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Thèse

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Présentée par

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Essais sur les mésalignements de change et la politique de change dans les pays en développement et les économies émergentes

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A ma famille

«*Ce que chaque chose coûte réellement, à celui qui veut se la procurer, c'est le travail et la peine qu'il doit s'imposer pour l'obtenir.*»

Adam Smith, dans *Recherches sur la nature et les causes de la richesse des nations*, Tome I (1776)

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Enfin, je veux témoigner ma profonde gratitude envers ma famille et mes proches qui m'ont toujours soutenu et encore plus durant ces trois années.

[1] Il convient toutefois de préciser qu'en dépit des conseils reçus, toutes les éventuelles erreurs contenues dans cette thèse sont miennes.

Résumé général

Cette thèse a pour objectif d'apporter de nouveaux éclairages sur certaines questions liées aux mésalignements de change réels et aux régimes de change dans les pays en développement et les économies émergentes. Dans un premier axe de recherche, nous réexaminons le lien entre les mésalignements de change et la croissance, en intégrant un canal de transmission dit de "la dette en devises". Nous montrons l'existence d'un canal financier de la dette en devises à travers lequel les mésalignements de change exercent un effet opposé, par rapport au canal traditionnel de la compétitivité-prix, sur la croissance. En outre, nous mettons en lumière le rôle joué par le régime de change dans la relation mésalignements de change-croissance et l'importance de la compatibilité du régime monétaire en vigueur avec la structure de la dette extérieure libellée en devises. Dans le second axe de recherche, nous nous intéressons à l'efficacité de la politique de change dans la prévention/correction des mésalignements de change. Nous montrons tout d'abord qu'en l'état actuel des choses, il est difficile d'établir une relation robuste entre les régimes de change et les mésalignements de change en raison notamment des définitions différentes des régimes monétaires adoptées par les classifications *de facto* des régimes de change. En particulier, seules les classifications permettant de distinguer les régimes monétaires défectueux permettent de discriminer les performances des régimes de change en matière de mésalignements de change. Nous montrons enfin que la transmission des variations du taux de change nominal au taux de change réel n'est pas systématiquement liée à l'ampleur de l'ajustement nominal mais qu'elle dépend fortement de la distorsion initiale du taux de change réel.

Mots-clés: Mésalignements de change; Régime de change; Pays en développement; Economies émergentes; Croissance économique; Politiques macroéconomiques.

Overall summary

The aim of this PhD thesis is to provide new insights on some key issues related to currency misalignments and exchange rate regimes in developing countries and emerging economies. The first focus explores and enlarges the issue of the transmission channels from currency misalignments to economic growth by including the foreign currency-denominated (FCD) debt channel. We first evidence the existence of this FCD debt channel through which currency misalignments affect growth. More specifically, we find that this channel attenuates the traditional impact of price competitiveness on economic growth. Second, we highlight the role played by the exchange rate regime in the currency misalignments-growth nexus as well as the importance of the compatibility between the existing monetary arrangement and the structure of the external debt denominated in foreign currencies. The second research topic focuses on the effectiveness of the exchange rate policy for the prevention/correction of currency misalignments. We first seek to better understand the impact of exchange rate regimes on the levels of currency misalignments, by relying on different *de facto* classifications of exchange rate regimes. The evidence appears to be mixed. We do not find a clear relationship, but, the classifications that distinguish nonfunctioning monetary regimes seem more willing to discriminate exchange rate regimes on the basis of their performances regarding currency misalignments. Finally, we show that the transmission of nominal exchange rate variations to real exchange rates is not necessarily linked to the magnitude of the nominal adjustment but rather depends on the initial distortion of the real exchange rate.

Keywords: Currency misalignments; Exchange rate regime; Developing countries; Emerging economies; Economic growth; Macroeconomic policies.

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Introduction générale

Ces dernières décennies, le contexte macroéconomique, dans lequel les pays en développement et les économies émergentes ont évolué, a été caractérisé par de profonds bouleversements économiques et financiers, comme en témoignent les nombreux programmes d'ajustement structurel mis en œuvre dans les années 1980 et 1990 et les crises économiques et financières survenues dans les années 1990 et au début des années 2000 (e.g. Mexique 1994-5, pays asiatiques 1997-9, Russie 1998, Brésil 1999 et Argentine 2002). Tous ces évènements ont en commun d'avoir mis en lumière le rôle important joué par le niveau du taux de change réel dans la stabilité macroéconomique et financière. De façon plus précise, il est apparu que les distorsions du taux de change réel, ou encore mésalignements du taux de change réel, pouvaient constituer un réel danger pour la stabilité et la croissance économique de ces pays.[2]

La littérature économique sur les effets des mésalignements est cependant encore dominée par un courant de pensées qui met l'accent sur un mécanisme de transmission à la croissance transitant par les exportations: l' "*export-led growth theory*" (la croissance tirée par les exportations). Selon cette théorie, les mésalignements de change réel exercent un effet asymétrique sur la croissance économique. En effet, le cœur de cette théorie réside dans l'avantage en termes de compétitivité-prix que procure une sous-évaluation de la monnaie, avantage qui permettrait de dynamiser les exportations et ainsi de stimuler la croissance. A contrario, les surévaluations du taux de change, associées à une perte de compétitivité, nuiraient à la croissance.[3] Les tenants du *Consensus de Washington* prônent, en revanche, la nécessité d'éviter des mésalignements de change importants, quelle que soit leur nature. Ceux-ci traduiraient, en effet, des déséquilibres de certains fondamentaux économiques, génèreraient des coûts économiques —notamment en termes d'inflation— et nuiraient ainsi à la croissance (Williamson, 1990; Berg et Miao, 2010;

[2]Les mésalignements de change sont définis comme étant les écarts entre le taux de change réel observé et sa valeur d'équilibre.

[3]Cf. entre autres, Klau (1998), Gala et Lucinda (2006), Roudet et al. (2007) et Elbadawi et al. (2008, 2009).

Schröder, 2013). La littérature empirique montre à cet effet que les mésalignements de change ont un pouvoir prédictif pour expliquer les crises financières/économiques (Kaminsky et al., 1998; Goldfajn et Valdes, 1998; Bussière et Fratzscher, 2006).

Faisant écho à ces derniers travaux, les études s'intéressant aux conséquences financières des variations/distorsions du taux de change réel émettent également des recommandations en faveur d'un taux de change stable et proche de son niveau d'équilibre. Ces études, en s'appuyant sur le constat d'une intégration financière croissante, montrent la nécessité de prendre en compte, dans la relation entre les distorsions de change et la croissance économique, l'existence d'effets de valorisation sur les actifs et passifs libellés en devises. En effet, les fluctuations du taux de change entrainent des effets de richesse et/ou des effets de bilan qui peuvent avoir des conséquences néfastes sur les économies (voir entre autres Galindo et al., 2003; Céspedes et al., 2004; Céspedes, 2005; Frankel, 2005). Ces effets de valorisation peuvent, en outre, être à l'origine de crises financières via notamment des effets de "*currency mismatch*" (Eichengreen et al., 2003; Bourguinat et al., 2007).[4] Les travaux de Bernanke et Gertler (1989, 1995) et Bernanke, Gertler et Gilchrist (1999) confèrent, par ailleurs, à ces effets un rôle de premier plan en montrant que, par le biais de l'accélérateur financier, ces effets sont non seulement amplifiés mais aussi transmis à la sphère réelle —via une baisse de l'investissement et de la consommation, allant ainsi au-delà des effets de richesse ou de l'augmentation du coût du capital.[5]

Ces dernières années, avec le creusement et la persistance des déficits courants entre les économies à l'échelle internationale, les distorsions de change réel ont à nouveau été au centre des débats dans la mesure où elles sont perçues comme le signe de positions extérieures nettes non soutenables et empêchent de ce fait le rééquilibrage des balances courantes à l'échelle mondiale (voir Bergsten, 2010; Goldstein, 2010).[6] Ces déséquilibres globaux seraient à leur tour à l'origine de la crise financière de 2007, comme l'ont soutenu certains économistes (voir entre autres Bernanke, 2005, 2009; Krugman, 2009; Obstfeld et Rogoff, 2009) qui avancent comme argument la thèse du "*saving glut*" (excès d'épargne) ou encore celle de la crise "inter frontières": les excédents courants dans plusieurs économies émergentes —en particulier en Chine— auraient contribué à alimenter un boom du crédit insoutenable et la prise de risque dans les principaux pays déficitaires, dont les Etats-Unis, en exerçant une pression

[4]Le terme "*currency mismatch*" renvoie à la non-concordance entre le montant des dettes (en devises) et celui des actifs (en monnaie domestique).

[5]Notons par ailleurs que les distorsions du taux de change, en induisant une mauvaise allocation des ressources, créent des distorsions dans les prix relatifs qui à leur tour réduisent le bien-être.

[6]Les déséquilibres globaux (ou encore les déséquilibres mondiaux) désignent les déséquilibres des comptes courants dont l'ampleur est telle qu'ils menacent la stabilité de l'économie mondiale.

à la baisse sur les taux d'intérêt mondiaux.[7] Pour ces auteurs (voir également Obstfeld et Rogoff, 2004; Goldstein, 2006, 2010; Blanchard et Milesi-Ferretti, 2011), la principale cause de la persistance des déséquilibres globaux et ses conséquences réside donc dans la mutation du système monétaire international en un système dit —de façon informelle— de Bretton Woods II, dans lequel la Chine est pointée du doigt pour sa politique de change basée sur la sous-évaluation de sa monnaie.[8]

En raison des craintes pour la stabilité et la prospérité de l'économie mondiale qu'elles suscitent —et donc des tensions internationales qu'elles génèrent, les distorsions de change réel sont donc au cœur des grands débats de la macroéconomie internationale et notamment ceux qui sont liés à la question de la régulation du système monétaire international. Au sein de ces débats, la question du choix du régime de change continue encore à figurer parmi les questions clefs de politique économique que les pays en développement et les économies émergentes sont amenés à reconsidérer.

Or, la littérature économique ne permet pas de se prononcer réellement sur le régime de change le plus à même de réduire les mésalignements de change. En effet, les différentes théories énoncent des arguments à la fois en faveur et contre les différents types de régimes de change, en opposant principalement les régimes de change fixe et flexible.[9] Friedman (1953) fût l'un des premiers à plaider en faveur des régimes flexibles. Il montre que contrairement à la doctrine prévalant sous le système monétaire international de Bretton Woods (les changes fixes permettent d'assurer la stabilité de l'économie mondiale), la flexibilité du taux de change permettrait une modification plus rapide des prix relatifs et par conséquent permettrait un meilleur ajustement aux chocs. Le triangle d'incompatibilités, mis en évidence dix ans plus tard par Mundell (1963), montre également qu'avec la mobilité croissante des capitaux, la fixité du taux de change contraint fortement l'autonomie des

[7]Par opposition à ce courant, certains auteurs, du fait de l'absence d'une relation causale clairement établie entre les déséquilibre globaux et la crise de 2007, privilégient la thèse de la crise "intra frontière" selon laquelle la crise financière trouve son origine dans la défaillance des systèmes financiers nationaux et internationaux (voir entre autres Borio et Disyatat, 2011; Taylor, 2013).

