Country *j* as outstanding claims from non-reporting Country *j* to Country *i*. There is partial offsetting effect of common factors impacting individual variables. However, common factors in error terms do not disappear because of first order and cross-country differentiation : there is still cross-section error dependency as shown by the rejection of the null hypothesis of Pesaran CD test. We therefore calculate:

- 1/ Cross-section averages of absolute value for cross-country growth and consumption differentials. Approximations of common factors by cross-section averages are a lower bound approximation of unobserved common factors impacting individual variables. By using absolute values of cross-country differentials, we have an upper bound.
- 2/ Cross-section averages of individual GDP and consumption growth variables. We do not reject the residuals' cross independence null hypothesis with a very high p-value.
- 3/ Cross-section averages of interaction and control variables only: since we need to be parsimonious and common factors have been partially out by cross-country differentiation, we do not cross-section average the GDP and consumption growth differentials.
- 4/ Cross-section averages of all but interaction terms (under the assumption that linear averaging will not capture non-linearity of these variables).



Table 3.18 – Cross-section averages robustness

	(1)	(2)	(3)	(4)
VARIA_GDP	0.641*** (36.41)	0.612*** (26.40)	0.629*** (27.81)	0.621*** (20.71)
VARIA_BANKING_LBS	0.000376 (0.30)	-0.00255* (-1.76)	0.00324 (1.35)	-0.00199 (-0.49)
INT_GDP_BANKING	-0.180*** (-3.92)	-0.147*** (-2.94)	-0.132* (-1.74)	-0.226 (-1.52)
INT_GDP_BU_UNI	0.0256 (1.29)	0.00143 (0.08)	0.0229 (1.16)	0.0355 (1.56)
INT_GDP_BU_BILAT	0.0141 (0.55)	0.00423 (0.16)	0.0367 (1.52)	0.0614** (2.38)
Constant	-0.000454 (-0.22)	-0.000455 (-0.55)	-0.0000435 (-0.09)	-0.000130 (-0.18)
Observations	7854	7854	8284	8284
Nb group	266	266	309	309
Average T dim	32.45	32.45	31.28	31.28
Nb MG regressors	1596	1596	1854	1854
R <sup>2</sup>	0.395	0.433	0.396	0.386
CD stat	1.319	0.0768	1.465	-1.454
CD p-value	0.187	0.939	0.143	0.146

z statistics in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Nb groups: number of countrypairs included in regression.

Average T dim: average number of observations per group included in regression.

Nb MG regressors: number of cross-section averages estimated.

CD stat: Pesaran (2015) cross-sectional weak dependence test statistic on residuals.

CD p-value: p-value of CD test..

We find that total unsmoothed idiosyncratic consumption risk is robust to various forms of common correlated effects, as well as the cross-border banking impact on risk sharing, except when we do not average out common factors between banking integration and risk sharing (Equation 4). In this case, the parameter relative to consumption risk smoothed by banking integration is not significant anymore at standard levels, with a higher standard deviation, while EBU dual membership now contributes negatively by 6 percentage points to total risk sharing.

### 3.6.5.3 Other estimators with standard error corrections

We have tested on LBS dataset (before extension) estimators with two other forms of standard error corrections: Generalized Least Squares (GLS) with heteroscedasticity and autocorrelation correction, GLS with cluster correction. We can see that panel cross-dependence-robust standard errors lead to much lower t-statistics for estimated coefficients, particularly on banking/GDP growth interaction term.

Table 3.19 – Comparison of GLS with standard error HAC and cluster correction, Within with Driscoll-Kraay (1998) cross-section dependence correction

Estimator	GLS		GLS		GLS		Within	
VARIA_GDP	0.664***	(51.25)	0.250***	(8.60)	0.725***	(21.66)	0.686***	(7.22)
INT_GDP_BANKING	-0.127***	(-5.65)	0.0175	(0.56)	-0.133**	(-2.58)	-0.136	(1.40)
INT_GDP_BU_BILAT	-0.466***	(-19.03)	-0.112***	(-3.44)	-0.543***	(-12.41)	-0.549***	(-5.70)
Constant	-0.610*	(-1.67)	0.353	(0.91)	0.386	(1.29)	-0.591***	(-4.30)
Observations	4819		1257		4819		4819	
Time period	Max		2012-2018		Max		Max	
Countrypair FE	YES		YES		NO		YES	
Time FE	YES		YES		YES		YES	
Standard errors correction	HAC		HAC		Cluster		Driscoll-Kraay	

### 3.7 Concluding remarks and further research

Our preferred empirical strategy, based on a common correlated factors model, has allowed us to identify both the idiosyncratic risk that is shared on a bilateral basis and the European Banking Union impact through the use of subgroup variables. Results tend to show that risk shared within the EU-25 is large and increasing (Figure 3.2), with an initial risk-sharing role from cross-border banking that has shifted towards capital markets channel (bonds and equity portfolio holdings) at the beginning of the 2000s. One interesting result is the destabilizing role of Austria in terms of credit markets' contribution to risk sharing within the EU-25.

Being a countrypair of EBU participants is not significant in terms of risk sharing if we consider the longest dataset, but being a mixed countrypair is significant and contributes negatively to average risk sharing. The shorter the pre-EBU period in the sample, the more negative become both EBU unilateral and bilateral impacts on risk sharing (10 percentage points in average), even though we control for the great retrenchment of banking flows during the 2010s with both the control variable and the common correlated factors (Figure 3.1). This consumption dissmoothing effect has been observed as well when we have excluded the Communist period from our data sample. We nevertheless acknowledge that participation to the EBU might act as risk sharing buffers (as estimated in Table 3.2). To improve identification and test this hypothesis, further research will extend the analysis and our panel to countrypairs inclusive of Denmark, Sweden and the United Kingdom, that are very important financial partners to the EU-25 and the EBU.

Regarding the level of risk shared between CESEE countries and EBU participants, it follows the same increasing trend as within the EU. We also found that a directional risk sharing model is adapted to these countries. On this data subset, Vienna Initiative impacts are better identified than in the EU-25 model (particularly Vienna Initiative 2) although they have a negative contribution to risk sharing. One very interesting result is that neither cross-border banking nor foreign claims play a positive role on risk sharing for CESEE countries. Banking integration measured with CBS foreign claims even has a significant and negative impact on risk sharing when CESEE countries are destination countries (Figure 3.3). This result has quite a policy impact in terms of international banking flows' regulation because foreign banking claims have a destabilizing effect in case of idiosyncratic shock. Over the long run, it is also noticeable that bilateral risk sharing from CESEE countries towards EBU participants has increased quite significantly since 2012. Regarding the risk sharing impact of the Supervision Pillar of the EBU through banking integration, we have found some evidence of such channel using

Locational Banking Statistics, that depends on the period considered: if globalization period is considered, EBU Members benefit from a positive risk sharing impact, whereas if the longest data span is used, EBU risk sharing impact through banking integration is not significant anymore for them and becomes negative for CESEE countries.

Finally, capital markets integration through equity and bond holdings seems to contribute largely to risk sharing for CESEE countries as in the wider EU-25 analysis. These results highlight the importance of Capital Markets Union implementation to foster consumption risk sharing at EU-25 level. They also point towards deepening of capital markets for CESEE countries, as a risk sharing opportunity.

Further research on bilateral risk sharing for CESEE countries should include Foreign Direct Investments as a bilateral variable, because even if our model needs to be particularly parsimonious to be consistent, we think unallocated shared risk remains high. Also, we would like to identify a potential Euro risk sharing effect within the same panel, by using an intensity variable taking into account the various Euro accession dates. This would be an additional contribution to the Euro accession debate for CESEE countries.

### 3.A Robust Hausman test

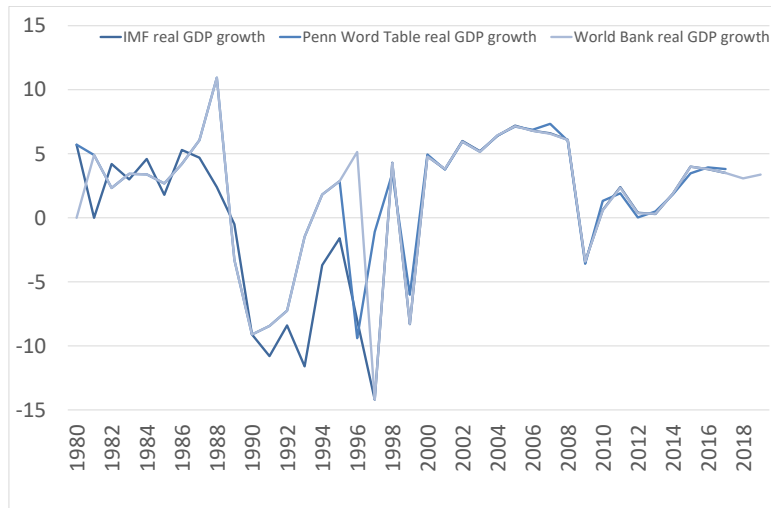
Fixed effects are formally tested with a robust [Hausman \(1978\)](#) specification test, with null hypothesis being that individual fixed effects are not correlated with the explanatory variables, and hence individual random effects estimator is consistent. Given the fact that the errors of our fixed effects model do not satisfy the homoscedasticity and independence conditions of the standard Hausman test, within and GLS estimators are not longer optimal under the null or alternative and inference is not possible anymore. We therefore perform a Wald test on an alternative formulation of the Hausman test as proposed by [Hoechle \(2007\)](#).

### 3.B Variance Inflation Factor analysis

Table 20 – VIF analysis of Equations 1 and 2, Table 3.2

Variable	EQ1		EQ2	
	VIF	1/VIF	VIF	1/VIF
varia_gdp_log_return	1.33	0.75	-	-
INT_GDP_EBU	-	-	1.45	0.69
INT_GDP_EUexEBU	-	-	1.18	0.85
INT_GDP_BU_BILAT	1.28	0.78	1.46	0.68
INT_GDP_BU_UNI	1.08	0.92	1.17	0.86
INT_GDP_BANKING	1.04	0.96	1.04	0.96
varia_banking	1.000	1.00	1.00	1.00
Mean VIF	1.15		1.19	

### 3.C Comparison of Bulgaria real GDP growth from various sources



Data source: IMF, World Bank and Penn World Table LHS: percentage points

### 3.D Panel unit root tests

Table 21 – Unit root and cross-sectional independence tests

	Level				
	CD test statistic*	CD test p-value	CADF Zt-bar** Constant and trend	Zt-bar	CADF Zt-bar Constant
Real consumption growth- origin countries	522.58	0.00	-31.01		-24.80
Real consumption growth- destination countries	516.5	0.00	-31.09		25.24
Real GDP growth- origin countries	811.11	0.00	-19.52		-32.14
Real GDP growth- destination countries	803.6	0.00	-19.96		-32.49
Log of outstanding banking claims (LBS)	300.54	0.00	NA		NA
Log of portfolio investment (CPIS)	449.13	0.00	1.934		4.17
Log of foreign claims (CBS)	230.48	0.00	2.17		3.20

\*Pesaran (2004) CD test H0: error terms are cross-sectionally independent  
 \*\*Pesaran (2003) CADF unit root test in presence of cross section dependence  
 5% CV for intercept/trend and intercept (N=200/T=20)= -3.43 / -4.01

The null is rejected if  $|CD| \geq 1.96$   
 H0: all series have unit root

	First difference				
	CD*	CD test p-value	CADF Zt-bar** Constant and trend	Zt-bar	CADF Zt-bar Constant
Real consumption growth differential	-3.3	0.001	-35.58		-43.23
Real GDP growth differential	-3.4	0.001	-32.35		-40.25
Oustanding claims growth (LBS)	114.23	0.00	NA		NA
Portfolio investment growth (CPIS)	211.04	0.00	NA		NA
Foreign claims growth (CBS)	106.38	0.00	NA		-9.67***

\*Pesaran (2004) CD test H0: error terms are cross-sectionally independent  
 \*\*Pesaran (2003) CADF unit root test in presence of cross-section dependence  
 \*\*\* Calculated for year > 2004  
 5% CV for intercept/trend and intercept (N=200/T=20)= -3.43 / -4.01  
 NA: too few observations or too many gaps to perform the test

The null is rejected if  $|CD| \geq 1.96$   
 H0: all series have unit root

### 3.E Descriptive statistics on the LBS 1990-2018 panel

Table 22 – Descriptive statistics

	(1)				
	b/count	mean	sd	min	max
countrypair_v2	12180.00	203.50	117.21	1.00	406.00
varia_cons	11468.00	-0.00	0.06	-0.46	0.46
varia_gdp	11468.00	0.00	0.05	-0.45	0.45
varia_banking	7672.00	0.07	0.60	-6.88	7.66
varia_asset	6068.00	0.14	0.70	-8.77	7.91
BU_dual_membership	12180.00	0.16	0.36	0.00	1.00
BU_unilateral	12180.00	0.08	0.26	0.00	1.00
VIENNA_1_ext	12180.00	0.01	0.09	0.00	1.00
VIENNA_2_ext	12180.00	0.01	0.09	0.00	1.00
banking_crisis_dum_o	11774.00	0.13	0.34	0.00	1.00
banking_crisis_dum_d	11774.00	0.13	0.34	0.00	1.00
INT_GDP_BANKING_LN	7291.00	-0.00	0.03	-0.38	0.70
INT_GDP_PORTFOLIO	5690.00	-0.00	0.03	-0.49	0.39
INT_GDP_BU_BILAT_LN	11468.00	0.00	0.02	-0.23	0.23
INT_GDP_BU_UNI_LN	11468.00	-0.00	0.01	-0.20	0.20
INT_GDP_VIENNA1	11468.00	0.00	0.00	-0.10	0.10
INT_GDP_VIENNA2_LN_EXT	11468.00	0.00	0.00	-0.04	0.04
INT_GDP_BILATBU_BANKING	7291.00	0.00	0.02	-0.38	0.70
INT_GDP_BILATUNIBANKING	7291.00	0.00	0.01	-0.18	0.20
<i>N</i>	12180				

## Chapitre 4

# Conclusion

Les différents chapitres de la thèse ont permis d'apporter un certain nombre de réponses sur les degrés et les déterminants des différents processus d'intégration financière, monétaire et bancaire à l'oeuvre dans les pays d'Europe Centrale et du Sud-Est, ainsi que sur les interactions existant entre intégration financière et mécanismes d'ajustement aux chocs.

Les stratégies empiriques ont été choisies pour permettre l'analyse sur longue période des pays CESEE, caractérisés depuis la fin des années 1990 par une transition vers l'économie de marché, puis une libéralisation financière et enfin une convergence nominale et réelle vers l'Union Economique et Monétaire. Nous avons traité la question de l'intégration financière et bancaire dans les chapitre 1 et 3 en utilisant des données de panel bilatérales, qui nous permettent tout d'abord de travailler sur les volumes bruts et effectifs de cette intégration; puis d'augmenter considérablement le nombre de données (et donc d'information) sur ces pays pour lesquels la dimension temporelle fiable est sinon de l'ordre de 30 ans. Les développements d'une économétrie des données de panel robuste aux effets communs inobservés propres aux panels macroéconomiques nous permettent d'estimer le modèle empirique de partage du risque idiosynchratique de façon robuste. Concernant le deuxième chapitre, l'utilisation d'une méthodologie de cointégration à ruptures structurelles nous a permis d'obtenir des résultats robustes aux ruptures endogènes dans les données.

Si l'on résume tout d'abord les principaux résultats du modèle de gravité bilatéral estimé dans le premier chapitre, les rôles significatifs joués par les variables de faible distance, d'histoire commune et d'appartenance à l'Union Européenne pointent tous vers l'importance des liens intra-européens comme facteurs de croissance des créances bancaires transfrontières sur la plus longue période d'estimation (1990-2019). Sur la période d'estimation plus courte (1996-2019), l'équation de gravité augmentée de variables relatives aux caractéristiques et à la santé des systèmes bancaires souligne la significativité et l'importance des conditions bancaires domestiques des pays d'origine (facteurs push), ce qui est un résultat en ligne avec le très haut niveau de détention des actifs bancaires



par les groupes bancaires européens.

Concernant l'influence des facteurs domestiques des pays CESEE, les variables relatives à la concentration du système bancaire et du niveau de capital réglementaire sont significatives et des facteurs limitants des créances. Le rôle de la réglementation bancaire pourrait néanmoins être clarifié puisque l'indice bilatéral reflétant la distance réglementaire entre deux pays n'est pas significatif. L'impact négatif de la concentration bancaire sur les créances transfrontières supporte quant à lui l'existence d'un effet positif de l'intégration bancaire sur les systèmes bancaires des pays débiteurs décrit dans la littérature. Les résultats relatifs aux facteurs globaux montrent que la base monétaire américaine est la seule variable significative sur longue période. Ce facteur global de liquidité a un effet significatif et positif sur les créances bancaires transfrontières détenues sur les pays CESEE, ce qui va dans le sens de l'existence du canal de la prise de risque bancaire de [Bruno and Shin \(2015a\)](#). Le facteur global relatif au cycle financier global estimé par [Miranda-Agrippino et al. \(2020\)](#), qui capte l'aversion au risque, est quant à lui non significatif, tout comme le TED spread. Ces deux résultats tendent à montrer que l'inclusion de variables financières, avec une périodicité plus élevée que les variables bancaires et macrofinancières, ne permet probablement pas une bonne identification des effets globaux dans notre modélisation. Enfin, le régime de change est un facteur significatif et déterminant des créances transfrontières, avec une forte fixité du régime de change associée positivement à ceux-ci. La stabilité des taux de change dans le cadre de la convergence avec l'UEM a potentiellement un coût en matière de vulnérabilités externes bancaires.

Les résultats de ce chapitre font ressortir d'une part, l'importance des facteurs environnementaux liés à l'intégration financière (globaux et push) et d'autre part, l'importance des liens européens comme déterminants des créances bancaires transfrontières des pays CESEE. Ils vont tous dans le sens d'un accroissement des créances bancaires transfrontières, qui sont un facteur de vulnérabilités financières. Du point de vue des recommandations de politique économique, il apparaît donc très important de promouvoir la coopération internationale et en particulier la coopération européenne en matière bancaire. Néanmoins, l'orientation actuelle des politiques des pays CESEE en matière de stabilité financière est une utilisation massive de la politique macroprudentielle domestique.

Deux types d'extensions de l'analyse permettraient de préciser la nature des effets de l'adhésion à l'Union Européenne d'une part, et l'apport de la réglementation et des mesures macroprudentielles en matière de stabilisation des créances transfrontières d'autre part. Du point de vue de l'appartenance à l'Union Européenne, nous souhaiterions améliorer l'identification de l'effet de l'intégration commerciale (les variables de contrôle individuelles étant non significatives) et proposer une identification de l'effet réglementaire spécifique à l'Union Européenne. L'environnement réglementaire bancaire domestique joue potentiellement un rôle contracyclique qui pourrait être exploré dans un deuxième

temps. Enfin, une troisième extension consisterait à estimer sur une période plus récente et avec une fréquence de données plus élevée les impacts des mesures macroprudentielles sur les créances bancaires transfrontières. La recherche actuelle s'intéresse par exemple à la construction d'indices reflétant l'intensité de la politique macroprudentielle pour la région CESEE (Eller et al., 2021). L'évaluation de ces politiques en matière d'efficacité sur la stabilité financière permettrait d'apporter un éclairage supplémentaire au débat relatif à l'adhésion à la zone Euro pour les pays CESEE hors du Mécanisme de Change Européen II.

Si l'on résume désormais les principaux résultats du deuxième chapitre, il apparaît tout d'abord un résultat commun avec le premier chapitre, qui est l'importance du régime de change dans les effets d'interdépendance. Le degré estimé d'intégration monétaire (définie comme l'autonomie monétaire dans le cadre de la convergence nominale avec l'UEM) est en effet en lien avec le régime de change de facto des pays CESEE, à l'exception de la Croatie. Par contre, les relations d'interdépendance monétaire ne se limitent pas à une transmission du taux de change via la parité non couverte des taux d'intérêt. Plus précisément, pour les pays participant au Mécanisme de Change Européen II, nos résultats montrent qu'il existe une interdépendance monétaire entre la zone Euro et la Bulgarie, avec une transmission complète du taux d'intérêt étranger vers le taux d'intérêt domestique en cohérence avec son régime monétaire de caisse d'émission. Pour les pays hors du MCE II, la République Tchèque et la Roumanie entretiennent des interdépendances monétaires avec la zone Euro dans le cadre de règles de politique monétaires augmentées du taux de change et du taux d'intérêt de la zone Euro. On trouve enfin des effets de transmission monétaire en ligne avec l'hypothèse de dilemme monétaire (et donc l'influence potentielle d'un cycle financier global de façon similaire au chapitre 1) pour la Hongrie. Les effets d'interdépendance monétaire en lien avec le trilemme de politique monétaire, estimés individuellement pendant la période de politique monétaire conventionnelle, sont robustes à l'utilisation d'un taux d'intérêt shadow pour la zone Euro (à l'exception de la République Tchèque), qui prend en compte les effets des mesures quantitatives de politique monétaire, qui impactent très fortement la liquidité du système monétaire en zone Euro.

Nos résultats confirment par ailleurs l'intérêt de deux aspects de la modélisation, à savoir la pertinence des ruptures structurelles d'une part, et du modèle multivarié qui rend compte des effets de convergence nominale avec l'UEM d'autre part. La modélisation à ruptures structurelles est adaptée aux pays d'Europe Centrale et à la Bulgarie, qui disposent d'une plus grande dimension temporelle. La prise en compte des ruptures structurelles change le nombre et la nature des relations de long terme: par exemple, on ne trouve pas de transmission du taux zone Euro en République Tchèque si l'on ne modélise pas ces ruptures. Cela est particulièrement vrai pour les dates de rupture relatives à l'histoire économique domestique. La modélisation de la convergence

nominale avec l'UEM (en incluant le taux d'inflation de la zone Euro) permet elle de rendre compte d'un potentiel effet de transmission du taux d'inflation zone Euro vers la Bulgarie et la République Tchèque.

Du point de vue des recommandations de politique économique, on voit donc apparaître un coût potentiel de l'adhésion à la zone Euro plus important pour la Pologne, et moins important pour la République Tchèque et la Roumanie, du fait d'une perte d'autonomie monétaire liée à l'intégration monétaire européenne. Le cas de la Hongrie est un peu à part car ce pays serait moins autonome monétairement du fait d'un plus fort impact du cycle global financier. Une première extension possible du travail consiste à améliorer le modèle d'étude pour les pays euroisés: en effet, on ne trouve pas de réponse au degré de transmission des conditions de la politique monétaire de la zone Euro pour la Croatie. Un tel modèle pourrait être utile à d'autres pays candidats à l'Union Européenne euroisés unilatéralement tels que le Kosovo ou le Monténégro. Enfin, il serait intéressant dans un deuxième temps d'utiliser le même modèle de cointégration à ruptures structurelles sur la période 2006-2021, caractérisée par deux ruptures structurelles exogènes (la crise financière globale et la crise européenne des dettes souveraines), en prenant en compte les effets de liquidité des politiques monétaires des pays CESEE via l'estimation de taux shadow individuels (ainsi que si possible, les interventions des banques centrales sur les marchés de change).

Le troisième chapitre permet de contribuer au débat sur la participation anticipée à l'Union Bancaire relativement aux bénéfices potentiels liés au mécanisme de partage privé du risque. Nous obtenons trois séries de résultats selon que l'on considère la période d'estimation la plus longue (1978-2018), la période d'estimation centrée sur la libéralisation financière et excluant la période communiste pour les pays CESEE (1990-2018) et la période la plus récente incluant les développements relatifs aux investissements de portefeuille (2002-2018). Ces analyses convergent vers des conclusions que nous résumons ci-dessous.

Le niveau moyen de partage du risque est tout d'abord un phénomène croissant dans le temps, qu'on envisage le partage du risque au sein de l'UE-25 ou entre pays de l'UE membres de l'Union Bancaire et pays CESEE. Il s'accroît directionnellement des pays CESEE vers les pays de l'UE membres de l'Union Bancaire à partir de 2012. On observe par ailleurs que les effets additionnels des canaux financiers au partage du risque moyen sont variables dans le temps: il y a par exemple une contribution significative et positive du canal du marché de crédit si l'on considère les périodes d'estimation les plus longues. Sur la période d'estimation la plus récente, il devient non significatif et est relayé par la contribution significative et positive des investissements de portefeuille. De même, les effets bilatéraux de partage du risque sont sensibles à l'inclusion de nouveaux pays partenaires financiers, comme par exemple l'Autriche.

Si l'on considère tout d'abord les effets bilatéraux de l'appartenance à l'Union Ban-

caire sur le partage du risque, il apparaît que celui-ci est plus faible entre pays membres de l'Union Bancaire après 2012 qu'entre membres de l'UE-25. Ce résultat est robuste aux différentes périodes d'estimation, aux deux types de créances bancaires (avec un effet supplémentaire si l'on considère les créances bancaires étrangères CBS) ainsi qu'à l'inclusion de la variable de contrôle de la croissance des créances bancaires. Sur la période de libéralisation financière, l'intégration bancaire liée à l'Union Bancaire est positive et significative du point de vue du partage du risque entre pays membres de l'Union Bancaire, ce qui est un résultat intéressant qui va dans le sens d'un canal de l'intégration bancaire de l'Union Bancaire.