[8]En référence au système de Bretton Woods qui définissait un système de parité fixes pour les devises, l'appellation Bretton Woods II désigne —de façon informelle— la nouvelle zone dollar créée par le système de parité fixe ou stabilisée avec le dollar (américain) adopté par des pays exportateurs, au premier rang desquels la Chine.

[9]En effet, si dans un premier temps les choix des pays en matière de régimes de change s'étendaient à toutes les catégories de régimes (fixe, intermédiaire, flexible), les crises survenues durant les années 1990 (e.g. Mexique 1994–5, Asie 1997–9, Brésil 1999) vont conduire à une remise en cause des régimes de change intermédiaires —qu'il s'agisse des schémas d'ancrage souple ou des flottements fortement contrôlés— car l'ouverture croissante des économies aux flux de capitaux rendait très difficile la viabilité à long terme de ces régimes.

politiques économiques et la capacité d'ajustement de l'économie aux chocs réels.[10] La théorie des zones monétaires optimales (ZMO) —développée initialement par Mundell (1961)— offre également différents cadres de référence pour l'analyse des implications (coûts/bénéfices) liées au choix du régime de change.[11]

Si ces différentes théories ont longtemps orienté les choix des régimes de change, les modèles de la nouvelle macroéconomie ouverte ont récemment remis en doute la validité de l'argument de Friedman (1953). C'est notamment le cas de Corsetti et al. (2010) qui récusent l'idée d'un ajustement efficient en régime de change flexible car les hypothèses sur lesquelles repose cet ajustement (à savoir un marché financier complet et un haut niveau de *pass-through* des prix à l'importation) ne sont pas nécessairement satisfaites. Dans la même lignée, Berka et al. (2012) —dans la continuité de Devereux (2000) et Devereux et Engel (2002, 2007)— rejettent l'argument de Friedman car sa validité est, selon eux, conditionnée par la fixation des prix dans la monnaie du producteur (*Producer Currency Pricing*, PCP) et la complète immobilité internationale du capital. L'existence (avérée) de segmentation tarifaire ("*pricing-to-market*") —et notamment d'une fixation des prix dans la monnaie du consommateur (*Local Currency Pricing*, LCP)— apparait ainsi comme un fait annihilant —sinon inhibant— le transfert international des dépenses consécutif à une variation du taux de change nominal. Par voie de conséquence, la flexibilité du taux de change et, plus généralement, le régime de change n'exercerait pas d'effets.

[10] Le cadre du modèle Mundell-Fleming (Fleming, 1962; Mundell, 1963) permet généralement de se prononcer sur la nature du régime de change à adopter selon les caractéristiques des chocs affectant les économies. En montrant que les régimes de change fixe et flexible —dans un contexte de forte mobilité des capitaux— ont des implications radicalement différentes pour la conduite de politiques de stabilisation, le modèle Mundell-Fleming préconise, pour une économie dominée par des chocs réels (resp. nominaux), un régime de change flexible (resp. fixe).

[11] En mettant l'accent sur la nature des chocs, Mundell (1961) montre que deux économies ont intérêt à avoir une politique monétaire commune (ancrage ou union monétaire) uniquement si les chocs auxquels sont confrontées ces économies sont symétriques. Par contre, si les chocs sont asymétriques et s'il n'existe pas de mécanismes d'ajustements alternatifs (flexibilité des prix et/ou des salaires, mobilité des facteurs de production, transferts fiscaux), une autonomie de la politique monétaire est à privilégier. La théorie des ZMO a été étendue par McKinnon (1963) et Kenen (1969). McKinnon (1963), en se focalisant sur le rôle de l'intégration économique, montre que l'optimalité d'un régime de change fixe croit avec l'intégration commerciale et la concentration géographique du commerce. Kennen (1969) montre également que les coûts d'une union monétaire entre des économies diversifiées serait faible car un choc négatif sur un secteur aura peu d'impact sur la production globale, l'ajustement étant facilité par la mobilité intersectorielle des facteurs de production. Notons également que la (quête de) crédibilité des politiques monétaires constitue également un argument pour le choix du régime de change. En effet, les régimes de change fixe, à travers la discipline qu'ils imposent, sont souvent vu comme un moyen pour ancrer la politique monétaire et les anticipations des agents. A travers ces effets, le régime de change fixe permet d'importer de la crédibilité. Selon cette théorie (développée initialement par Barro et Gordon, 1983), les pays souffrant d'un problème de crédibilité et/ou d'inflation tendront à adopter un régime de change fixe tandis que les autres pays privilégiant la flexibilité de l'économie et la stabilisation du cycle économique préfèreront un régime de change flexible. Voir également Edwards (1989), Faini et de Melo (1990), Welch et McLeod (1993) et Agénor (1994).

D'autres auteurs (cf. notamment Rey, 2015) ont montré récemment que la libéralisation du compte de capital subordonne la politique monétaire des petites économies ouvertes à celles des grandes économies, et ce même en régimes de changes flottants. Ils en concluent que les pays font plutôt face à un dilemme de politique économique plutôt qu'au trilemme défini dans le cadre du triangle d'incompatibilités : les banques centrales retrouvent l'indépendance de leur politique monétaire s'il y a contrôle des capitaux, et ce indépendamment du régime de change.

Ces avancées au niveau théorique, ajoutées aux difficultés rencontrées par les pays en régimes de change fixe (notamment les pays de la zone euro), ont remis au centre des débats les questions relatives aux choix et aux conséquences des régimes de change surtout en termes de capacité d'ajustement —comme en témoignent les travaux initiés par Chinn et Wei (2008, 2013). Or, comme le montrent un certain nombre de travaux, les modalités de l'ajustement de l'économie restent un objectif central des stratégies de change menées par certains pays. En effet, soucieux de la valeur de leur monnaie, certains pays mènent une stratégie de change active en vue d'accommoder les variations de leur taux de change à leurs besoins et situations. Comme l'ont souligné Calvo et Reinhart (2002), certains pays interviennent sur le marché des changes en raison d'une peur du flottement (*fear of floating*); flottement qui aurait des conséquences sur le niveau d'inflation et générerait des effets de valorisation, créant ainsi un environnement instable. Plus récemment, Levy-Yeyati et al. (2013) ont montré que ces interventions de change ciblent surtout les appréciations du taux de change dans la mesure où les pays sont soucieux de maintenir un certain niveau de compétitivité-prix (*fear of appreciation*). Cette stratégie de change active peut ainsi contraster avec les déclarations officielles que font les pays auprès du Fonds Monétaire International (FMI). Cette divergence a d'ailleurs conduit au développement de nouvelles classifications de régimes de change dites *de facto*, basées sur les politiques effectivement menées par les pays, en réponse aux insuffisances de la classification définie par le FMI sur la seule base des déclarations officielles des pays, classification dite *de jure*. Par la suite, le FMI a également révisé sa classification, en ne la basant plus sur les seules déclarations officielles des pays.[12]

Ainsi, les stratégies de change restent au cœur des préoccupations des économies émergentes et en développement. Ces stratégies reflètent l'arbitrage auquel sont confrontés les pays —dans un contexte d'intégration financière croissante et de forte mobilité du capital— entre la flexibilité totale du taux de change d'un coté, et l'abandon du taux de change comme outil d'ajustement de l'autre. C'est dans ce

[12]Pour une revue de la littérature sur les différentes méthodes de classification des régimes de change *de facto*, voir Tavlas et al. (2008) et Klein et Shambaugh (2010).

débat riche et passionnant portant sur le choix et les conséquences du régime de change dans les pays en développement et les économies émergentes que s'inscrit cette thèse, dont la particularité est de se focaliser sur les questions relatives aux ajustements des économies à travers l'étude des mésalignements de change.

Problématique(s) et objectif de la thèse

L'objectif de cette thèse est de réexaminer certaines questions liées aux mésalignements de change réels en relation avec les régimes de change suivis par les pays émergents et en développement, à la lumière des évolutions économiques de ces pays telles qu'elles ont été retracées précédemment. En particulier, les questions principales auxquelles nous entendons répondre sont les suivantes: Comment les mésalignements de changes réels agissent-ils sur la croissance des pays en développement et des économies émergentes, dans un contexte d'ouverture financière croissante ? En particulier, les gains ou pertes en capital liés aux distorsions de taux de change réels compensent-ils les variations opposées des prix relatifs dans ces pays? Les régimes de change exercent-il un impact sur les mésalignements de change réel ? Si oui, quels sont les régimes de change qui permettent de minimiser ces mésalignements? Sous quelles conditions l'ajustement du taux de change nominal se répercute-t-il dans une dépréciation du taux de change réel ?

Les réponses à ces différentes questions s'organisent autour de deux axes de recherche dont nous précisons les contours et motivations ci-après.

Mésalignements de change et croissance économique: au-delà des effets de compétitivité-prix

Le premier axe de recherche autour duquel s'articule cette thèse porte sur les conséquences des mésalignements du taux de change réel dans les économies émergentes et les pays en développement, à travers l'analyse plus spécifique du lien entre les mésalignements de change et la croissance économique. Au-delà du mécanisme de transmission "classique" exercé par les mésalignements via l'ajustement des prix relatifs, nous nous intéressons plus particulièrement à un autre mécanisme de nature plus financière transitant par des effets de valorisation sur la dette libellée en monnaies étrangères et dont les conséquences ont été moins étudiées.

En effet, à ce jour, l'accent a surtout été porté sur le canal de transmission classique transitant par la compétitivité-prix et l'ajustement de la balance commerciale:

une sous-évaluation (resp. surévaluation) de la monnaie entraîne un gain (une perte) de compétitivité-prix qui aura pour conséquence d'améliorer (resp. de détériorer) la croissance via un accroissement (resp. une réduction) du volume des exportations.[13] Dans les pays en développement —et dans une moindre mesure dans les économies émergentes, ce canal peut jouer un rôle important dans la mesure où les secteurs d'exportation constituent généralement la principale source de devises étrangères et sont surtout pourvoyeurs de recettes publiques. Toutefois, pour ces pays, un autre canal de transmission tout aussi important transitant par les stocks de dettes libellées en devises peut également être à l'œuvre. L'existence de ce canal financier passant par des effets de valorisation peut en effet avoir des conséquences économiques importantes, plus particulièrement sur la croissance. Dans le cas d'une forte exposition au risque de change, l'effet exercé par une sous-évaluation sur la croissance peut être ambigu: positif via les gains de compétitivité-prix qu'elle induit; mais également négatif via l'augmentation de la dette libellée en devises qu'elle entraîne.[14] Or, une des fragilités des pays en développement et de certains pays émergents tient à leur incapacité à émettre dans leur propre monnaie sur les marchés internationaux, ce qui les conduit à accumuler des dettes en devises. L'existence d'importants stocks de dettes en devises —en raison de ce phénomène qualifié de "péché originel" ("*original sin*"; Eichengreen and Hausmann, 1999)— expose ces pays à un risque de change, qui peut être d'une ampleur considérable.

C'est pourquoi, nous nous concentrons dans cette première partie sur les effets de valorisation affectant les stocks de dettes libellées en monnaies étrangères induits par les mésalignements de change réels. En particulier, nous nous demandons si l'impact des mésalignements du taux de change réel sur la croissance, via les variations de prix relatifs qu'ils induisent, est atténué par des effets opposés de valorisation sur les dettes libellées en devises. Nous examinons par ailleurs le rôle du régime de change dans la mesure où celui-ci peut jouer un rôle (direct et/ou indirect) important dans la diffusion des effets de valorisation qui sous-tendent ce canal de la dette extérieure.

[13] D'autres canaux de transmission, plus ou moins dans la même lignée, ont également été proposés. Il s'agit notamment du canal: (*i*) des biens échangeables (Rodrik, 2008); (*ii*) de l'épargne et de l'accumulation du capital (Levy-Yeyati et Sturzenegger, 2007; Montiel et Serven, 2008; Gluzmann et al., 2011); (*iii*) de la performance des entreprises (Elbadawi et al., 2009; Korinek et Serven, 2010).

[14] On peut également postuler une relation inverse dans le cas des surévaluations.

Mésalignements de change, régimes de change et ajustement des économies

Le second axe de cette thèse porte sur l'analyse de l'efficacité de la politique de change dans la prévention/correction des mésalignements de change.

La première question à laquelle nous nous intéressons est la suivante: le choix du régime de change influe-t-il *ex ante* sur les mésalignements de change? Autrement dit, le choix du régime de change est-il déterminant dans la capacité des économies à atteindre leurs équilibres macroéconomiques?

Dans la mesure où les mésalignements de change reflètent l'ampleur des déséquilibres externes et internes des économies, ils constituent un indicateur de choix pour analyser les capacités d'ajustement des économies. L'analyse de la performance des régimes de change sous l'angle des mésalignements n'a cependant pas réellement fait l'objet d'une attention particulière dans la littérature, celle-ci se focalisant plutôt sur les mésalignements de change comme indicateurs potentiels de crises (Kaminsky et al., 1998; Goldfajn et Valdes, 1998; Bussière et Fratzscher, 2006) et de changements de régime monétaire.[15] Par ailleurs, les rares travaux s'intéressant aux niveaux de mésalignements associés aux régimes de change souffrent de certaines insuffisances qui laissent planer un doute sur la validité de leurs résultats et ainsi les recommandations qui en découlent. C'est notamment le cas de Dubas (2009) dont l'analyse s'appuie sur la seule classification du FMI et Caputo (2015) qui considère une typologie *de facto* assez réduite des régimes de change (Shambaugh, 2004). Par ailleurs, dans ces deux études, aucune analyse de robustesse n'est menée, notamment sur la classification des régimes de change retenue. Aussi, dans cette thèse, nous analysons les niveaux (moyens) de mésalignements de change selon les régimes de change, en tenant compte d'un certain nombre de biais inhérents à ce type d'analyse —tels que les discordances entre les régimes de change *de facto*, l'endogénéïté du régime de change et la sensibilité des résultats à l'échantillon de pays (e.g. selon leur niveau de développement, leur degré d'ouverture financière).

La deuxième question s'inscrit dans la continuité de la première, en mettant l'accent sur les moyens dont disposent les pays pour corriger, *ex post*, les mésalignements de change via l'ajustement du taux de change réel. De façon plus spécifique, nous nous intéressons aux conditions d'effectivité de l'ajustement par le taux de

[15] On notera toutefois l'existence d'une littérature sur la persistance du taux de change réel selon les régimes de change.

change nominal.

La dévaluation nominale a souvent été au cœur des programmes d'ajustements de certains pays[16], alors que la dépréciation nominale a souvent accompagnée les épisodes de crises financières. Comme mis en avant par certains auteurs (Edwards, 1989; Edwards et Santaella, 1992; Kiguel, 1994; Guillaumont et Guillaumont, 1995), la réussite d'une dévaluation/dépréciation passe d'abord par son effectivité c'est à dire la mesure dans laquelle cet ajustement nominal se traduit par une dépréciation du taux de change réel. Cette effectivité dépend elle-même d'un ensemble de facteurs tels que l'environnement institutionnel, le régime de change et les politiques macroéconomiques d'accompagnement. Toutefois, en raison du postulat —général— que cet ajustement nominal est nécessaire en cas d'importante surévaluation du taux de change réel, la littérature qui cherche à évaluer le degré de transmission des variations du taux de change nominal à celles du taux de change réel rencontre une limite considérable. En effet, exceptée l'étude de Guillaumont et Guillaumont (1995), aucune ne s'est intéressée à l'importance des conditions initiales de la dévaluation —notamment celle relative au déséquilibre initial du taux de change réel. Cette insuffisance de la littérature revêt un caractère important en raison des dévaluations compétitives souvent mises en œuvre (e.g. "*Beggar-thy-neighbour policies*") et de leurs effets attendus. En effet, sans dépréciation du taux de change réel, seuls des effets de valorisation négatifs (e.g. inflation, hausse de la dette en devises) sont à attendre, ce qui fait de la question de l'effectivité de l'ajustement nominal un enjeu important de politique économique.

L'ensemble des questions posées au travers des deux axes de recherche de cette thèse sont à bien des égards centrales pour les pays en développement et les économies émergentes. Ces pays sont caractérisés en effet par une forte exposition aux chocs économiques, et pour certains un faible niveau de crédibilité dans la conduite de la politique économique ainsi qu'un secteur financier insuffisamment développé. Ces questions visent donc (*i*) à appréhender les effets des mésalignements de change réels sur la croissance des économies émergentes et des pays en développement, dans un contexte d'intégration financière croissante et (*ii*) à examiner, sous divers angles, leurs conséquences en matière de politique économique, et plus particulièrement en matière du choix et de conduite de leur politique de change.

[16] Avec pour but d'améliorer la situation économique via un accroissement de la rentabilité des activités d'exportation et de substitution à l'importation.

Choix (et contraintes) méthodologiques

Champ d'étude de la thèse

Figure 1 — Ensemble des pays considérés dans cette thèse

Note: Les nuances de gris indiquent la fréquence des pays dans les échantillons considérés pour les différents chapitres

Comme on peut le voir dans la Figure 1, les pays dits en "développement" et les économies dites "émergentes" constituent le champ d'étude de cette thèse. Il s'agit principalement des pays d'Afrique —qui occupent une place centrale, d'économies d'Asie centrale et du sud-est, du Moyen-Orient, de pays d'Amérique latine et des caraïbes, mais aussi de la Turquie et de la Russie. Ainsi, bien que n'incluant pas expressément les pays dits "développés", cette thèse se veut être, de par la diversité des économies considérées, une contribution à certaines grandes questions de la macroéconomie internationale.

La prise en compte d'un panel aussi varié de pays obéit principalement à deux raisons. La première d'entre elles est liée aux enseignements pouvant être tirés de l'histoire économique des pays aujourd'hui qualifiés d'émergents. En effet, bon nombre d'économies aujourd'hui dites émergentes se trouvaient, il y'a encore quelques décennies, au même niveau de développement que certains pays en développement. Dans leur processus de développement, ces économies ont opté pour certaines politiques macroéconomiques, mis en place certaines stratégies et ont été confrontées à des chocs et crises de natures diverses. Une réflexion sur les pays en développement se doit donc de tenir compte des ces expériences et de leur(s) enseignement(s)

dans la mesure où ces pays peuvent ou pourront être confrontés aux mêmes difficultés/défis que les économies dites aujourd'hui "émergentes". La deuxième raison pour ce choix d'un panel de pays assez varié est celle des similitudes que partagent les pays en développement et les économies émergentes, similitudes qui pour certaines sont au cœur des analyses développées dans les différents chapitres de cette thèse. C'est notamment le cas (*i*) de la diversité et des changements fréquents des politiques/régimes de change[17], (*ii*) —pour certains pays— du faible niveau de crédibilité de leurs institutions —ce qui les expose au "péché originel" et a pour conséquence un important endettement en devises, et (*iii*) de la forte sensibilité à l'environnement économique international (e.g. cours des matières premières).

Approches retenues dans la thèse

Les mésalignements de change constituent la variable macroéconomique clé autour de laquelle s'articule cette thèse. Ces mésalignements correspondent, par définition, aux écarts entre les taux de change effectifs réels observés et leur niveau d'équilibre. Cependant, les niveaux d'équilibre des taux de change ne sont pas observables. Ainsi, les controverses entourant la détermination des mésalignements de change résident dans celles entourant la détermination de ces taux de change dit d'équilibre.

La question du taux de change d'équilibre —qui remonte aux débuts du XXème siècle avec les travaux de Cassel (1918)— a donné naissance à une abondante littérature marquée par une diversité d'approches.[18] Ces différentes approches de détermination du taux de change d'équilibre peuvent être réparties en deux grands groupes. Le premier groupe est composé des approches basées sur les modèles de base du taux de change: la PPA (Parité des Pouvoirs d'Achats), l'approche $CHEER$ (*Capital Enhanced Equilibrium Exchange Rate*), l'approche $ITMEER$ (*Intermediate-Term Model-based Equilibrium Exchange Rate*). Le second groupe comprend les approches —dites— structurelles du taux de change d'équilibre. Au sein de ce dernier groupe on dénombre trois principales catégories d'approches: l'approche macroéconomique ($FEER$: *Fundamental Equilibrium Exchange Rate*, $DEER$: *Desired Equilibrium Exchange Rate*), l'approche (macro)économétrique ($BEER$: *Behavioral Equilibrium*

[17]En effet, les pays en développement et les économies émergentes ont plus souvent changé de régimes de change que les pays industrialisés, ces derniers ayant opté généralement pour la flexibilité. Ces changements fréquents de régime de change dans les pays en développement et les économies émergentes, à certaines exceptions, font de ces pays des "candidats" idéaux pour analyser les effets du choix du régime de change.

[18]La détermination du taux de change d'équilibre dépend de l'analyse théorique sous-jacente et donc n'a pas de définition unique.