Si nous résumons les principaux résultats relatifs aux pays CESEE, il apparaît tout d'abord une différence d'impact entre créances bancaires transfrontières et créances consolidées sur le partage du risque idiosyncratique. L'intégration bancaire n'a pas significativement d'effet additionnel sur le risque moyen partagé vers les pays membres de l'UE quand on considère l'intégration transfrontière; elle est par contre significative et négative si l'on considère l'intégration bancaire consolidée, c'est-à-dire déterminée par la présence de banques étrangères dans les pays CESEE. Ce résultat est un élément de réponse supplémentaire concernant les effets positifs ou négatifs de l'intégration financière: la présence locale de banques étrangères amoindrirait l'efficacité du mécanisme de partage des risques. En termes de recommandation de politique économique, nous préconisons ainsi un contrôle spécifique des créances locales en devise locale.

Sur l'effet unilatéral de la non-adhésion à l'Union Bancaire sur le partage du risque entre pays CESEE et pays de l'UE membres de l'Union Bancaire, nous trouvons que cet effet est significatif mais son signe est variable selon les périodes d'estimation. Sur la période la plus récente incluant le développement des investissements de portefeuille, cet effet est négatif de 5 points mais il est plus faible que l'effet bilatéral entre pays membres de l'Union Bancaire de 20 points. Il existerait ainsi un effet de groupe significatif de 15 points de risque idiosyncratique supplémentaire partagé sur la période récente.

Si l'on cherche enfin à comparer les effets des Initiatives de Vienne à ceux de l'Union Bancaire sur le niveau de partage des risques, il est notable que leurs effets sont mieux identifiés quand ils sont estimés sur créances consolidées. Il apparaît que les deux Initiatives de Vienne impactent principalement le niveau de partage du risque moyen entre pays CESEE et pays de l'UE membres de l'Union Bancaire (et non le niveau moyen partagé au sein de l'UE-25) et qu'ils sont significatifs dans les deux sens du partage du risque bilatéral. Le niveau de partage du risque entre participants à l'Initiative de Vienne 1 est ainsi inférieur de près de 10 points au niveau moyen, et de près de 20 points entre les participants à l'Initiative de Vienne 2. La différence d'impact entre les Initiatives de Vienne et l'Union Bancaire nous laisse penser qu'une initiative multilatérale est probablement insuffisamment identifiée dans une approche bilatérale.

Tout comme pour le chapitre 1, nous souhaiterions étendre notre analyse en précisant les effets de la participation bilatérale à l'Union Bancaire en utilisant une variable

d'intensité de la participation à celle-ci. On pourrait adopter la même approche en précisant les effets d'appartenance à l'Union Européenne et à la zone Euro, en utilisant une variable reflétant les différentes dates d'adhésion.

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Membre de l'université Paris Lumières

# Léonore Raguideau-Hannotin

## **Pays d'Europe Centrale et du Sud-Est : Analyse de l'intégration financière, monétaire et bancaire avec l'Union Européenne et la zone Euro**

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sous la direction de M. Jean-Pierre ALLEGRET (Université Côte d'Azur)

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La thèse porte sur les problématiques d'intégration financière, monétaire et bancaire des pays Membres de l'Union Européenne (UE) situés géographiquement en Europe Centrale et du Sud-Est (pays CESEE), à savoir la Bulgarie, la Croatie, la Hongrie, la Pologne, la République Tchèque et la Roumanie, dans le contexte institutionnel spécifique de l'UE. Ces six pays partagent une histoire commune suite à leurs adhésions successives à l'UE dans les années 2000, après avoir précédemment partagé l'expérience socialiste comme pays membres du Bloc de l'Est entre la fin des années 1940 jusqu'en 1991, puis une période de transition vers l'économie de marché durant la décennie 1990. Ils partagent enfin une histoire plus ancienne avec leurs voisins de l'Europe du milieu situés entre l'Allemagne et la Russie: nombre de ces pays ont été annexés ou vassalisés par les Empires hasbourgeois et ottomans entre les XIV<sup>ème</sup> et XIX<sup>ème</sup> siècles, parfois pendant cinq siècles.

De par la richesse de leur histoire récente, différents processus économiques sont à l'oeuvre au sein de ces pays de façon concomitante, processus qui font l'objet de recherches en économie. En premier lieu, la transition vers l'économie de marché (processus proche de l'achèvement en 2015 tel que mesuré par les indicateurs de transition de la Banque Européenne pour la Reconstruction et le Développement); en deuxième lieu, l'intégration au commerce et aux flux de capitaux internationaux et plus particulièrement, intra-européens; en troisième lieu, la convergence nominale comme condition nécessaire à l'adhésion à la zone Euro et telle que mesurée par les critères de Maastricht; enfin, la convergence réelle au sein de l'Union Economique et Monétaire (UEM), favorisée par les transferts transnationaux via les fonds structurels et mesurée par le niveau de revenu par habitant.

Les processus d'intégration financière, monétaire et bancaire de ces économies au sein de l'Union Européenne sont particulièrement intéressants pour trois raisons principales que nous développerons dans la section suivante. Tout d'abord, un certain nombre de caractéristiques de cette intégration sont spécifiques aux pays CESEE par rapport à d'autres pays émergents, comme par exemple la détention de leurs actifs bancaires par de grands groupes bancaires européens. Par ailleurs, la récurrence de crises financières depuis trois décennies et leurs coûts macroéconomiques et financiers nous amènent à réfléchir aux effets de cette intégration sur les mécanismes d'ajustement aux chocs. Ceci paraît d'autant plus important que les pays CESEE présentent une grande variété de régimes monétaires et de change, ce qui peut induire des réponses différentes de politique économique en cas de choc. Enfin, bien que leur statut actuel vis-à-vis de l'Union Economique et Monétaire soit assez varié, l'analyse de leur intégration monétaire et bancaire permet d'apporter des éléments de réponse aux débats sur l'adhésion à la monnaie unique et sur la participation anticipée à l'Union Bancaire. Ces débats ont de l'importance à un moment où la convergence des niveaux de développement des pays CESEE avec les pays de la zone Euro, mesurée par l'évolution du revenu réel par habitant en parité de pouvoir d'achat, se ralentit depuis la crise financière globale de 2008, pour

les pays du Sud-est particulièrement (graphique 1). Les PIB réels par habitant se situent en 2019 entre 60 et 70% de la moyenne de la zone Euro (à l'exception de la République Tchèque, autour de 90% et de la Bulgarie à 50%).

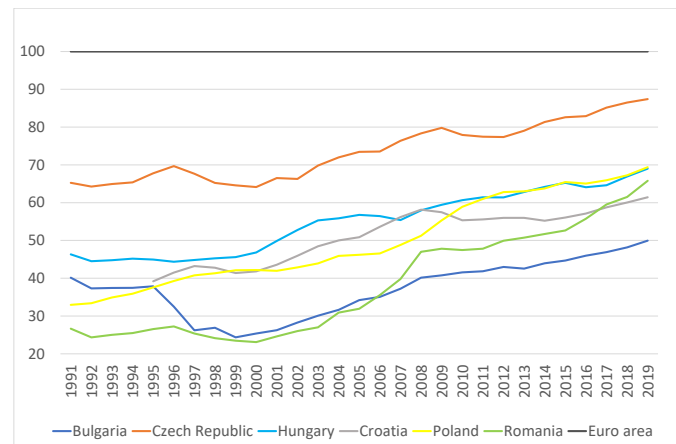


Figure 1 – Revenu réel par habitant (PPA)

Notes: Volume indices % Euro area; Source: WB World Development Indicators

Nous allons dans un premier temps définir les processus d'intégration financière, monétaire et bancaire à l'oeuvre dans les pays CESEE, en s'appuyant sur des indices synthétiques ou agrégés. Puis dans un deuxième temps, nous analyserons les vulnérabilités financières communes ainsi que l'état d'avancement du processus d'intégration européenne vers l'UEM. Etant donné ce contexte, nous développerons enfin l'état de la littérature ainsi que les motivations, stratégies empiriques et résultats des trois chapitres.

## 1 Définition et mesures de l'intégration financière, monétaire et bancaire des pays CESEE

Si l'on souhaite caractériser le niveau global d'intégration financière de ces économies en utilisant des mesures synthétiques, il existe des indices de jure et de facto de la même manière que pour la classification des taux de change. Quand on utilise une mesure de facto comme l'indice d'ouverture financière en volume de Lane and Milesi-Ferretti (2018) en graphique 2, les pays CESEE ont un degré d'ouverture deux fois moindre que la zone Euro, à l'exception notable de la Hongrie. Quand on considère une mesure de jure comme l'indice d'ouverture financière de Chinn and Ito (2006), qui reflète le degré de libéralisation des flux de capitaux, il apparaît que la majorité des pays CESEE ont atteint au début des années 2000 un degré d'intégration financière comparable à ceux des pays Membres de la zone Euro (graphique 3a). Les pays présentant actuellement le degré d'ouverture financière le plus faible sont la Pologne et la Croatie. Quel que soit l'indice d'intégration financière retenu, il apparaît néanmoins que ce phénomène est commun à tous les pays.

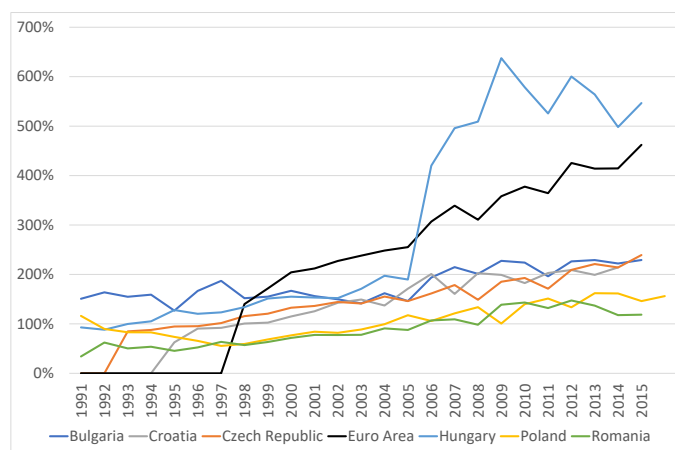
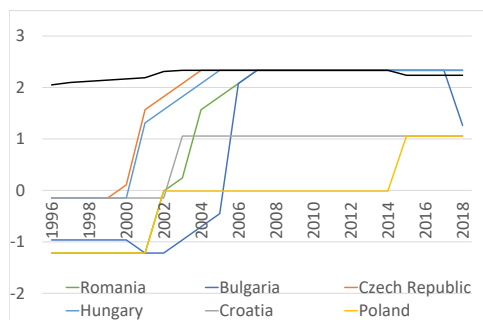


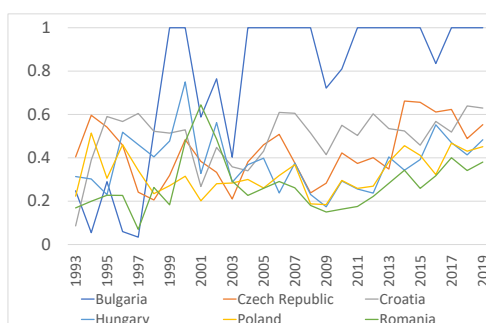
Figure 2 – Indice d'intégration financière en volume

Notes: Ratio de la somme des actifs et passifs sur le PIB, exprimé en dollar courants. Source: EWN database

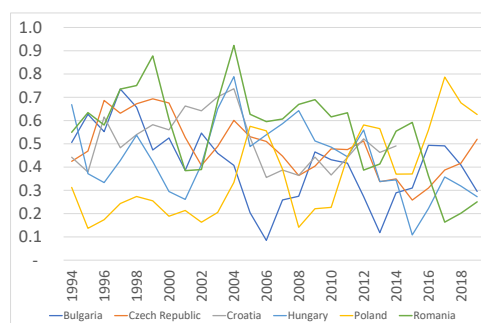
L'intégration monétaire des pays CESEE au niveau international peut elle aussi se mesurer grâce aux deux autres indices du trilemme de politique monétaire de [Aizenman, Chinn, and Ito \(2008\)](#), relatifs à la stabilité du taux de change et à l'indépendance monétaire (graphiques 3b et 3c). Il apparaît ainsi que le degré d'indépendance monétaire s'est tendanciellemeent réduit depuis 2004. La Hongrie, la Roumanie et la Bulgarie ont en 2018 l'indépendance monétaire la plus faible (indices autour de 0,3), tandis que la Pologne est la plus indépendante monétairement (indice égal à 0,65).



(a) Ouverture financière



(b) Stabilité du taux de change



(c) Indépendance monétaire

Figure 3 – Les indices du trilemme monétaire

Notes: Plus l'indice est élevé, plus le taux de change est stable, l'indépendance monétaire est forte ou l'ouverture financière élevée; Source: [Aizenman et al. \(2008\)](#)

Pour autant, l'intégration monétaire à la zone Euro recouvre une réalité différente car elle est encadrée et officiellement mesurée par des critères de convergence de Maastricht, qui donnent des niveaux de référence des variables monétaires (taux d'inflation, taux d'intérêt et taux de change) et de finance publique (dette et déficit public).