Exchange Rate, $PEER$: *Permanent Equilibrium Exchange Rate*) et l'approche dynamique ($NATREX$: *Natural Real Exchange Rate*).[19]

Dans cette thèse, nous avons privilégié l'approche $BEER$ (*Behavioral Equilibrium Exchange Rate approach*) ou encore approche comportementale du taux de change d'équilibre (Clark et MacDonald, 1998). En effet, au-delà des critiques adressées aux autres approches susmentionnées[20], l'approche $BEER$ a été retenue car elle a l'avantage d'être relativement simple à mettre en oeuvre et de nécessiter peu de données.[21] En effet, l'idée de l'approche $BEER$ est d'évaluer le taux de change d'équilibre à partir d'une équation réduite du taux de change réel. Cette équation réduite s'appuie sur les relations de long terme qui existent entre le taux de change réel et des variables économiques fondamentales agissant sur les équilibres interne et externe. La méthodologie de l'approche $BEER$ est donc basée sur l'estimation d'une relation de long terme entre le taux de change réel et un ensemble de *fondamentaux* —i.e. variables influençant le taux de change réel à la fois dans le court et le long terme. Ce faisant, l'approche $BEER$ permet de calculer une trajectoire du taux de change réel d'équilibre —de long terme— à partir de laquelle les mésalignements peuvent être directement calculés. Elle permet en outre de tenir compte de facteurs qui jouent un rôle important dans la détermination du taux de change d'équilibre pour le type de pays que nous considérons. Ce sont notamment les écarts de productivité relative (effet Balassa-Samuelson), les termes de l'échange et la position extérieure nette.

Un autre choix fait dans cette thèse concerne la démarche méthodologique adoptée et le type d'argumentation fournie. En effet, les travaux réalisés dans cette thèse s'inscrivent dans la lignée des travaux d'économie appliquée dans la mesure où nous répondons à des problématiques économiques sur la base d'arguments empiriques. Notre démarche empirique s'appuie en particulier sur le recours aux techniques économétriques. Le manque de données —sur de longues périodes ou à

[19] Pour plus de détails sur ces différentes approches, se référer à Driver et Westaway (2004). Notez également que la méthodologie $CGER$ (*Consultative Group on Exchange Rate Issues*) adoptée par le FMI englobe trois approches: une approche macroéconomique similaire au $FEER$, une approche économétrique proche du $BEER$, et une approche basée sur la soutenabilité des comptes extérieurs.

[20] L'approche PPA est une approche de très long terme et ignore le rôle des flux de capitaux et des déterminants du taux de change réel (MacDonald, 2000); la dimension "normative" de l'approche FEER et sa non prise en compte des effets de stock —à travers la dynamique de la position extérieure nette et du stock de capital.

[21] Ce dernier point s'avère crucial compte tenu du fait que bon nombre de données pour les pays en développement et pour certains pays émergents ne sont pas disponibles. Il convient également de préciser que nous ne postulons pas que l'approche $BEER$ est supérieure aux autres approches. En effet, toutes ces différentes approches du taux de change d'équilibre, loin de s'opposer, sont plutôt complémentaires dans la mesure où elles correspondent à des horizons différents d'un même cadre théorique (Bénassy-Quéré et al., 2010).

haute fréquence— pour la plupart des pays considérés nous a amené à privilégier plutôt l'économétrie des données de panel. De façon plus précise, diverses techniques économétriques ont été mobilisées pour —tenter de— répondre aux questions posées dans cette thèse. Il s'agit notamment des récentes techniques de cointégration en panel qui permettent de prendre en compte l'hétérogénéité entre les pays et la dépendance inter-pays; des approches Bayésiennes utilisées à des fins de robustesse pour la détermination des principales variables explicatives et permettant ainsi la prise en compte de l'incertitude liée à la spécification des modèles empiriques (modèle du taux de change d'équilibre et/ou de croissance). D'autres méthodes économétriques (linéaires et non linéaires) sont également utilisées dans le cadre de ce travail, leur pertinence étant systématiquement discutée suivant les questions soulevées dans les différents chapitres.

Ce choix en faveur des techniques économétriques est également motivé par le caractère trop normatif des approches basées sur les modèles d'équilibre général et en particulier des modèles d'équilibre général dynamique et stochastique (*DSGE*, *Dynamic Stochastic General Equilibrium*). En effet, ces derniers s'abstiennent généralement de l'utilisation d'une demarche descriptive et formelle de l'économétrie, en privilegiant plutôt le recours aux techniques du calibrage. L'ambition de ces modèles, construits à l'aide d'hypothèses sur les paramètres et sur le comportement des agents —souvent "représentatifs", est d'obtenir un ajustement aux observations afin de pouvoir réaliser par la suite des exercices de simulation ou des prévisions (Pirotte, 2004). Ce dernier point a également constitué une motivation supplémentaire pour privilégier les techniques économétriques dans la mesure où les problématiques adressées dans cette thèse appellent des réponses "précises" et ne nécessitent —pas forcément— des exercices de simulations. Enfin, cette thèse se compose d'une succession d'articles, d'où nécessairement des redites d'un article à l'autre —notamment sur le calcul des taux de change d'équilibre.

Plan de la thèse

Cette thèse s'articule autour de quatre chapitres regroupés en deux parties.

Dans la première partie, nous nous intéressons aux conséquences des mésalignements de change et plus particulièrement à leurs effets sur la croissance économique.

Le premier chapitre revisite le lien entre les mésalignements de change et la croissance économique pour les pays de la zone CFA, en prenant en compte la dynamique de la dette extérieure libellée en devises (autres que le Franc français et

l'euro). Nous proposons d'examiner dans ce chapitre un canal de transmission à travers lequel les mésalignements de change pourraient impacter la croissance: le canal de la dette libellée en devises. Du fait de leur ancrage à la monnaie française, le cas des pays de la zone CFA est particulièrement intéressant pour cette analyse. En effet, dans un contexte d' "euro fort", les pays de la zone CFA enregistrent une perte de compétitivité-prix qui peut inhiber leur croissance. Dans le même temps, cet "euro fort", via des effets de valorisation, peut également réduire le poids de leur dette extérieure libellée en devises, et ainsi soutenir leur croissance. Dès lors, la question cruciale qui se pose pour ces pays est d'analyser les déterminants de la croissance en étudiant non seulement le canal —traditionnel— de la compétitivité-prix, mais également celui de la dette extérieure. Pour procéder à une telle analyse, nous estimons une équation de croissance à partir d'un modèle non-linéaire à transition lisse (*Panel Smooth Transition Regression, PSTR*) afin de mettre en évidence d'éventuels effets non-linéaires exercés par les mésalignements sur la croissance et sur la dynamique de la dette libellée en devises. Nos résultats indiquent que si la croissance dans les pays de la zone CFA est principalement expliquée par le canal de la compétitivité-prix, cet effet est atténué par des effets de valorisation exercés par les mésalignements sur la dette libellée en devises. Nos résultats mettent donc en évidence un autre canal de transmission à travers lequel les mésalignements exercent un effet non-linéaire sur la croissance.

Le deuxième chapitre s'inscrit dans la continuité du précédent puisqu'il analyse l'existence du même canal de la dette extérieure mais pour un échantillon plus large composé de 72 pays (émergents et en développement). Par ailleurs, l'accent est également mis sur le rôle du régime de change dans la diffusion des effets de valorisation qui sous-tendent le canal de la dette extérieure. En ce qui concerne la méthodologie, nous recourons à (*i*) une analyse bayésienne de type *Bayesian Model Averaging* (BMA) pour tenir compte de l'incertitude liée au choix du modèle de croissance et (*ii*) à la méthode des moments généralisés en système pour assurer une robustesse des résultats en présence d'endogénéïté. Nos résultats confirment l'existence d'un canal de la dette extérieure, qui, par rapport au canal traditionnel de la compétitivité-prix, exerce des effets opposés sur la croissance. Toutefois, les effets de valorisation qui sous-tendent ce canal de la dette extérieure apparaissent plus significatifs en cas de sous-évaluation plutôt que de surévaluation du taux de change réel. Par ailleurs, il ressort également de notre analyse que le régime de change joue un rôle important dans la diffusion de ces effets de valorisation. Nos résultats soulignent donc l'importance pour ces pays de minimiser les mésalignements de change et surtout de suivre un régime de change compatible avec la composition

de leur dette.

Dans la deuxième partie —qui comprend les troisième et quatrième chapitres— l'accent est mis sur la question de l'efficacité de la politique de change dans la prévision/correction des mésalignements de change.

Le chapitre III analyse le lien entre les régimes de change et la capacité d'ajustement du taux de change, sous l'angle des mésalignements de change. L'idée sous-jacente à cette analyse est qu'un régime de change approprié devrait faciliter les ajustements macroéconomiques des économies et ainsi leur permettre d'éviter des mésalignements de change importants. Notre analyse, basée sur un échantillon de 73 pays émergents et en développement et mobilisant diverses classifications *de facto* de régimes de change, ne parvient pas cependant à établir de façon robuste l'existence d'un lien entre le régime de change et les mésalignements de change. Les performances des régimes de change en terme de mésalignements dépendent, en effet, de la classification utilisée. Plus particulièrement, nous montrons que pour discriminer les régimes de change sur la base des mésalignements de change, il est important de les différencier sur la base de leur cohérence avec les politiques macroéconomiques sous-jacentes. Les mésalignements de change n'apparaissent pas ainsi relever de l'arbitrage entre régimes fixes et flexibles, ni de l'utilisation des réserves de change —qui ne capturent pas de façon adéquate les interventions sur le marché des changes, mais sont principalement le résultat de régimes de change dysfonctionnants.

Le chapitre IV s'inscrit dans la continuité du chapitre III dans la mesure où il s'intéresse à la transmission des variations du taux de change nominal à celles du taux de change réel. De par son effet sur la structure des prix relatifs, la dévaluation a souvent été au cœur des programmes d'ajustement avec pour but d'améliorer la situation économique via un accroissement de la rentabilité des activités d'exportation et de substitution à l'importation. Toutefois, la réalisation de cet objectif est conditionnée en amont par l'effectivité de l'ajustement nominal, i.e. par la capacité de celui-ci à se traduire par une dépréciation réelle. La question de la transmission des variations du taux de change nominal à celles du taux de change réel s'avère donc capitale. L'objectif de ce quatrième chapitre est donc d'analyser cette question en accordant une attention particulière aux rôles joués par l'ampleur de l'ajustement nominal ainsi qu'à l'ampleur initiale du mésalignement du taux de change réel, deux éléments moins étudiés dans la littérature. Pour ce faire, nous constituons un échantillon de 57 épisodes de dévaluation (dans 40 pays émergents et en développement) puis recourons à une analyse bayésienne de type *Bayesian Averaging of Classical Estimates* (BACE) afin d'identifier les fondamentaux du taux de change réel les plus

pertinents pour l'évaluation des mésalignements. En nous appuyant sur un cadre théorique formel, des faits stylisés, et diverses analyses économétriques, l'analyse souligne qu'une surévaluation considérable du taux de change réel est un facteur clé pour que les variations du taux de change nominal se transmettent aux taux de change réel. Nos résultats mettent également en évidence l'existence d'une relation non-linéaire et soulignent ainsi l'importance jouée par l'ampleur de l'ajustement nominal, un ajustement important du taux de change nominal ne se traduisant pas nécessairement par une forte dépréciation du taux de change réel.

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Part I

Exchange rate misalignments and economic growth: beyond the competitiveness effects

Chapter 1

Revisiting the nexus between currency misalignments and growth in the CFA zone*

Abstract

In this paper, we revisit the link between currency misalignments and economic growth by taking into account foreign currency-denominated debt dynamics for the CFA zone countries over the period 1985-2011. Relying on a BEER approach and using panel cointegration techniques, we first derive currency misalignments. We then estimate a panel smooth transition growth equation that allows currency misalignment to exert nonlinear impacts on both economic growth and foreign currency-denominated debt dynamics. We find that the nonlinear impact of currency misalignments on growth through the competitiveness channel is mitigated by the foreign currency-denominated debt dynamics through a valuation effect.

Keywords: Currency misalignments; CFA zone; debt; economic growth; panel smooth transition regression.

JEL Classifications: C33, E42, F3, F43.

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1.1 Introduction

A relatively abundant literature has highlighted the importance of assessing equilibrium exchange rates in order to limit, or even eliminate, the adverse impact that real exchange rate's misalignments (defined as the difference between the observed real exchange rate and its equilibrium value) may have on economies.

If until now there is no consensus in the determination of equilibrium real exchange rates (see Edwards and Savastano, 2000; Driver and Westaway, 2004), many studies, during these last few years, have sought to link currency misalignments to economic growth (Aguirre and Calderón, 2005; Gala and Lucinda, 2006; MacDonald and Vieira, 2010; Béreau et al., 2012; among others). Recent empirical studies agree that undervalued currencies usually exert a positive effect on growth. In particular, Elbadawi et al. (2009), Levy-Yeyati and Sturzenegger (2007), Rodrik (2008), Korinek and Servén (2010) state that this positive impact is channeled through respectively an increase in exports, an expansion of savings, of capital accumulation, and of investment as well as through learning-by-doing externalities in the tradables sector.

However, the generalization of these results may be questionable as impacts exerted by currency misalignments on growth have not been totally explored. In particular, very little research exists on the link between misalignments and the foreign currency-denominated debt. Indeed if a currency overvaluation can cause a competitive disadvantage, it can also reduce the external debt denominated in foreign currency. This issue is particularly accurate for the CFA zone countries. On one hand, their competitiveness depends on the variations of their anchor currency vis-à-vis third currencies; on the other hand, their revenue coming from their exports dominated by primary products incited them to be indebted in US dollars. Then, for the CFA zone countries, it can be expected that currency misalignments could impact economic growth through two antagonistic effects. For example, in case of a real overvaluation, the deterioration of their competitiveness could inhibit their growth while the decrease of their foreign currency-denominated debt, through valuation effects, could inversely benefit to their growth. Thus, a crucial issue for these countries is to analyze how currency misalignments may be transmitted to growth not only through the competitiveness channel, but also through the channel

of valuation effects. This is the purpose of this paper.

Accordingly, we implement a methodological approach in two steps. The first step consists in determining the equilibrium exchange rates of the CFA zone countries in order to derive their currency misalignments. To do so, we adopt the Behavioral Equilibrium Exchange Rate (BEER) approach (Clark and MacDonald, 1998) and use panel data econometric techniques (panel unit root tests and panel cointegration) for the determination of equilibrium exchange rates. The second step consists in estimating a growth equation which allows us to take into account the two transmission channels of misalignments to growth mentioned above. Given that competitiveness and valuation effects crucially depend on whether the real exchange rate is over or undervalued, we rely on a Panel Smooth Transition Regression (PSTR) model (González et al., 2005) in order to take into account those potential nonlinear impacts that currency misalignments may exert on growth.

We therefore extend the literature on the nexus between currency misalignments and growth in two respects. First, we depart from the traditional viewpoint that real undervaluation always fosters growth by assuming instead that the relationship may not be straightforward. Second, we contribute to the literature investigating the effects of currency misalignments on growth in sub-Saharan African countries by estimating this relationship in a nonlinear framework.

Considering a panel of twelve CFA zone countries over the 1985-2011 period, our results show that currency misalignments exert a nonlinear impact on growth dynamics through two conflicting effects: a competitiveness effect and a valuation effect. More precisely, we evidence that a real undervaluation tends to boost growth through competitiveness gains but also tends to hamper it through an increase in the foreign currency-denominated debt.

The rest of the paper is organized as follows. Section 2 is devoted to a review of literature on the linkage between growth, currency misalignments and debt dynamics. In Section 3, we present the methodologies and describe the data. In Section 4, we present and discuss the results on the relationship between currency misalignments, debt and economic growth. Finally, Section 5 concludes.

1.2 Currency misalignments, debt and economic growth: a review of literature

1.2.1 Currency misalignments and growth

For developing countries and especially for sub-Saharan African (SSA) countries, the issue of currency misalignments is central to their growth process. Because of institutional weaknesses and market failures, currency misalignments may be persistent and may then cause important economic disturbances. So, it is not surprising that a considerable number of empirical works has pointed out a negative link between misalignments and economic growth in those countries.

Cavallo et al. (1990) studied the relation between real exchange rate behaviour and economic performance over a sample of less developed countries. Using two measures of misalignments (a PPP-based index and a regression-based index[1]), they highlighted the negative link between GDP growth and real exchange rate's instabilities (volatility and misalignment). Following Cavallo et al. (1990), Ghura and Grennes (1991) also investigated the relationship between indicators of macroeconomic performance and real exchange rate misalignments in sub-Saharan countries over the period 1970-1987. Their empirical results pointed out a negative link between misalignments and economic growth. According to these authors, better economic performances are usually linked to lower levels of real exchange rate misalignments.

Beyond the size of misalignments, several studies have pointed the specific adverse impact exerted by overvaluations on growth. Klau (1998) emphasized that one of the main causes of poor economic performance in the CFA zone from the mid-1980s to early 1990s, was the CFA Franc overvaluation during that period. It is in this context of important economic imbalances that the CFA devaluation occurred in 1994. This result has been reinforced by recent studies. Gala and Lucinda (2006) and Toulaboe (2006) have offered more robust evidence of the negative link

[1]The authors consider the following fundamentals of real exchange rates: terms of trade, differential productivity, excess domestic credit creation, net capital inflows and the income over trade ratio.

between real GDP growth and overvaluations by using panel data approach. More recently, Elbadawi et al. (2009) have investigated the impact of currency misalignments on economic growth and exports for 83 sub-Saharan countries over the period 1970-2004. Using a dynamic model developed initially by Elbadawi et al. (2008) to derive real exchange rate misalignments indexes[2], they also find a negative impact of overvaluation on growth as well as on export diversification and sophistication.

This relationship has been clarified by studies which emphasize possible asymmetric impacts of under- and overvaluations on economic growth. Razin and Collins (1997) explore the relationship between real exchange rate misalignments and economic growth for a large sample of countries and show that there are important nonlinearities in this relationship. More specifically, only a very high overvaluation appears to be associated with slower economic growth. Moderate to slightly high undervaluations, on the contrary, go hand in hand with more rapid economic growth. Aguirre and Calderón (2005) consider a panel of 60 developed and developing countries over the 1965-2003 period. To capture potential asymmetric effects of misalignments, they estimated a growth equation in which they include interaction variables.[3] Their empirical results show that an undervaluation up to 12% enhances growth, whereas an overvaluation tends to hamper it. Several studies based on regime switching models have also found a positive and significant link between undervaluation and growth, while an overvaluation above an estimated threshold negatively affects economic growth (see for instance, Béreau et al., 2012; Aflouk and Mazier, 2013; Couharde and Sallenave, 2013). Overall, these results clearly highlight the asymmetrical behaviour of over- and undervaluation. Firstly, the wider the currency misalignment, the more negative the impact on growth is. In particular, large undervaluations seem to hamper growth dynamics while small to moderate undervaluations enhance it. Secondly, the impact of currency misalignments depends on their sign: a real overvaluation generally exerts a negative impact on growth while the effect of a real undervaluation is found to be positive.

[2]The reduced form of the real exchange rate's equation includes: terms of trade, endowment variables (natural resources and human capital), government consumption, productivity levels, foreign aid, the stock of foreign debt and taxes.

[3]The authors assume possible differentiated countries' behaviors depending on the size and/or the sign of their currency misalignments.

1.2.2 The issue of transmission channels

Beyond the question of the effects of currency misalignments on growth, the issue of transmission channels at stake is also a fundamental one. However, as underlined by Gala (2008), theoretical analyses of those transmission channels through which real exchange rate levels could affect economic growth are very scarce.

Rodrik (2008) argues that the relevant channel operates through the size of the tradable sector. Undervaluation has a positive effect on the relative size of the tradable sector, and especially of industrial economic activities which in turn may boost growth. For Elbadawi et al. (2009), the main channel operates through export diversification and sophistication. An overvalued real exchange rate damages the manufacturing base, leads to more export concentration, and undermines the development of more sophisticated products. Gala (2008) also supports the idea that undervaluations encourage exports.[4] However, according to him, two important channels through which exchange rates levels affect growth are related to investment and technological change. A relatively undervalued currency should lead to lower real wage levels and higher profit margins and then contribute to more employment and investment by increasing capacity utilization. Also, a competitive exchange rate would help developing countries to climb the technological ladder. In the same vein, Gluzmann et al. (2011) suggest that undervaluation fosters growth by the channel of savings and investment rather than foreign trade dynamics: an undervalued exchange rate tends to increase the investment and the domestic saving rate, which in turn stimulate growth by increasing the rate of capital accumulation. Regarding the saving rate channel, Montiel and Servén (2008) do not support this conclusion. Drawing from standard analytical models, stylized facts on saving and real exchange rates, and existing empirical research on saving determinants, they assess the link between the real exchange rate and saving. Their main conclusion is that saving is unlikely to provide the mechanism through which the real exchange rate affects growth. Focusing on the investment channel, Ali and Elsharif (2012) find support for the positive impact of real undervaluation through Foreign Direct Investment (FDI). They run causality analyses between the real exchange rate and

[4] A relatively undervalued currency may also help to avoid financial crises and therefore put the economy on a more sustained development path.

FDI, and between FDI and GDP growth for the CFA zone. Their results show that the RER level impacts FDI flows which in turn affect economic activity and therefore growth. These findings are in line with previous studies suggesting the need to avoid overvaluation of the RER to attract FDI and thus promote growth (see for instance, Goldberg and Klein, 1998; Kiyota and Urata, 2004).