Ces critères de convergence ne donnent néanmoins pas d'information sur l'intégration monétaire effective, qui elle ne fait pas l'objet d'une mesure synthétique comme ses équivalents commerciaux ou financiers qui reposent sur des flux (ratio d'ouverture commerciale, indice d'intégration financière en volume). La question de la mesure de l'intégration monétaire des pays CESEE avec la zone Euro sera ainsi au coeur de notre deuxième chapitre.

Si l'on s'intéresse enfin au processus d'intégration bancaire des pays CESEE avec la zone Euro, on peut le caractériser comme précédemment en utilisant des indicateurs agrégés en volume, et en comparant dans un premier temps la dynamique des prêts des pays CESEE en fonction du type d'emprunteur (interbancaires d'une part et au secteur privé et gouvernement d'autre part) avec celles de la zone Euro. Cette analyse permet de déterminer si l'horizon d'intégration par les flux est de court terme ou long terme.

Pour ce faire, nous précisons tout d'abord le contexte global d'intégration bancaire au niveau intra zone Euro. Celle-ci devrait à priori être soutenue par la mise en place de l'Union Bancaire depuis 2012: pour autant, l'évolution récente des indicateurs en volumes depuis la crise financière de 2008 vont dans le sens d'une décroissance puis d'un redémarrage très lent du niveau global des prêts bancaires.

Le graphique 4, qui s'intéresse aux prêts interbancaires (qui constituent le marché professionnel des prêts entre institutions financières), montre que la proportion de ceux-ci a diminué en proportion de la totalité des prêts accordés pour les douze pays coeur de la zone Euro, particulièrement en Autriche, Belgique, Allemagne, Grèce et Chypre (avec des niveaux initiaux moyens de 30% des prêts totaux dans la période de forte croissance du crédit précédant la crise financière de 2008, qui ont été divisés par deux depuis). Par ailleurs, tel qu'indiqué dans le graphique 5, le volume global de prêts transfrontières aux secteurs privé et public hors institutions financières, n'a retrouvé son niveau de 2011 qu'en 2019. Ce phénomène de retranchement des flux bancaires en zone Euro post crise financière de 2008, voire de désintégration financière, a été identifié par la littérature ([Bouvatier and Delatte, 2015](#)).

Il n'en va pas de même pour les pays CESEE pour lesquels il apparaît en graphique 4 que la proportion de prêts interbancaires a faiblement décliné seulement sur la même période (sur une base initiale moyenne de 5% des prêts totaux). Comme nous le verrons dans notre analyse des vulnérabilités financières communes, l'intégration bancaire par les flux des pays CESEE au niveau européen ne s'est pas faite par les prêts interbancaires transfrontières comme intra zone Euro mais par une explosion des créances bancaires locales en devises locales (graphique 13), portées par des filiales de banques européennes.

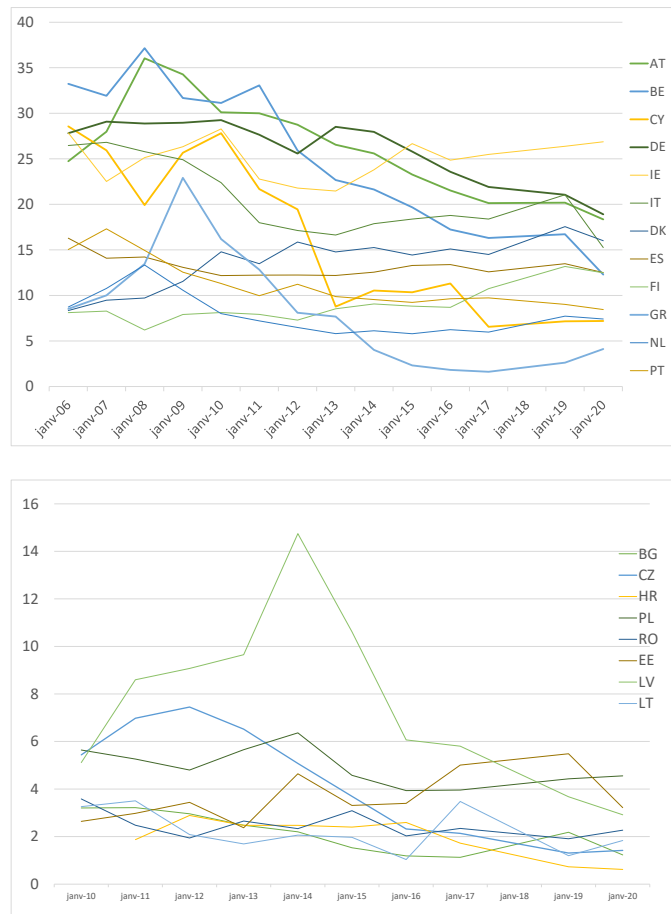


Figure 4 – Prêts interbancaires dans la zone Euro (12), dans les pays CESEE et les pays Baltes

Data source: ECB Risk Assessment Indicators; % of total loans by country LHS

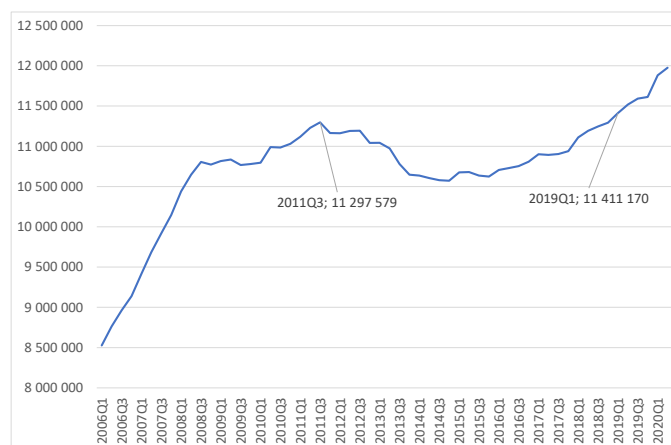


Figure 5 – Prêts bancaires aux ANF des institutions de crédit de la zone Euro, intra zone Euro: Evolution depuis 2006

Data source: ECB Balance Sheet Items, quarterly data; LHS: millions of Euros

L’horizon d’intégration bancaire des pays CESEE est donc de long terme et soutenue par la demande de crédit des secteurs privé non financier et public. Il apparaît d’ailleurs que ce type de prêts a commencé à décroître plus tardivement qu’en zone Euro (en proportion du PIB, à partir de 2012, tel qu’indiqué par les statistiques agrégées du WDI de la Banque Mondiale), ce qui est en faveur d’un cycle de crédit différent entre pays CESEE et pays de la zone Euro.

## 2 Importance des vulnérabilités financières et de l’intégration européenne

Après avoir rappelé la succession de crises financières depuis le début des années 1990 et leurs impacts sur la volatilité de la croissance économique, nous allons préciser certains faits stylisés relatifs à l’intégration financière et bancaire des pays CESEE, à savoir l’accumulation de vulnérabilités financières, des caractéristiques structurelles des systèmes bancaires communes, avant de préciser leur statut actuel vis-à-vis de l’UEM.

L’histoire économique récente des pays CESEE a été marquée par une forte occurrence de chocs financiers, de type et de nature variés (structurels, conjoncturels, idiosyncratiques, globaux). Le tableau 1 en annexe récapitule les dates de ces crises telles qu’estimées par [Laeven and Valencia \(2008\)](#) et [Reinhart, Rogoff, and Cabot \(2008\)](#) pour les crises bancaires et les crises de change, et par [Forbes and Warnock \(2012\)](#); [Eichengreen and Gupta \(2016\)](#); [David and Gonçalves \(2019\)](#) pour les épisodes de tarissement des flux de capitaux internationaux ou sudden stops. Chaque méthodologie a ses spécificités pour dater les crises, mais il apparaît néanmoins que les années 1990 sont marquées par des crises bancaires et des défauts souverains, qui durent souvent plusieurs années, au début de la période de transition vers l’économie de marché. Elles sont suivies de crises de change en Bulgarie, Roumanie et République Tchèque, qui conduisent à un changement de régime de change pour la Bulgarie. Les crises financières changent ensuite de nature durant les années 2000 et deviennent presque exclusivement des sudden stops. La décennie des années 2010 fait suite à la crise financière globale en 2008-2009 qui a provoqué des crises de balance des paiements en Hongrie et en Roumanie, qui ont nécessité une aide conjointe du FMI et de l’Union Européenne. Certains pays CESEE ont aussi été confrontés à la réapparition de crises bancaires domestiques (Bulgarie) et des phénomènes globaux de tarissement des flux de capitaux internationaux (en 2013 et en 2015), à l’origine de dépréciations des monnaies domestiques et d’une plus grande volatilité de la croissance du PIB (Croatie, Hongrie, République Tchèque). Si l’on s’intéresse au coût macroéconomique de ces crises, en menant une analyse standard des taux de croissance du PIB réel et de leurs volatilités au graphique 6, il apparaît une instabilité de la croissance économique, avec un taux de croissance fortement volatil (en absolu et en relatif par rapport à l’Allemagne, qui a connu la réunification). Par ailleurs, il y a eu une baisse très marquée de celui-ci lors de la crise financière globale de 2008, supérieure à celle observée dans d’autres pays émergents ([Allegret, 2012](#)).

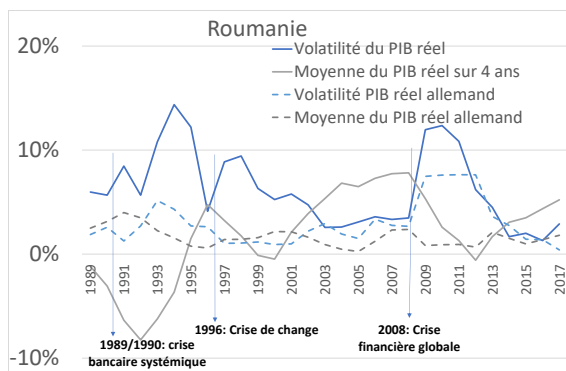
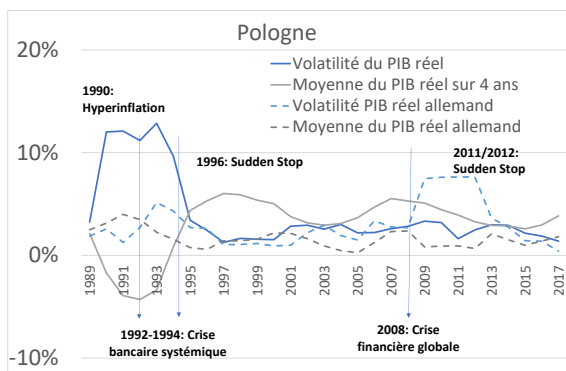
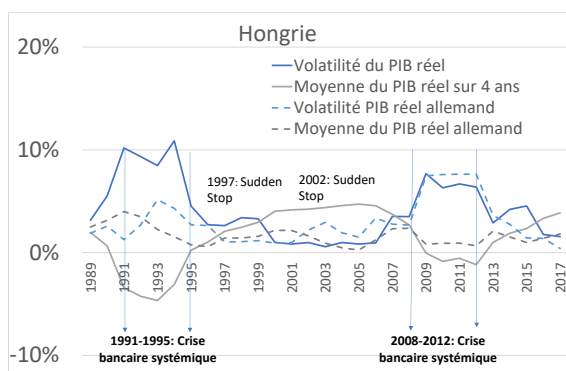
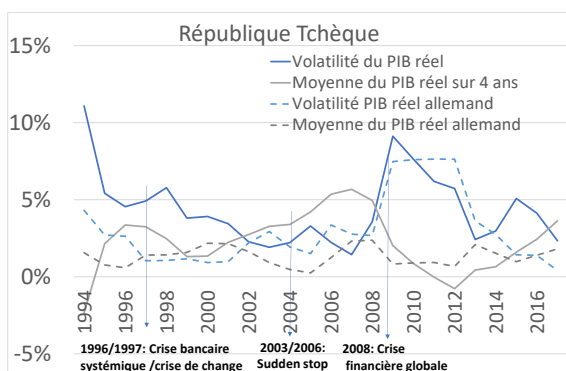
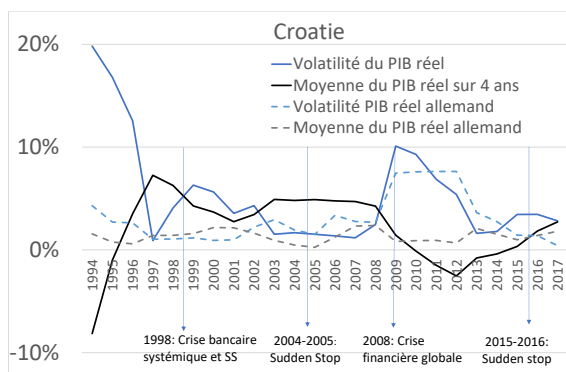
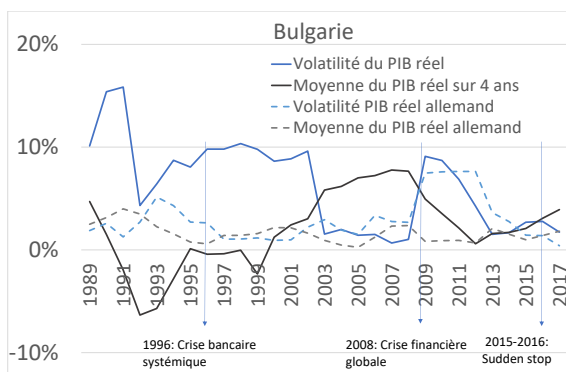


Figure 6 – Taux de croissance et volatilité annuels du PIB réel par habitant et par pays

Notes: Volatilité calculée comme l'écart-type du taux de croissance moyen du PIB réel sur les quatre années précédentes, glissantes au cours de la période; Source PIB réel et population : PWT

Les décennies 1990 et 2000 ont aussi été marquées par la libéralisation financière, particulièrement du compte de capital. La vitesse de libéralisation a été variable selon les pays et souvent fonction des perspectives d'adhésion à l'OCDE et à l'Union Européenne (Arvai, 2005). La République Tchèque fait partie des pays qui ont le plus rapidement ouvert leur compte de capital, tandis que la Hongrie, la Pologne ont été plus prudents dans leur ouverture aux capitaux étrangers. Les pays CESEE ont connu une forte dégradation de leur position extérieure nette entre 1990 et 2009, tout d'abord sous la forme d'entrées nettes massives d'investissements directs à l'étranger dans la décennie 1990, puis à cause du poids des créances bancaires transfrontières (graphique 7). Cette dépendance extérieure est par ailleurs caractérisée par une forte concentration géographique des pays investisseurs et créanciers dans l'Union Européenne.

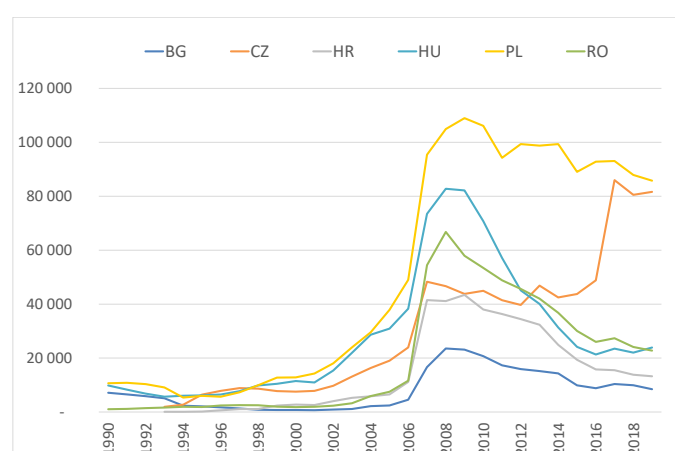


Figure 7 – Créances bancaires transfrontières

Notes: en millions de dollars US; Source: Fond Monétaire International

Cette libéralisation financière a permis à un certain nombre de grands groupes bancaires européens de prendre des participations dans les banques des pays CESEE, lors des vagues de privatisations au début de la période de transition. Les actifs bancaires sont ainsi majoritairement détenus par des groupes bancaires européens. Hüttl and Schoenmaker (2016) précisent qu'entre 55 et 75% des actifs bancaires étrangers trouvent leur origine dans les pays de la zone Euro. Le graphique 9 qui s'intéresse à la période 2007-2019 nous montre qu'il existe deux groupes de pays distincts: d'une part, la Hongrie et la Pologne dont les actifs bancaires sont détenus pour moitié par des investisseurs étrangers (avec un fort mouvement de renationalisation bancaire depuis la crise financière globale de 2008). D'autre part, la Bulgarie, la Croatie, la République Tchèque et la Roumanie dont la proportion de détention étrangère des actifs bancaires varie entre 75 et 90%. Dans les deux cas, ces niveaux de détention étrangère des actifs bancaires sont bien supérieurs au niveau moyen au sein de la zone Euro et de l'UE, respectivement à 15 et 20% en 2019.



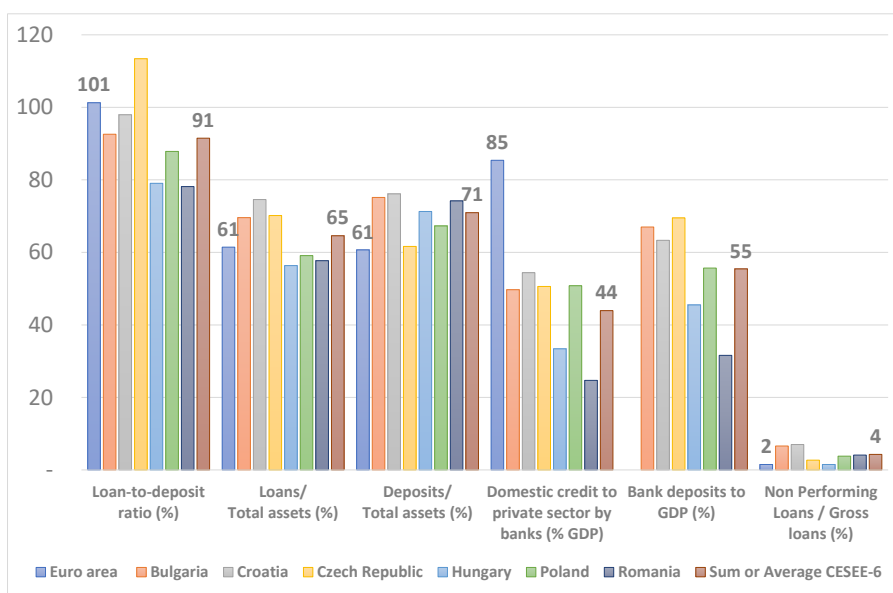


Figure 8 – Caractéristiques des systèmes bancaires en 2019  
Source: Statistiques bancaires consolidées de la BCE

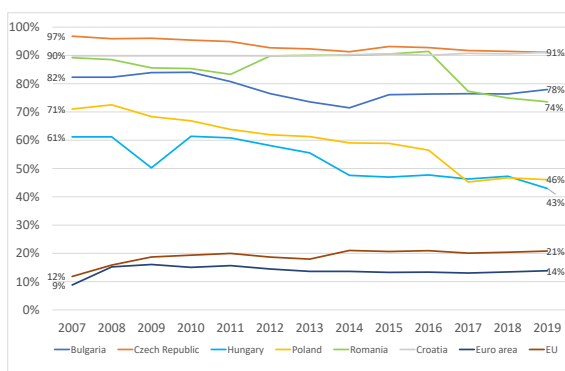


Figure 9 – Détention étrangère des actifs bancaires (% total actifs)  
Source: Statistiques bancaires consolidées de la BCE

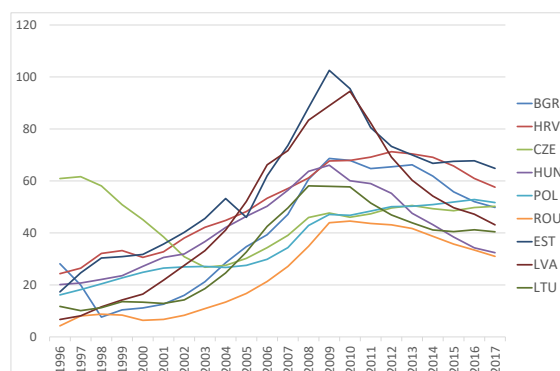


Figure 10 – Crédit domestique (% PIB)  
Légende: ISO3-codes;  
Source: WB Global Financial Development

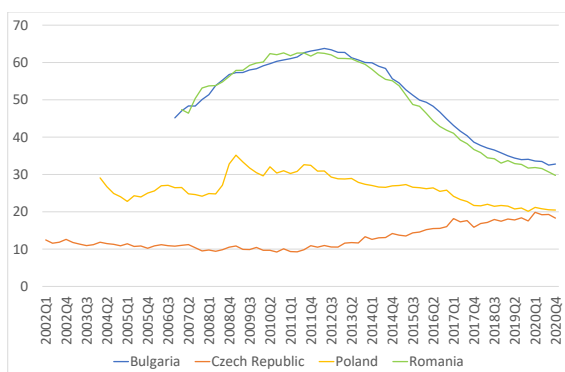


Figure 11 – Prêts en devise étrangère (% volume total prêts)  
Source: ECB SDW

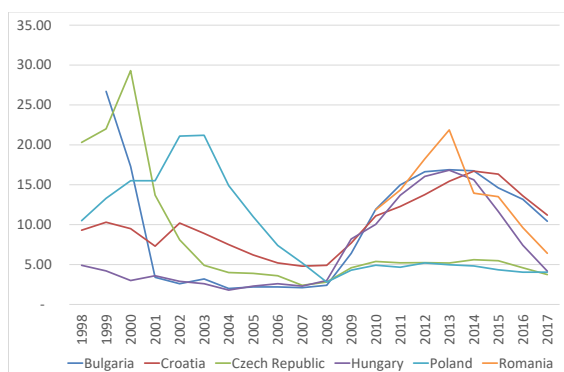


Figure 12 – Prêts non performants (% volume total prêts)  
Source: WB WDI

Enfin, si l'on compare les secteurs bancaires des pays CESEE avec celui de la zone Euro, il est notable que la taille des secteurs bancaires (en volume et relativement au PIB) est très inférieure de celle de la zone Euro. En 2019, les actifs bancaires des six pays CESEE représentent 1.13 trillion d'euros, alors qu'au niveau de l'UE ils représentent près de 43 trillions d'euros. Il apparaît aussi que certains ratios de liquidité (ratio prêt/dépôt) ou de financement (ratio dépôts/actif, ratio prêts/actifs) convergent vers voire dépassent la moyenne de la zone Euro. Les dépôts couvrent désormais presque intégralement les prêts. L'ensemble de ces indicateurs sont résumés pour l'année 2019 dans le graphique 8.

Néanmoins, d'autres indicateurs identifiés dans la littérature comme des vulnérabilités financières (Ghosh, Qureshi, Kim, and Zalduendo, 2014) tels que les volumes de crédit domestique au secteur privé ou le niveau des prêts en devises étrangères, diffèrent nettement de ceux de l'Union Européenne, en particulier leur dynamique. En effet, le modèle de financement externe de ces économies ainsi que les caractéristiques structurelles de leurs systèmes bancaires ont entraîné une croissance excessive du crédit bancaire domestique privé. La détention massive des actifs bancaires par de grands groupes européens a rendu inopérantes les politiques microprudentielles de contrôle du crédit dans la période précédant la crise financière de 2008. Le graphique 10 montre qu'en moyenne le poids du crédit domestique en proportion du PIB a triplé entre 2000 et 2010, voire quintuplé pour la Bulgarie, la Hongrie et la Roumanie.

Deux dynamiques distinctes ont été à l'oeuvre qui ont renforcé les vulnérabilités financières liées au crédit bancaire:

- en premier lieu, une forte croissance des créances libellées en devises étrangères (graphique 11), en particulier en Hongrie, en Roumanie et en Bulgarie, qui a créé de larges positions de change non couvertes au passif des ménages.

- en second lieu, une croissance exponentielle des prêts locaux en monnaie locale octroyés par les filiales de banques étrangères, dont on voit la dynamique dans les statistiques bancaires consolidées de la BRI (graphique 13). L'extension de ce type de créances est un fait stylisé commun aux pays émergents, mais l'ampleur du phénomène dans les pays CESEE est caractéristique.

Ces phénomènes sont à l'origine d'une forte augmentation des prêts non-performants après la crise financière de 2008 (graphique 12): ils ont représenté jusqu'à 17% en moyenne du portefeuille de prêts en 2012-2013.

Ces vulnérabilités financières caractéristiques des pays CESEE ont fait l'objet de suivis et de politiques de réduction spécifiques, voire même de restructuration/conversion du portefeuille au niveau national (Hongrie), qui ont été efficaces très rapidement. Le niveau de prêts non performants ne représente plus en 2019 que 4% du portefeuille en moyenne, ce qui correspond néanmoins au double du niveau moyen européen.