Both channels mentioned above are so far the two dominant views in the literature. But, as Montiel and Servén (2008) emphasized, the literature addressing the issue of the channel through which the real exchange rate impacts growth is in its infancy, and there is no consensus on the precise channels through which effects are generated.

Another channel, less investigated, is the impact of currency misalignments on the foreign currency-denominated debt and more particularly on the burden of these debts. Indeed, a high level of foreign currency-denominated debt can hamper growth, in particular in developing countries, through balance sheets effects (Calvo and Reinhart, 2001; Céspedes et al. 2004). The underlying mechanism is the following: a domestic currency depreciation considerably increases foreign currency-denominated debt burdens, leading thus to a decrease in firms production mainly because of corporate financial distress, absence of trade credit and increasing costs of imported inputs and goods. These balance sheet effects also weaken the balance sheets of banks and the government's fiscal position. On the other hand, an appreciation reduces the foreign currency-denominated debt and improves the ability to borrow in foreign currency. There is then a trade-off between competitiveness and balance sheet effects and, as argued by Craigwell et al. (2010) and Gnangnon (2012), the total effect will depend on the effectiveness of the depreciation: an exchange rate depreciation will lead to a decline of the external debt stock if the induced rise in export earnings of this depreciation is sufficiently enough to service the external debt.

This problem of balance sheets effects is common to developing countries and the main reason can be found in the "original sin" according to which developing countries generally cannot borrow in their own currency (Eichengreen and Hausmann,

1999). Khan (2005) surveys the literature on the original sin by paying special attention to sub-Saharan Africa (SSA) countries and argues that due to undeveloped and relatively small size of their financial and bond markets, SSA countries (except South Africa which has a quite developed financial sector) are heavily dependent of foreign capital or aid inflows. Moreover, as emphasized by Ul Haque (2002) and Goldstein and Turner (2004), the ability to borrow abroad in domestic currency, depends not only on financial markets development but also on the credibility of national macroeconomic policies (apprehended mainly by low inflation) and on institutional factors which are usually weak in SSA countries. Therefore, for all those reasons, those countries are usually exposed to the "original sin".

Until now, the way through which these effects could happen for the CFA zone countries has not been studied. On the one hand, the CFA countries benefit from credibility that is conventionally associated to their irrevocable commitment to a fixed exchange-rate regime and guaranteed convertibility of their currency that allow them to borrow on financial markets. As displayed in Tables A.2.1 and A.2.2 in Appendix, their foreign currency-denominated debt (except in the anchor currency) represents a significant weight (around 45% of GDP and 65% of the total public debt). On the other hand, given their peg to the euro (French Franc before 1999), fluctuations of the anchor currency against currencies of third countries should therefore have some impacts on the CFA Franc variations and then on the foreign currency-denominated debt of the CFA zone countries. Indeed, as depicted in Figure 1.1, variations of the CFA Franc have mirrored the anchor currency's variations (except in 1994 when the CFA Franc was devalued by 50 per cent against the French Franc).

In particular, since 2003 with the appreciation of the euro, the issue of the interactions between the misalignment of the CFA Franc and the evolution of the anchor currency has been highlighted in several studies. Coudert et al. (2011) note that, for the CFA zone, the evolution of the anchor currency has impacted the level of misalignments, and that the CFA Franc has tended to be overvalued in periods when the euro was strong. Gnansounou and Verdier-Chouchane (2012) also evidence that the misalignment curve of the CFA Franc is closely linked to that of the euro / dollar exchange rate (except when prices of major commodities exported by

each country increase). Gnimassoun (2012) who empirically studied the effect of the peg (more specifically the effects of the anchor currency misalignments within the CFA zone) found that a 1% nominal overvaluation of the French Franc (resp. euro) results in an overvaluation of the CFA Franc between 1.2% and 1.5% (resp. 0.69%). As a result, due to their exchange rate regime, the CFA countries could be confronted with two contradictory effects stemming from currency misalignments. They should reap a competitive advantage but also register an increase in their foreign currency-denominated debt in periods when their currency tends to be undervalued. Conversely, with real exchange rates overvalued, they could record a loss of competitiveness while benefiting from a decrease in their foreign currency-denominated debt. The nexus between currency misalignments and growth is then not straightforward and should be clarified by taking account those two transmission channels.

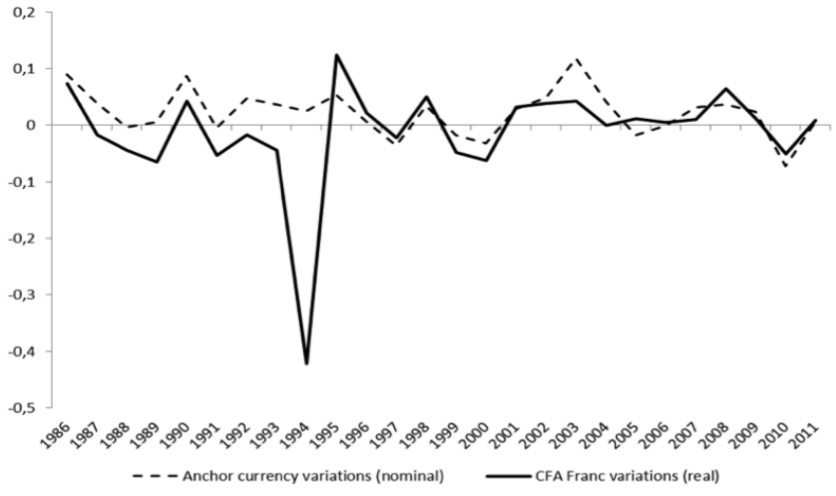

Figure 1.1 — CFA Franc and anchor currency variations (in%)

Note: The CFA variations are those of the real effective exchange rate, those of the anchor currency correspond to the nominal effective exchange rate (euro and French Franc before 1999).
Source: Author's calculation

1.3 Econometrical framework

1.3.1 Methodology

Derivation of real exchange rate misalignments

To derive our misalignments series, we rely on the BEER (Behavioral Equilibrium Exchange Rate) approach (Clark and MacDonald, 1998).[5] The BEER approach is based on the estimation of a long-run relationship between the observed real effective exchange rate and a set of economic variables likely to influence it in the long run, more commonly known as fundamentals. This estimated long-run relationship is assumed to give an assessment of the equilibrium exchange rate. We follow the existing literature on the determination of equilibrium exchange rate in developing countries and more specifically in the CFA zone (see Abdih and Tsangarides, 2006; Roudet et al., 2007; Elbadawi et al., 2009; Couharde et al., 2011; among others) and consider the following determinants of the real effective exchange rate: productivity differential (*rprod*), terms of trade (*tot*), government consumption (*gov*), openness (*open*) and the net foreign assets (*nfa*). We expect a positive relationship between the real effective exchange rate and these fundamentals. Indeed, an increase in the productivity differential, in government consumption and in openness as well as an improvement in the net foreign asset and the terms of trade are expected to induce an appreciation of the real effective exchange rate. Our long-run relationship is therefore specified as follows:

$$q_{i,t} = \alpha_i + \beta_1\ tot_{i,t} + \beta_2\ rprod_{i,t} + \beta_3\ open_{i,t} + \beta_4\ gov_{i,t} + \beta_5\ nfa_{i,t} + \epsilon_{i,t} \qquad (1.1)$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ respectively indicate the individual and temporal dimensions. $q_{i,t}$ represents the real effective exchange rate; α_i are the countries fixed effects and $\epsilon_{i,t}$ the disturbances.

Before estimating equation (1.1), we first determine the order of integration of the real effective exchange rates and their fundamentals and then test the existence

[5]For extensive surveys on the BEER and related concepts (such as PPP, CHEER, FEER, DEER, PEER, NATREX) we refer to MacDonald (2000), Edwards and Savastano (2000), and Driver and Westaway (2005).

of a cointegration relationship by applying non-stationary panel methods.[6] If results reveal the existence of a cointegration relationship, we will estimate equation (1.1) using an efficient panel cointegration estimation procedure.

Once equation (1.1) estimated, real equilibrium exchange rates are assessed —using the Elbadawi et al. (2008) methodology— by feeding the estimated model with the permanent components of the fundamentals. We use the Hodrick-Prescott filter to decompose our fundamentals into their temporary and permanent component. Currency misalignments ($Mis_{i,t}$) are there deduced as follows:

$$MIS_{i,t} = q_{i,t} - q^*_{i,t} \tag{1.2}$$

where $q_{i,t}$ is the observed real effective exchange rate and $q^*_{i,t}$ its equilibrium level (the fitted value of $q_{i,t}$ using equation (1.1) estimates).

Investigating the debt channel in the misalignments-growth nexus

To investigate now the potential nonlinear effects exerted by currency misalignments on growth, we rely on a Panel Smooth Transition Regression (PSTR) model (González et al., 2005). With this specification, González et al. (2005) proposed an extension of the Panel Threshold Regression (PTR) models (Hansen, 1999) by allowing coefficients to vary smoothly from one regime to another, depending on the value (threshold) of a transition variable. Transition from on regime to another is ensured by a transition function which allows coefficients to change smoothly.

As we expect that the impact of currency misalignments on growth is non linear and is channeled through a competitiveness effect and a valuation effect, we consider that the transition variable is the currency misalignment and that only the coefficients of the foreign-currency denominated debt variable and the misalignments series vary depending on the sign and/or the size of the currency misalignment. Thus

[6]The use of panel data has the distinct advantage of allowing working with small sample size in the temporal dimension - as is often the case in African countries - and thus to overcome the classic problem of low power tests in small sample.

we consider the following PSTR model:

$$\Delta y_{i,t} = \mu_i + \beta_{01} Debt_{i,t} + \beta_{02} Mis_{i,t} + [\beta_{11} Debt_{i,t} + \beta_{12} Mis_{i,t}]\ g(Mis_{i,t}; \gamma, c) + \Omega_0 X_{i,t} + \ u_{i,t} \tag{1.3}$$

for $i = 1, \ldots, N$, and $t = 1, \ldots, T$, where N and T denote the cross-section and times dimensions of the panel, respectively. $\Delta y_{i,t}$ is the dependent variable, the per capita GDP annual growth; μ_i represent the fixed individual effects; $debt_{i,t}$, is the foreign currency-denominated debt in % of GDP and $Mis_{i,t}$ is the currency misalignment. $X_{i,t}$ is a k-dimensional vector of time varying control variables, and $u_{i,t}$ is an independent and identically distributed error term.

According to this specification, debt and currency misalignment coefficients are allowed to vary depending on the level of currency misalignment. PSTR models being regime switching models in which the transition from one regime to the other is smooth rather than discrete, the change in the estimated value of coefficients is smooth and gradual.