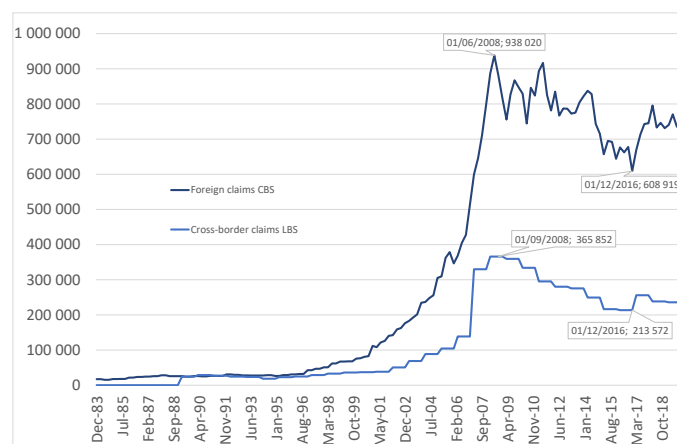


Figure 13 – Evolution des créances bancaires transfrontières et consolidées agrégées  
Unité: Millions de dollars US ; Source: Statistiques bancaires territoriales et consolidées de la BRI

Si l'on s'intéresse finalement aux situations de chaque pays vis-à-vis de l'Union Economique et Monétaire, ces Etats Membres ne font actuellement pas partie de la zone Euro et sont censés à terme adhérer à la monnaie unique en vertu du Traité instituant l'UE. Certains pays sont néanmoins plus avancés que d'autres dans le processus d'adhésion à l'euro. La Bulgarie et la Croatie, en régimes de change fixe ou quasi fixe, participent au Mécanisme de change européen (MCE II) depuis juin 2020, récemment renforcé par l'obligatoire participation anticipée à l'Union Bancaire. Les autres pays, en régimes de change flottant ou intermédiaire, n'ont quant à eux pas donné de date cible de candidature au MCE II (à l'exception de la Roumanie qui indiquait en 2018 vouloir candidater en 2026). En termes de convergence nominale mesurée par les critères de Maastricht en juin 2020, les performances nationales sont contrastées, en particulier en termes d'inflation.

Concernant la possibilité de participation anticipée à l'Union Bancaire, facultative pour les pays Membres de l'UE hors MCE II, celle-ci n'a pas été retenue par les autres pays CESEE. L'Union Bancaire a été créée en septembre 2012 en réponse à la crise des dettes souveraines dans l'Union Européenne et repose sur quatre piliers: le Règlement uniforme, la Supervision unique, la Résolution unique et la Garantie des dépôts bancaires. La participation anticipée consiste en une coopération rapprochée avec la BCE en matière de supervision bancaire et une adhésion au Mécanisme de Résolution Unique (et en particulier, l'abondement au Fonds de Résolution Unique). Les pays CESEE participent pourtant depuis 2008 à l'Initiative de Vienne, qui a instauré une coopération multilatérale en matière bancaire depuis la crise financière globale.

Les motivations des chapitres présentées ci-après sont ainsi liées aux vulnérabilités financières communes et au processus d'intégration européenne. Si le premier chapitre cherche à caractériser les flux de prêts bancaires vers les pays CESEE pour orienter les

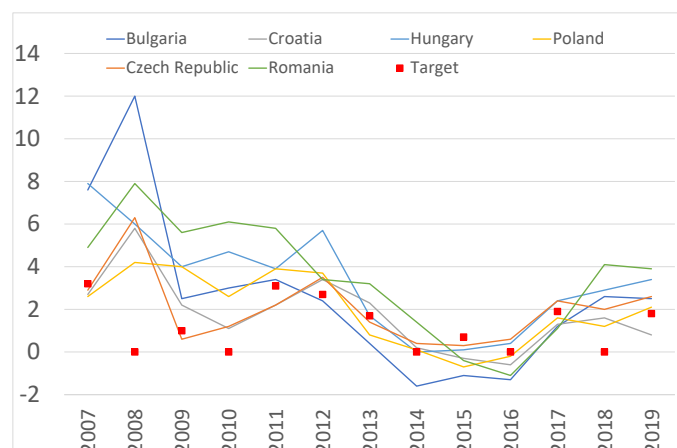


Figure 14 – Taux d'inflation harmonisés et références des rapports de Convergence  
Source: INSEE

choix de politiques économiques en cas de choc, les chapitres deux et trois s'attachent à montrer les interactions existant entre l'intégration financière et monétaire et les mécanismes d'ajustement aux chocs (politique monétaire, partage du risque).

### 3 Etat de la littérature et motivations de la recherche

La motivation du premier chapitre est d'analyser les déterminants des vulnérabilités externes d'origine bancaire des pays CESEE pour proposer des réponses de politiques publiques adaptées.

Tout d'abord, les faits stylisés développés dans la section 2 de cette introduction font apparaître une forte interdépendance financière et bancaire des pays CESEE avec l'Union Européenne (en particulier leur modèle bancaire), qui s'est faite de façon concomitante avec une augmentation des vulnérabilités financières. Un autre fait stylisé développé dans le chapitre sous-tend le choix des créances bancaires transfrontières comme variable d'intérêt. L'analyse agrégée de la position extérieure nette de ces pays montre une forte dégradation de celle-ci jusqu'à la crise financière globale. La décomposition des engagements dans le temps montre une surpondération des IDE pendant la décennie 1990, et une forte accélération du poids des crédits transfrontières pendant la décennie 2000. Si la tendance actuelle est à la progression du poids des investissements de portefeuille, les créances transfrontières permettent de mener une analyse de long terme, qui est l'horizon d'étude de cette thèse.

Par ailleurs, s'il existe beaucoup de statistiques relatives aux créances bancaires, il existe comparativement peu de littérature spécifique sur les mouvements internationaux de capitaux bancaires vers les pays CESEE. Plus précisément, les pays CESEE sont souvent inclus comme pays destinataires des flux de capitaux bancaires dans les études

empiriques sur l'UE ou les pays émergents (Milesi-Ferretti, Strobbe, and Tamirisa, 2010), qui parfois adoptent une modélisation de type gravitaire (Bouvatier and Delatte, 2015; Herrmann and Mihaljek, 2011; Emter, Schmitz, and Tirpák, 2019). Quelques exceptions récentes s'intéressent aux déterminants des flux de capitaux (particulièrement bancaires) vers les pays CESEE (Braná and Lahet, 2012; Eller, Huber, and Schuberth, 2016) et complètent une littérature centrée sur les flux de capitaux avant la crise de 2008, particulièrement sur les IDE (Arvai, 2005; Bakker and Gulde, 2010; Buch, Kokta, and Piazzolo, 2003; Lane and Milesi-Ferretti, 2007; von Hagen and Siedschlag, 2008).

Au contraire, il existe une littérature abondante sur les déterminants des flux de capitaux dans les pays émergents qui va nous guider dans nos analyses. Un pan de cette littérature s'intéresse aux facteurs propres aux économies domestiques, ou facteurs "pull", tels que le taux d'intérêt réel, le taux de change réel, le régime de change, ainsi que la taille, l'ouverture et la fragilité du système financier. Les facteurs qui se transmettent des pays développés vers les pays émergents, tels que la croissance du PIB de l'économie dominante, les conditions de liquidité ou l'aversion au risque, sont des facteurs dits "push": ils sont récemment analysés dans Cerutti, Claessens, and Puy (2019). Enfin, le poids des facteurs globaux, tels que le cycle financier global (identifié par Rey (2013) et revisité par Cerutti, Claessens, and Rose (2018)) a pris de l'importance dans la littérature récente.

La motivation du deuxième chapitre est de comprendre les différents stades d'avancement des pays CESEE dans le processus d'adhésion à l'euro.

Un argument en faveur du statu quo vis-à-vis de l'adhésion à l'euro est que les pays CESEE ont largement eu recours à la politique monétaire comme mécanisme d'ajustement aux crises financières récentes. Concernant la crise financière globale de 2008, Gallego, Gardó, Martin, Molina, and Serena (2010) précisent que les réponses de politique monétaire ont été moins rapides que dans les pays de la zone Euro du fait d'une inflation plus prononcée, mais que les baisses des taux directeurs sont néanmoins intervenues à partir de la fin 2008. Ishi, Stone, and Yehoue (2009) recensent l'ensemble des politiques non conventionnelles utilisées par ces pays: il s'agit principalement d'injections de liquidités dans le système bancaire (baisse des réserves obligatoires, modifications des conditions de collatéral) et d'interventions sur le marché des changes (Hongrie, Pologne, Roumanie). Ces pays ont aussi eu recours, pour la première fois pour la plupart d'entre eux, à des politiques quantitatives d'achats d'actifs lors de la crise du Covid-19 (Magyar Nemzeti Bank, 2020). Enfin, certains pays comme la Hongrie ont utilisé très activement la politique monétaire dans leur gestion des prêts en devise étrangère, en allant jusqu'à modifier leurs instruments de référence (swaps de change).

Un argument en faveur de l'accélération du processus d'adhésion à l'euro est que l'autonomie monétaire des pays CESEE est théoriquement compromise par l'existence des dilemme (Rey, 2013), trilemme (Aizenman et al., 2008; Mundell, 1963; Obstfeld,

2015) voire quadrilemme (Aizenman, 2011) de politique monétaire. Le trilemme de la politique monétaire de Mundell-Fleming énonce la compatibilité de seulement deux objectifs sur trois entre la stabilité du taux de change, l'indépendance de la politique monétaire et la libre circulation des capitaux. Le dilemme de politique monétaire énoncé par Rey (2013) est que la politique monétaire ne peut être indépendante en l'absence de contrôle des capitaux ou, plus largement, de mesures macroprudentielles, quel que soit le régime de change, du fait de l'existence d'un cycle financier global. Que l'on considère le trilemme ou le dilemme de politique monétaire, les processus d'intégration financière et de convergence nominale avec l'UEM tels que décrits plus haut sont des facteurs théoriquement limitatifs de l'autonomie monétaire pour ces pays.

La littérature empirique ne donne pas de réponse claire sur la problématique que nous soulevons. L'autonomie monétaire des pays CESEE vis-à-vis de la zone Euro a fait l'objet d'études empiriques dans un cadre de long terme de transmission internationale des taux d'intérêt (entre autres Camarero, Ez, and Tamarit (2002); Holtemöller (2005)) et qui a alors pour corollaire la stationnarité du taux de change. Si l'utilisation de la PTINC comme modèle empirique univarié de long terme est justifiée (Chinn and Meredith, 2004), l'étude des propriétés des séries de taux de change des pays CESEE montre néanmoins que ces séries ne sont pas stationnaires. Par ailleurs, ces études ne modélisent pas le cadre de convergence nominale de ces pays avec la zone Euro.

La motivation du troisième chapitre est d'analyser l'impact de l'adhésion à l'Union Bancaire sur le mécanisme de partage du risque. En effet, ce point n'est pas débattu dans la littérature sur la participation anticipée des pays CESEE à l'Union Bancaire. Celle-ci s'est surtout concentrée sur les risques institutionnels existant pour les pays CESEE (Darvas and Wolff, 2013; Howarth and Quaglia, 2016; Hüttl and Schoenmaker, 2016) et non sur les bénéfices économiques de l'adhésion à l'Union Bancaire, particulièrement en termes d'ajustement et d'intégration. En l'absence d'un système de transfert budgétaire au niveau européen, le mécanisme de partage du risque est pourtant un mécanisme d'ajustement aux chocs domestiques par les marchés internationaux de capitaux et de crédit, potentiellement intéressant pour les pays CESEE très intégrés à l'Europe bancaire.

Celui-ci se fait par le lissage de la consommation et du revenu des ménages via les canaux budgétaires et financiers, qui compensent les pertes salariales liées au choc sur le produit. Le partage du risque s'opère via trois canaux principaux (Asdrubali, Sorensen, and Yosha, 1996): les revenus internationaux du capital liés à la détention de titres financiers non affectés par le choc idiosyncratique, les transferts budgétaires et l'ajustement du comportement d'épargne (et le recours à l'endettement rendu possible grâce au marché du crédit). Le partage du risque au sein de la zone Euro fait l'objet de recherches empiriques récentes (European Central Bank, 2018; Ioannou and Schäfer, 2017), qui cherchent à estimer le niveau effectif du partage du risque. Deux méthodolo-

gies principales permettent une telle estimation: la première consiste à décomposer la variance des chocs sur le produit en utilisant des identités de comptabilité nationale qui permettent l'identification des différents revenus (Dufrenot, Gossé, and Clerc, 2020; Poncela, Pericoli, and Manca, 2016; Sørensen and Yosha, 1998). La deuxième méthode consiste à estimer le niveau moyen de partage du risque (principalement le lissage de la consommation) puis les effets des différents canaux de l'intégration financière en utilisant des variables relatives aux mouvements effectifs de capitaux entre économies. (Cimadomo, Ciminelli, Furtuna, and Giuliadori, 2020; Kose, Prasad, and Terrones, 2009; Lewis, 1996).