$g(Mis_{i,t}; \gamma, c)$ is the transition function normalized to be bounded between 0 and 1 which, following Gonzalez et al. (2005), can be specified as follows:

$$g(Mis_{it}; \gamma, c) = \left[1 + exp\Big(- \gamma \prod_{j=1}^{m} (Mis_{i,t} - c_j)\Big)\right]^{-1} \ with\ \gamma > 0 \text{ and } c_1 \leq c_2 \leq \ldots \leq c_m \tag{1.4}$$

where γ is the slope parameter determining the smoothness of the transition, $Mis_{i,t}$ the transition variable and c_j the threshold parameters.

With $m = 1$ and $\gamma \to \infty$, the PSTR model is equivalent to the two-regime Panel Threshold Regression (PTR) model (see Hansen, 1999). Indeed, the higher the slope parameter, the more abrupt the regime shift; the extreme case being when $\gamma \to \infty$. For any value of m and when $\gamma \to 0$, the model collapses into a homogenous (linear) panel regression model with fixed effects. As González et al. (2005) emphasized, any nonlinearity can be captured with $m = 1$ (the transition function is logistic) or $m = 2$ (the transition function is logistic quadratic). For $m = 1$, the nonlinearity implies two extreme regimes associated with high and low values of the currency misalignment relative to its threshold. For $m = 2$, the nonlinearity implies two

transition points which delimitate an intermediate regime in which the dynamic is different compared to the one followed by the two extreme regimes.

We follow the three steps methodology proposed by González et al. (2005). The first step (model specification) consists of *(i)* testing the homogeneity of the model against the PSTR alternative and *(ii)* choose the appropriate transition function (order of m) as well as the appropriate transition variable. The second, estimation step relies on the use of nonlinear least squares to obtain the parameter estimates, once the data have been demeaned. The third and last stage is devoted to the application of misspecification tests in order to ensure the validity of the PSTR model: parameter constancy and no remaining heterogeneity. The latter test is useful for determining the number of transitions in the model.

1.3.2 Data

Our sample includes twelve CFA zone countries: Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal and Togo which belong to the West African Economic and Monetary Union (WAEMU); Cameroon, Central African Republic, Chad, Congo and Gabon for the Central African Economic and Monetary Community (CEMAC).[7]

As mentioned before, our analysis is based on a two-phase approach. In the first stage we estimate a long run relationship between the real effective exchange rate (*reer*) - the dependant variable - and the following explanatory variables: the productivity differential (*rprod*), the terms of trade (*tot*), the government expenditures (*gov*), the openness (*open*), and the net foreign assets position (*nfa*). All series are in logarithms, except *gov*, *nfa* and *open* which are expressed in percentage of GDP. This step allows us to assess currency misalignments. In the second stage, we estimate a nonlinear growth equation, conditioning on the estimates of currency misalignments from the first stage. Following the literature on growth in developing countries (see Barro, 1991; Barro and Sala-i-Martin, 1995; Mirestean and Tsangarides, 2009; among others), but paying a special attention to African

[7]Guinea-Bissau and Equatorial Guinea have been excluded from the panel. Guinea Bissau belongs to the CFA zone over the past few years. Given problems of data availability, it has not been possible to include Equatorial Guinea.

countries (Tsangarides, 2012), we also consider the following control variables.[8] In accordance with the neoclassical theory, we first retain two variables: (*i*) human capital development through life expectancy, and (*ii*) population through population growth rates.[9] We also consider macroeconomic variables such as: (*iii*) government consumption (measured in percentage of GDP), (*iv*) inflation rates, (*v*) investment (in percentage of GDP) and (*vi*) external debt service (public and publicly guaranteed, as percentage of GDP); variables related to the trade regime: (*vii*) openness and (*viii*) terms of trade. Finally, we include a measure of the external environment through (*ix*) the ratio aid to GDP.[10]

Finally, we report in Appendix A.2, details of the calculation of the foreign currency-denominated debt. Given the purpose of our study and the aforementioned mechanisms, we consider the foreign currency-denominated debt except the French Franc- and euro-denominated debt — and not the external debt converted into foreign currency. We therefore built our variable of interest using the external debt stocks, public and publicly guaranteed (PPG) as percentage of GDP and its currency composition (in euro and French Franc).[11]

All data are annual and cover the period 1985-2011. Definitions and sources as well as measurements of the data are reported in Table A.1 in Appendix A.

Unit root tests

As in any empirical study with sufficient time dimension, we tested for the existence of unit root in our series. To do so, we rely on the second-generation unit root tests (Choi, 2002; and Pesaran, 2003) which relax the assumption of cross-sectional independence. We justify this choice by the strong correlation between real effective exchange rates of our countries sample. Indeed, their peg to the same anchor currency implies that the inter-individual independence assumption underlying the first generation tests may be no relevant. The Choi (2002) test relies on an error-

[8]The approach developed by Tsangarides (2012) is particularly interesting as it deals with the issue of model uncertainty by relying on Bayesian techniques.

[9]We could also take into account the gross secondary-school enrollment according to the literature (see Barro (1991) among others) but this variable is not available for all countries of our sample.

[10]See Table A.1 in Appendix A for the presentation, definition and sources of the data.

[11]Because of data availability, we use this variable which must then be considered as a proxy of the foreign currency-denominated debt.

components panel model and removes the cross-section dependence by eliminating (i) individual effects using the Elliott, Rothenberg and Stock (1996) methodology (ERS), and (ii) the time trend effect by centering on the individual mean. The Pesaran (2003) CIPS test is based on Dickey-Fuller type regressions augmented with the cross-section averages of lagged levels and first differences of the individual series. Both tests are based on the null hypothesis of unit root. The unit root test results are reported in Table A.3.1 (Appendix A.3).

For explanatory variables of equilibrium exchange rates —i.e. *tot, rprod, gov, open*, and *nfa*— and real effective exchange rates ($reer$), results indicate that all series, except *open*, are integrated of order one (I(1)). As reer has been found I(1), the exchange rate fundamentals need to be I(1) in order to test for the existence of a cointegration relationship. We therefore exclude *open* from our set of fundamentals. If we now analyze the time series properties of variables related to the growth analysis, all tests conclude that *debt*, investment ($invest$), and life expectancy ($life$), are integrated of order one (I(1)) while, population growth (pop), inflation ($inflation$), external debt service (debt serv) and aid (aid) are stationary processes (I(0)) at 5% confidence level.

1.4 Results

1.4.1 Estimating equilibrium exchange rate and currency misalignments

The second step in our empirical analysis of equilibrium exchange rates and of the corresponding exchange rate misalignments consists in testing the existence of a cointegration relationship between reer and *rprod, tot, nfa* and *gov*. To this end, we perform the Westerlund (2007) cointegration test which, in addition to be robust to cross-sectional dependence, allows for various form of heterogeneity.[12] As displayed in Table A.3.2 in Appendix A.3, results indicate that there is a cointegration relationship between the real effective exchange rate and the fundamentals. We then

[12] Among the four tests developed by Westerlund (2007), two are designed to test the alternative hypothesis that the panel is cointegrated as a whole while for the other two tests; the alternative is that at least one unit is cointegrated. Note that the null of the test is that there is no cointegration.

proceed to the estimation of our long-run relationship.

The coefficients of the long-run relationship are derived by using DOLS (Mark and Sul, 2003) and PMG (Pesaran et al., 1999) estimators. The choice of these estimators is motivated by the fact that (*i*) the DOLS estimator takes into account potential endogeneities among the variables, and, (*ii*) the PMG estimator has the advantage to provide estimates not only of the long-run parameters, but also of the short-run dynamics and the speed of adjustment to equilibrium; in addition, it allows for some degree of heterogeneity. Results of both PMG and DOLS estimations are displayed in Table 1.1.[13]

Table 1.1 — PMG and DOLS estimation results

	PMG		DOLS	
	Coef.	*z*	Coef.	*t*
Long-run dynamic				
rprod	0.382 ***	5.94	0.363 ***	4.46
tot	0.172 ***	3.40	0.218 ***	3.76
nfa	0.058	1.41	0.078	1.22
gov	0.331 ***	6.70	0.420 ***	8.03
Short-run dynamic				
ec.	-0.311 ***	-5.90		
rprod	-0.181	-1.51		
tot	-0.116 ***	-2.93		
nfa	0.268 ***	5.36		
gov	0.090	1.23		
const.	1.262 ***	5.93		

Note: ***, **, and * denote respectively significance at 1%, 5%, and 10% level. Although PMG estimator takes into account the non-stationary nature of the variables, we deliberately excluded *open* from the short-run dynamic in order to limit the collinearity risk in the growth equation.

Estimation results of the long-run relationship are in accordance with the theory: an increase in the productivity differential and in government consumption as well as an improvement in the terms of trade leads to an appreciation of the equilibrium real exchange rate in the long run. The net foreign asset position impacts the equilibrium exchange rate only in the short-run. The coefficient of the error correction term, -0.311, corresponds to a half-life of approximately 2.56 years[14]: *ceteris paribus*, following a shock, the real effective exchange rate returns to its equilibrium

[13]The DOLS procedure imposes an homogeneous cointegration vector, which explains the absence of short-run dynamics in the DOLS estimates and also discrepancies —although weak— between the PMG and DOLS long-run estimates.

[14]The half-life (HL) is defined as the number of periods required for the impulse response to a unit shock to a time series to dissipate by half. It is calculated as follows: $HL = |log(0.5)/log(1-\gamma)|$ where γ is the coefficient of the error correction term.

level after 5.2 years. Our value of the error correction term is a bit higher than those estimated by Gnimassoun (2012) and Couharde et al. (2013) which found a coefficient of respectively -0.26 and -0.23 (half-life of approximately 3 - 3.35 years).

Using the estimates in Table 1.1 and relying on the methodology proposed by Elbadawi et al. (2009) —see section 3.1.1 —, we compute our equilibrium exchange rate indexes and derive afterwards the corresponding exchange rate misalignments.

Figures B.1 and B.2 in Appendix B display respectively the evolution of the real effective exchange rates (observed and equilibrium) and currency misalignments series for each considered country. In general, our results corroborate ones of previous studies (Gnimassoun, 2012; Couharde et al., 2013). As pointed out by Couharde et al. (2013), the CFA Franc was overvalued since the late 1980s and until the devaluation of 1994 (see Figure B.2). In 1993, all countries except Togo, exhibited important levels of overvaluation. In particular, Benin, Burkina Faso, Cote d'Ivoire, Cameroon and Senegal have overvaluation's levels above 18%. Over the period 1990-1993, a partial decrease of misalignments can be observed, which was probably due to the structural adjustment plans in place at this time in those countries. Following the devaluation that occurred in 1994, misalignments turn, in all countries, from overvaluations to undervaluations. Nevertheless, for most of the countries, this competitiveness advantage has been reduced progressively with the introduction of the euro and more particularly to 2002 when the euro begun to appreciate against third currencies and more particularly against the US dollar. Only in some CAEMC economies (Cameroon, Republic of Congo, Chad), the appreciation of the euro has been more than offset by an improvement in their terms of trade, thereby allowing them to record important undervaluations.[15]

1.4.2 Revisiting the growth - currency misalignments nexus

Before estimating the PSTR model, we start by testing the null hypothesis of linearity (testing homogeneity). In particular, we test whether the response of growth is different, depending on the size and the sign of the real exchange rate misalignment, identified here as the threshold variable.