Pour autant, l'impact de l'adhésion à l'Union Bancaire sur le partage du risque au niveau européen ne fait pas à notre connaissance l'objet d'étude empirique, alors même que celle-ci a théoriquement des effets directs et indirects sur le niveau et l'allocation du partage du risque. La revue de ces différents canaux de transmission, l'estimation des effets bilatéraux et unilatéraux de la participation à l'Union Bancaire ainsi que la comparaison avec un autre type de coopération multilatérale bancaire que sont les Initiatives de Vienne seront les principaux objectifs de notre troisième chapitre.

## 4 Questions de recherche et contributions

La question de recherche énoncée dans le premier chapitre est de caractériser l'intégration financière des pays CESEE en estimant les déterminants des créances transfrontières. Notre contribution à la littérature est triple: nous estimons un modèle bilatéral de gravité spécifiquement sur le stock de créances transfrontières détenues sur les pays CESEE. Nous estimons par ailleurs les déterminants bilatéraux, individuels (domestiques-pull et externes-push) et globaux de ces capitaux bancaires. Cela est rendu possible par l'utilisation de données bilatérales brutes et nous rattache ainsi à la littérature sur l'importance des capitaux bruts par rapport aux capitaux nets (Forbes and Warnock, 2012). Le modèle avec combinaisons d'effets fixes que nous utilisons permet enfin une estimation sans biais de l'effet institutionnel de l'adhésion à l'Union Européenne d'une part et de la proximité réglementaire entre pays d'autre part.

La question de recherche énoncée dans le deuxième chapitre est de tester et mesurer l'autonomie monétaire des pays CESEE vis-à-vis de la zone Euro, dans le cadre de la convergence nominale avec l'UEM. Nous faisons l'hypothèse que les autorités craignent la perte de deux instruments de politique monétaire, à savoir le taux directeur et les interventions sur le marché des changes. Notre contribution à la littérature est triple: nous utilisons un modèle empirique original sous la forme d'un modèle multivarié de long terme (modèle vectoriel à correction d'erreur - VECM) que nous estimons par pays. Ce modèle est robuste aux ruptures structurelles caractéristiques des séries macroéconomiques des pays CESEE, ce qui permet de mener une analyse de politique monétaire standard. Enfin, nous modélisons la convergence nominale dans l'UEM en

incluant des variables de politique monétaire de la zone Euro dans le système de cointégration qui inclut le taux de change nominal.

La question de recherche du troisième chapitre est d'identifier les effets bilatéraux et unilatéraux de l'Union Bancaire sur le partage du risque en zone Euro et avec les pays CESEE. Le corollaire est de savoir si les effets de transmission de l'Union Bancaire aux pays CESEE, s'ils existent, sont comparables à ceux des Initiatives de Vienne. Notre contribution à la littérature est triple: tout d'abord, nous utilisons des données financières bilatérales (bancaires, investissements de portefeuille) rendant possible cette identification. Nous mettons ensuite en oeuvre deux modélisations robustes aux corrélations inter-individuelles caractéristiques des panels macroéconomiques. Enfin, nous estimons les effets de l'Union Bancaire sur deux types de créances spécifiques aux pays CESEE, à savoir les créances transfrontières des Statistiques bancaires territoriales (LBS) de la Banque des Règlements Internationaux (BRI) et les créances étrangères des Statistiques bancaires consolidées (CBS) de la BRI (graphique 13).

## 5 Stratégies empiriques

Nos stratégies empiriques sont basées sur des modèles d'économie internationale et monétaires dont les fondements théoriques ou les méthodes d'estimation ont été récemment revisités. Elles s'appuient sur des approches économétriques robustes aux données macroéconomiques des pays CESEE caractérisées par des ruptures et souvent une non stationnarité d'une part; aux panels macroéconomiques qui présentent de la corrélation inter-individuelle, d'autre part.

La stratégie empirique du premier chapitre est ainsi basée sur un modèle de gravité multiplicatif adapté aux flux financiers qui s'apparente au modèle de gravité des flux commerciaux de [Anderson and van Wincoop \(2003\)](#) étendu par [Okawa and van Wincoop \(2012\)](#) et que nous estimons sur données de panel. Dans ce modèle, les échanges financiers sont proportionnels à la taille des économies et inversement proportionnels à un ensemble de frictions à l'échange. La variable dépendante est le niveau des créances bancaires transfrontières, tous secteurs, dans un pays de destination, déclaré par des banques étrangères d'un pays d'origine. Ces données bilatérales sont issues des Statistiques bancaires territoriales de la BRI: les pays d'origine ne se limitent pas à la zone Euro et incluent tous les pays déclarants. Nous estimons trois spécifications qui permettent d'identifier successivement, via des combinaisons d'effets fixes par pays ou par paire de pays, les déterminants bilatéraux invariants, variables puis les déterminants individuels variables de ces créances. L'estimateur du modèle est un estimateur non linéaire de type pseudo-vraisemblance d'une loi de Poisson ([Santos Silva and Tenreyro, 2006](#)), dont la spécificité est d'associer le même poids à chaque observation. Nos résultats sont en référence à deux périodes distinctes, en fonction de la disponibilité des données: l'une



avec une grande hétérogénéité temporelle (1990-2019), l'autre sur données plus récentes (1996-2019).

La stratégie empirique du deuxième chapitre se fonde sur la théorie de la cointégration, c'est-à-dire sur le fait que des variables économiques non stationnaires peuvent être dans une relation d'équilibre de long terme, vers lequel elles convergent grâce à une force de retour à la moyenne (à savoir le terme de correction d'erreur). Nous adoptons l'approche multivariée de [Johansen, Mosconi, and Nielsen \(2000\)](#), qui est une extension du modèle traditionnel de [Johansen \(1995\)](#) avec des ruptures déterministes à la fois dans le niveau et la tendance des variables, mais aussi dans l'espace de cointégration. Le choix des variables s'inspire du modèle vectoriel autorégressif (VAR) monétaire de [Peersman and Mojon \(2001\)](#) augmenté des taux directeur et d'inflation de la zone Euro et d'une tendance déterministe. Nous estimons quatre modèles vectoriels à correction d'erreur par pays, sur des périodes individuelles allant des années 1990 à la fin 2014: un modèle avec ruptures, un modèle sans rupture, un modèle avec ruptures qui inclut le taux d'inflation de la zone Euro, et un modèle de robustesse des résultats à la politique monétaire quantitative en zone Euro qui utilise le taux court shadow de [Krippner \(2015\)](#).

La stratégie empirique du troisième chapitre se base sur un modèle bilatéral de partage du risque (plus particulièrement de lissage de la consommation), où le partage du risque idiosyncratique se fait entre un pays d'origine et un pays de destination. Nous estimons ce modèle sur des données de panel non cylindrées, en identifiant les effets des différents canaux financiers (Union Bancaire, marchés de crédit et marchés de capitaux) du partage du risque via des termes d'interaction. Notre approche rejoint celles mises en oeuvre par [Lewis \(1996\)](#); [Kose et al. \(2009\)](#) que nous avons décrite en section 3 et plus récemment par [Cimadomo et al. \(2020\)](#) pour la dimension individuelle bilatérale.

Nous faisons le choix d'une double stratégie d'identification pour deux raisons. Tout d'abord, il existe des corrélations inter-individuelles dans les panels macroéconomiques qu'on peut corriger de deux façons et comparer. Nous utilisons donc successivement deux estimateurs: l'estimateur à effets fixes temporels et individuels (usuellement utilisé dans la littérature) avec correction des écarts-type de [Driscoll and Kraay \(1998\)](#), puis l'estimateur à effets communs corrélés de [Pesaran \(2006\)](#) qui permet de purger les effets globaux et ainsi d'identifier le risque idiosyncratique. En second lieu, le traitement de l'hétérogénéité individuelle inobservée par effets fixes peut capturer une proportion d'effets idiosyncratiques et ainsi rendre leur identification difficile. C'est en effet ce que nous observons dans la première étape de notre analyse, ce qui nous pousse à retenir l'identification par les facteurs communs.

Concernant la dimension individuelle du panel, nous menons des analyses sur deux groupes de pays. Tout d'abord, nous analysons le partage du risque au sein de 25 pays membres de l'Union Européenne soit les 19 pays de l'Union Bancaire et les 6 pays

CESEE qui n'appartiennent pas à l'Union Bancaire. Ceci nous permet d'identifier des effets bilatéraux et unilatéraux de la participation à l'Union Bancaire. Puis nous étudions le partage du risque entre les pays de l'Union Bancaire et les pays CESEE seulement, c'est-à-dire en excluant les pays de l'Union Bancaire des pays destinataires. Ceci nous permet d'identifier les effets directionnels de partage du risque entre l'Union Bancaire et les pays CESEE, selon qu'ils soient l'origine ou la destination de ces capitaux. Les pays CESEE n'étant pas des pays déclarants, nous utilisons dans le cas des données LBS les engagements des banques résidentes dans les pays CESEE comme les avoirs des banques dans les pays CESEE sur les pays de l'Union Bancaire, suivant de ce point de vue la démarche de [Brei and von Peter \(2018\)](#).

La dimension temporelle est un enjeu spécifique de notre modélisation pour deux raisons. D'une part, les données relatives à la période socialiste peuvent ne pas être fiables. D'autre part, les données bilatérales d'investissements de portefeuille sont disponibles annuellement à partir de 1998 seulement. Nous estimons donc notre modèle sur la période la plus longue (1979-2018), puis sur la période de libéralisation financière en excluant les données de l'époque socialiste (1990-2018); enfin, sur la période 2002-2018 qui permet l'identification des effets du canal des marchés de capitaux. Dans les trois cas, il nous faut privilégier un modèle parcimonieux pour avoir un degré suffisant de liberté et assurer la convergence de l'estimateur.

## 6 Résultats

Les différents chapitres de la thèse ont permis d'apporter un certain nombre de réponses sur les degrés et les déterminants des différents processus d'intégration financière, monétaire et bancaire à l'oeuvre dans les pays d'Europe Centrale et du Sud-Est, ainsi que sur les interactions existant entre intégration financière et mécanismes d'ajustement aux chocs.

Les stratégies empiriques ont été choisies pour permettre l'analyse sur longue période des pays CESEE, caractérisés depuis la fin des années 1990 par une transition vers l'économie de marché, puis une libéralisation financière et enfin une convergence nominale et réelle vers l'Union Economique et Monétaire. Nous avons traité la question de l'intégration financière et bancaire dans les chapitre 1 et 3 en utilisant des données de panel bilatérales, qui nous permettent tout d'abord de travailler sur les volumes bruts et effectifs de cette intégration; puis d'augmenter considérablement le nombre de données (et donc d'information) sur ces pays pour lesquels la dimension temporelle fiable est sinon de l'ordre de 30 ans. Les développements d'une économétrie des données de panel robuste aux effets communs inobservés propres aux panels macroéconomiques nous permettent d'estimer le modèle empirique de partage du risque idiosyncratique de façon robuste. Concernant le deuxième chapitre, l'utilisation d'une méthodologie de cointégra-

tion à ruptures structurelles nous a permis d'obtenir des résultats robustes aux ruptures endogènes dans les données.

Si l'on résume tout d'abord les principaux résultats du modèle de gravité bilatéral estimé dans le premier chapitre, les rôles significatifs joués par les variables de faible distance, d'histoire commune et d'appartenance à l'Union Européenne pointent tous vers l'importance des liens intra-européens comme facteurs de croissance des créances bancaires transfrontières sur la plus longue période d'estimation (1990-2019). Sur la période d'estimation plus courte (1996-2019), l'équation de gravité augmentée de variables relatives aux caractéristiques et à la santé des systèmes bancaires souligne la significativité et l'importance des conditions bancaires domestiques des pays d'origine (facteurs push), ce qui est un résultat en ligne avec le très haut niveau de détention des actifs bancaires par les groupes bancaires européens.

Concernant l'influence des facteurs domestiques des pays CESEE, les variables relatives à la concentration du système bancaire et du niveau de capital réglementaire sont significatives et des facteurs limitants des créances. Le rôle de la réglementation bancaire pourrait néanmoins être clarifié puisque l'indice bilatéral reflétant la distance réglementaire entre deux pays n'est pas significatif. L'impact négatif de la concentration bancaire sur les créances transfrontières supporte quant à lui l'existence d'un effet positif de l'intégration bancaire sur les systèmes bancaires des pays débiteurs décrit dans la littérature. Les résultats relatifs aux facteurs globaux montrent que la base monétaire américaine est la seule variable significative sur longue période. Ce facteur global de liquidité a un effet significatif et positif sur les créances bancaires transfrontières détenues sur les pays CESEE, ce qui va dans le sens de l'existence du canal de la prise de risque bancaire de [Bruno and Shin \(2015\)](#). Le facteur global relatif au cycle financier global estimé par [Miranda-Agrippino, Nenova, and Rey \(2020\)](#), qui capte l'aversion au risque, est quant à lui non significatif, tout comme le TED spread. Ces deux résultats tendent à montrer que l'inclusion de variables financières, avec une périodicité plus élevée que les variables bancaires et macrofinancières, ne permet probablement pas une bonne identification des effets globaux dans notre modélisation. Enfin, le régime de change est un facteur significatif et déterminant des créances transfrontières, avec une forte fixité du régime de change associée positivement à ceux-ci. La stabilité des taux de change dans le cadre de la convergence avec l'UEM a potentiellement un coût en matière de vulnérabilités externes bancaires.

Les résultats de ce chapitre font ressortir d'une part, l'importance des facteurs environnementaux liés à l'intégration financière (globaux et push) et d'autre part, l'importance des liens européens comme déterminants des créances bancaires transfrontières des pays CESEE. Ils vont tous dans le sens d'un accroissement des créances bancaires transfrontières, qui sont un facteur de vulnérabilités financières. Du point de vue des recommandations de politique économique, il apparaît donc très important de promouvoir la

coopération internationale et en particulier la coopération européenne en matière bancaire. Néanmoins, l'orientation actuelle des politiques des pays CESEE en matière de stabilité financière est une utilisation massive de la politique macroprudentielle domestique.

Deux types d'extensions de l'analyse permettraient de préciser la nature des effets de l'adhésion à l'Union Européenne d'une part, et l'apport de la réglementation et des mesures macroprudentielles en matière de stabilisation des créances transfrontières d'autre part. Du point de vue de l'appartenance à l'Union Européenne, nous souhaiterions améliorer l'identification de l'effet de l'intégration commerciale (les variables de contrôle individuelles étant non significatives) et proposer une identification de l'effet réglementaire spécifique à l'Union Européenne. L'environnement réglementaire bancaire domestique joue potentiellement un rôle contracyclique qui pourrait être exploré dans un deuxième temps. Enfin, une troisième extension consisterait à estimer sur une période plus récente et avec une fréquence de données plus élevée les impacts des mesures macroprudentielles sur les créances bancaires transfrontières. La recherche actuelle s'intéresse par exemple à la construction d'indices reflétant l'intensité de la politique macroprudentielle pour la région CESEE ([Eller, Hauzenberger, Huber, Schubert, and Vashold, 2021](#)). L'évaluation de ces politiques en matière d'efficacité sur la stabilité financière permettrait d'apporter un éclairage supplémentaire au débat relatif à l'adhésion à la zone Euro pour les pays CESEE hors du Mécanisme de Change Européen II.

Si l'on résume désormais les principaux résultats du deuxième chapitre, il apparaît tout d'abord un résultat commun avec le premier chapitre, qui est l'importance du régime de change dans les effets d'interdépendance. Le degré estimé d'intégration monétaire (définie comme l'autonomie monétaire dans le cadre de la convergence nominale avec l'UEM) est en effet en lien avec le régime de change de facto des pays CESEE, à l'exception de la Croatie. Par contre, les relations d'interdépendance monétaire ne se limitent pas à une transmission du taux de change via la parité non couverte des taux d'intérêt. Plus précisément, pour les pays participant au Mécanisme de Change Européen II, nos résultats montrent qu'il existe une interdépendance monétaire entre la zone Euro et la Bulgarie, avec une transmission complète du taux d'intérêt étranger vers le taux d'intérêt domestique en cohérence avec son régime monétaire de caisse d'émission. Pour les pays hors du MCE II, la République Tchèque et la Roumanie entretiennent des interdépendances monétaires avec la zone Euro dans le cadre de règles de politique monétaires augmentées du taux de change et du taux d'intérêt de la zone Euro. On trouve enfin des effets de transmission monétaire en ligne avec l'hypothèse de dilemme monétaire (et donc l'influence potentielle d'un cycle financier global de façon similaire au chapitre 1) pour la Hongrie. Les effets d'interdépendance monétaire en lien avec le trilemme de politique monétaire, estimés individuellement pendant la période de politique monétaire conventionnelle, sont robustes à l'utilisation d'un taux d'intérêt

shadow pour la zone Euro (à l'exception de la République Tchèque), qui prend en compte les effets des mesures quantitatives de politique monétaire, qui impactent très fortement la liquidité du système monétaire en zone Euro.

Nos résultats confirment par ailleurs l'intérêt de deux aspects de la modélisation, à savoir la pertinence des ruptures structurelles d'une part, et du modèle multivarié qui rend compte des effets de convergence nominale avec l'UEM d'autre part. La modélisation à ruptures structurelles est adaptée aux pays d'Europe Centrale et à la Bulgarie, qui disposent d'une plus grande dimension temporelle. La prise en compte des ruptures structurelles change le nombre et la nature des relations de long terme: par exemple, on ne trouve pas de transmission du taux zone Euro en République Tchèque si l'on ne modélise pas ces ruptures. Cela est particulièrement vrai pour les dates de rupture relatives à l'histoire économique domestique. La modélisation de la convergence nominale avec l'UEM (en incluant le taux d'inflation de la zone Euro) permet elle de rendre compte d'un potentiel effet de transmission du taux d'inflation zone Euro vers la Bulgarie et la République Tchèque.

Du point de vue des recommandations de politique économique, on voit donc apparaître un coût potentiel de l'adhésion à la zone Euro plus important pour la Pologne, et moins important pour la République Tchèque et la Roumanie, du fait d'une perte d'autonomie monétaire liée à l'intégration monétaire européenne. Le cas de la Hongrie est un peu à part car ce pays serait moins autonome monétairement du fait d'un plus fort impact du cycle global financier. Une première extension possible du travail consiste à améliorer le modèle d'étude pour les pays euroisés: en effet, on ne trouve pas de réponse au degré de transmission des conditions de la politique monétaire de la zone Euro pour la Croatie. Un tel modèle pourrait être utile à d'autres pays candidats à l'Union Européenne euroisés unilatéralement tels que le Kosovo ou le Monténégro. Enfin, il serait intéressant dans un deuxième temps d'utiliser le même modèle de cointégration à ruptures structurelles sur la période 2006-2021, caractérisée par deux ruptures structurelles exogènes (la crise financière globale et la crise européenne des dettes souveraines), en prenant en compte les effets de liquidité des politiques monétaires des pays CESEE via l'estimation de taux shadow individuels (ainsi que si possible, les interventions des banques centrales sur les marchés de change).

Le troisième chapitre permet de contribuer au débat sur la participation anticipée à l'Union Bancaire relativement aux bénéfices potentiels liés au mécanisme de partage privé du risque. Nous obtenons trois séries de résultats selon que l'on considère la période d'estimation la plus longue (1978-2018), la période d'estimation centrée sur la libéralisation financière et excluant la période communiste pour les pays CESEE (1990-2018) et la période la plus récente incluant les développements relatifs aux investissements de portefeuille (2002-2018). Ces analyses convergent vers des conclusions que nous résumons ci-dessous.

Le niveau moyen de partage du risque est tout d'abord un phénomène croissant dans le temps, qu'on envisage le partage du risque au sein de l'UE-25 ou entre pays de l'UE membres de l'Union Bancaire et pays CESEE. Il s'accroît directionnellement des pays CESEE vers les pays de l'UE membres de l'Union Bancaire à partir de 2012. On observe par ailleurs que les effets additionnels des canaux financiers au partage du risque moyen sont variables dans le temps: il y a par exemple une contribution significative et positive du canal du marché de crédit si l'on considère les périodes d'estimation les plus longues. Sur la période d'estimation la plus récente, il devient non significatif et est relayé par la contribution significative et positive des investissements de portefeuille. De même, les effets bilatéraux de partage du risque sont sensibles à l'inclusion de nouveaux pays partenaires financiers, comme par exemple l'Autriche.

Si l'on considère tout d'abord les effets bilatéraux de l'appartenance à l'Union Bancaire sur le partage du risque, il apparaît que celui-ci est plus faible entre pays membres de l'Union Bancaire après 2012 qu'entre membres de l'UE-25. Ce résultat est robuste aux différentes périodes d'estimation, aux deux types de créances bancaires (avec un effet supplémentaire si l'on considère les créances bancaires étrangères CBS) ainsi qu'à l'inclusion de la variable de contrôle de la croissance des créances bancaires. Sur la période de libéralisation financière, l'intégration bancaire liée à l'Union Bancaire est positive et significative du point de vue du partage du risque entre pays membres de l'Union Bancaire, ce qui est un résultat intéressant qui va dans le sens d'un canal de l'intégration bancaire de l'Union Bancaire.

Si nous résumons les principaux résultats relatifs aux pays CESEE, il apparaît tout d'abord une différence d'impact entre créances bancaires transfrontières et créances consolidées sur le partage du risque idiosyncratique. L'intégration bancaire n'a pas significativement d'effet additionnel sur le risque moyen partagé vers les pays membres de l'UE quand on considère l'intégration transfrontière; elle est par contre significative et négative si l'on considère l'intégration bancaire consolidée, c'est-à-dire déterminée par la présence de banques étrangères dans les pays CESEE. Ce résultat est un élément de réponse supplémentaire concernant les effets positifs ou négatifs de l'intégration financière: la présence de banques étrangères amoindrirait l'efficacité du mécanisme de partage des risques. En termes de recommandation de politique économique, nous préconisons ainsi un contrôle spécifique des créances locales en devise locale.

Sur l'effet unilatéral de la non-adhésion à l'Union Bancaire sur le partage du risque entre pays CESEE et pays de l'UE membres de l'Union Bancaire, nous trouvons que cet effet est significatif mais son signe est variable selon les périodes d'estimation. Sur la période la plus récente incluant le développement des investissements de portefeuille, cet effet est négatif de 5 points mais il est plus faible que l'effet bilatéral entre pays membres de l'Union Bancaire de 20 points. Il existerait ainsi un effet de groupe significatif de 15 points de risque idiosyncratique supplémentaire partagé sur la période récente.

Si l'on cherche enfin à comparer les effets des Initiatives de Vienne à ceux de l'Union

Bancaire sur le niveau de partage des risques, il est notable que leurs effets sont mieux identifiés quand ils sont estimés sur créances consolidées. Il apparaît que les deux Initiatives de Vienne impactent principalement le niveau de partage du risque moyen entre pays CESEE et pays de l'UE membres de l'Union Bancaire (et non le niveau moyen partagé au sein de l'UE-25) et qu'ils sont significatifs dans les deux sens du partage du risque bilatéral. Le niveau de partage du risque entre participants à l'Initiative de Vienne 1 est ainsi inférieur de près de 10 points au niveau moyen, et de près de 20 points entre les participants à l'Initiative de Vienne 2. La différence d'impact entre les Initiatives de Vienne et l'Union Bancaire nous laisse penser qu'une initiative multilatérale est probablement insuffisamment identifiée dans une approche bilatérale.

Tout comme pour le chapitre 1, nous souhaiterions étendre notre analyse en précisant les effets de la participation bilatérale à l'Union Bancaire en utilisant une variable d'intensité de la participation à celle-ci. On pourrait adopter la même approche en précisant les effets d'appartenance à l'Union Européenne et à la zone Euro, en utilisant une variable reflétant les différentes dates d'adhésion.

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TABLE 1 – Crises financières : crises bancaires, de change, sudden stops

	Crises bancaires systé- miques <a href="#">Laeven and Valencia (2018)</a>	Crises bancaires systé- miques <a href="#">Reinhart et al. (2008)</a>	Crises de change <a href="#">Reinhart et al. (2008)</a>	Stops (1980-2019) <a href="#">Forbes and Warnock (2012)</a>	Sudden stops <a href="#">Eichengreen and Gupta (2016)</a>	Sudden stops <a href="#">David and Gonçalves (2019)</a>
Bulgarie	Janvier 1996	1994	1996	NA	NA	2008 q4 - 2010 q1 2015 q3- 2016 q1
Croatie	Mars 1998 - 1999	NA	NR	1998 q4-1999 q2 2004 q4-2005 q3 2010 q2-2011 q1 2015 q3-2016 q2	2011 q3 (2)	
Hongrie	1991-1995 Sept 2008 - 2012	1991 2008	NR	1996 q4-1997 q1 2002 q2-2002 q3 2009 q3-2009 q4 2009 q1-2010 q2 2017 q4-2018 q3	1996 q1 (2)	1996 q4- 1997 q2 2009 q1- 2010 q1
Rep Tchèque	Juin 1996 - 2000	NA	1997 m5	2003 q2-2004 q1  2006 q2-2006 q4 2008 q4-2009 q3 2018 q1-2018 q4	2008 q4 (2)	2003 q2- 2004 q1  2006 q2-2006 q3
Pologne	1992 - 1994	1991	NR	1996 q3-1997 q1 2001 q4-2002 q3/1 2008 q4-2009 q3 2017 q3-2017 q4	2008 q4 (2)	2008 q4-2009 q3 2011 q4-2012 q3
Roumanie	1998 - 1999	1990	1996	1999 q4-2000 q1 2008 q3-2009 q4(2010q1)	2008 q4 (2)	2008 q3-2009 q4