[15]Since the CEMAC zone countries are mainly oil exporters, the improvement in the terms of trade has induced an appreciation of their equilibrium exchange rates which in turn has resulted in an undervaluation of their real exchange rates.

As stated in the methodology section, the PSTR model can be reduced to a homogenous form model by imposing either $H_0 : \gamma = 0$ or $H_0^{'} : \beta_1 = 0$ (see equations (1.3) and (1.4)). A way to test the linearity assumption could therefore consist in testing for these last two assumptions. However, these tests are nonstandard because under either null hypothesis the PSTR model contains unidentified nuisance parameters. Indeed, c (the location parameter) is not identified under both null hypotheses, while this is the case for β_1 under H_0 and for γ under $H_0^{'}$. Following Luukonnen et al. (1988), González et al. (2005) proposed to the null hypothesis of $H_0 : \gamma = 0$ by replacing the transition function by its first-order Taylor expansion around $\gamma = 0$. After reparameterization, this test simply amounts to test a constrained model against an unconstrained model.

In Table 1.2, are reported respectively in the first and in the second lines the results of this test and of the no remaining heterogeneity test. As indicated by González et al. (2005), in addition to be a misspecification test, the latter test is a useful tool for determining the number of transitions in the model.

Table 1.2 — Homogeneity and no remaining heterogeneity tests results

			$LM_{\chi}stat$	$LM_{F}stat$	Pseudo LRT
H_0 : Linearity	vs.	H_1 : PSTR model	6.871	3.340	6.962
$r = 0$		$r = 1$	(0.032)	(0.037)	(0.030)
H_0 : No remaining		H_1 : Heterogeneity	7.504	1.819	7.603
heterogeneity	vs.		(0.111)	(0.125)	(0.107)
$r = 1$		$r = 2$			

Note: We reported tests results for our most significant specification (see Table 1.3 for more details). r denotes the number of transition.

Results reported in Table 1.2 show that the null hypothesis of linearity can be rejected at the 5% significance level. Then the impact of real exchange rate misalignments on growth is nonlinear. Moreover, the results indicate a two-regime model associated with the sign of misalignments (we do not reject the null hypothesis of no remaining heterogeneity). Thus we proceed with estimating our PSTR model (equation (1.3)).

The estimation stage consists in eliminating the individual effects by removing individual-specific means and then apply Nonlinear Least Squares (NLS) to the transformed data. Note that the estimation relies on annual rather than 5-years averaged data. Indeed, even if working with averaged data presents the advantage

to remove business cycles effects from the growth rate, it is costly in observations. We therefore opt for a relatively high number of degrees of freedom by using annual data. Also, unlike usual works on growth, we do not include the initial position of the economy (initial level of real GDP per capita) since it is difficult to deal with an endogeneity issue in a nonlinear panel. Parameter estimates are reported in Table 1.3.

Table 1.3 — Estimated PSTR model[16]

Threshold:	$c = -0.075329$			
Smoothness:	$\gamma = 189.479$			
	g(.)=0		**g(.)=1**	
	β_0	t-stat	β_1	t-stat
Misalignment	0.032*	1.667	-0.087*	-1.791
Debt	-0.226***	-2.597	0.151*	1.817
Investment	0.162***	4.197		
Government spending	-0.236***	-2.765		
Population growth	-0.844***	-2.726		
Life expectancy	0.021**	2.197		
Aid	0.072**	2.030		

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

Our results show a nonlinear impact exerted by currency misalignments. The estimated threshold value, -0.0753, delimits the two following regimes. A first regime associated with "$g(.) = 0$" corresponds to undervalued currencies (undervaluation higher than 7.53%). In this case, the estimated coefficients are those reported in column "$g(.) = 0$". The second regime, related to "$g(.) = 1$", refers to real exchange rates overvalued or slightly undervalued (*i.e.* less than 7.53%). In this case, the estimated coefficients of the variables subject to nonlinearities (currency misalignments and the foreign currency-denominated debt) are defined by the sum of the estimates in columns "$g(.) = 0$" and "$g(.) = 1$". With the high value of the slope parameter, the transition between the two regimes is quite abrupt, as depicted by the transition function displayed in Figure B.3 in Appendix B.

Looking first at the control variables, all coefficients have the expected sign and are statistically significant. Investment, through its positive impact on capital accumulation, increases economic growth. Moreover this variable is one of the most significant growth determinants (the coefficient has the highest t-statistic) as emphasized by Tsangarides (2012). Life expectancy and aid flows also appear to

[16]Some of the variables have been excluded from the final estimation since they were not significant.

be positively correlated with growth. Conversely, government consumption and the population growth hamper growth. The negative sign of government spending seems to confirm the growing consensus that consistent and increasing government presence in an economy can hinder economic growth, especially in developing countries (Rodrik, 2008; Berg and Miao, 2010; MacDonald and Vieira, 2010).[17] In accordance with the Solow model, the population growth coefficient is also negative and significant. An increase of 1% in the population growth leads to a 0.84 decrease of the annual GDP per capita growth.

Let us turn now to our two main variables of interest. First, regarding the impact of currency misalignments on growth, we evidence a nonlinear effect depending on whether real exchange rates are strongly undervalued (more than 7.53%) or not. In the first regime (regime of strong undervaluation), the coefficient associated with the real exchange rate misalignment is positive: beyond a threshold of 7.53%, a real undervaluation has a positive impact on growth. The coefficient is equal to 0.032, meaning that, other things being equal, an undervaluation of the real exchange rate of 10% contributes for an increase in GDP per capita growth about 0.32%. Conversely, in the second regime corresponding to real exchange rates slightly undervalued or overvalued, the impact of currency misalignments is negative (-0.055).[18] Our results are then in line with the bulk of the literature in this area that tends to evidence a positive effect on growth exerted by real undervaluations and an hampered one induced by real overvaluations.

Turning finally to the impact exerted by the foreign currency-denominated debt on growth, results confirm our prediction that it depends on the sign of currency misalignments. Indeed, in the first regime (i.e. in the undervaluation regime), the impact of the foreign currency-denominated debt on growth is negative: an increase of 1% in the foreign currency-denominated debt causes, *ceteris paribus*, a 0.226% decrease in the GDP per capita growth. Nevertheless, this negative impact tends

[17] Another explanation is provided by Barro (1991) who argued that government consumption introduces distortions, such as high tax rates, but does not provides an offsetting stimulus to investment and growth. Economic growth and prosperity should therefore be higher in a context dominated by private enterprises and free market. Others works on the CFA zone confirm this results pointing the lack of complementary between the public and private investment (see Nubukpo (2007) for a review of literature).

[18] $\beta_0 + \beta_1 = 0.032 - 0.087 = -0.055$

to decrease in the second regime (the coefficient is equal to -0.075), meaning that the lower the real undervaluation is, the lower the negative effect of the foreign currency-denominated debt on growth will be.

Overall our findings show that growth dynamics in the CFA zone countries is nonlinearly impacted by currency misalignments through two conflicting channels: a competitiveness channel and a debt channel. A real undervaluation, by improving the international competitiveness —i.e. by lowering the price of the exported goods in international markets—, boosts growth through a re-energized export sector (export-led growth). However, in the same time, a real undervaluation also tends to hamper growth by increasing the foreign currency denominated debt.

1.4.3 Robustness check

To test the robustness of our results, we conduct a number of additional regressions. First, as currency misalignments estimates are often controversial, we estimate the previous PSTR model by considering an alternative measure of misalignments. Accordingly, we rely on an alternative equilibrium exchange rate approach, the Atheoretical Permanent Equilibrium Exchange Rate (APEER) approach, as Aghion et al. (2009) and Béreau et al. (2012). This approach consists in filtering the real effective exchange rate using a Hodrick-Prescott filter and considers the currency misalignment as the cyclical components of the series. For sake of consistency in the discussion, we keep the specification in Table 1.3. We report in Table 1.4, the results of the PSTR model estimated with those alternative misalignment series.

Table 1.4 — Robustness check

Threshold:	$c = -0.1259$			
Smoothness:	$\gamma = 63.6197$			
	g(.)=0		**g(.)=1**	
	β_0	t-stat	β_1	t-stat
Misalignment	0.037***	4.58	-0.109**	-2.19
Debt	-0.301*	-1.85	0.176*	1.68
Investment	0.034***	5.18		
Government spending	-0.157**	-2.01		
Population growth	-0.874**	-1.97		
Life expectancy	0.051**	2.15		
Aid	0.061	1.05		

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

As one can note, we reach the same results as those reported in Table 1.3. Firstly,

the results confirm the robustness of our previous findings on nonlinearities exerted by currency misalignments. However, the value threshold corresponds to a larger real undervaluation— -0.125 — and a transition between the two regimes smoother. But, we still have two extreme regimes associated with exchange rate misalignments. When real exchange rates are strongly undervalued (more than 12.6%), economic growth is both boosted by a competitiveness channel and hampered by the negative impact of the foreign currency-denominated debt. Conversely, slight undervalued or overvalued real exchange rates tend to reduce economic growth while the negative impact exerted by the foreign currency-denominated debt is diminishing. Secondly, the impact of the growth determinants is the same (except the coefficient associated with the official aid which is no more significant). An increase in investment and life expectancy positively impact growth while a negative effect is attributed to the government spending and the population growth.

Finally, as the CFA zone countries (except Gabon) have benefited from debt relief initiatives (namely the Heavily Indebted Poor Countries, HIPC, initiative) during the 2000s, we run additional regressions in order to control for this initiative which in most cases has resulted in a decrease in the external debt.[19] Indeed, the aim of this initiative is to ensure that no poor country faces a debt burden it cannot manage, to reduce to sustainable levels the external debt burdens. In his implementation, the HIPC initiative appears more like a poverty reduction / development initiative as countries must meet specific criteria, establish and implement keys reforms to benefit from debt reliefs.[20] The debt relief (after the completion point) and especially the external debt service reduction (between the decision point and the completion point) should thereby enable to fight more effectively against poverty by allocating more resources to social spending (heath and education). The HIPC initiative can then be seen as a transfer of resources from the external debt service to social spending (in others words, an official development assistance). Accordingly, in order to control for the HIPC effects, we have added both external debt service and government consumption as explanatory variables in our initial growth equation. We have

[19]See Table A.2.3 in Appendix A.2 for further details.

[20]See the IMF Factsheet "Debt Relief Under the Heavily Indebted Poor Countries (HIPC) Initiative" for more details. http://www.imf.org/external/np/exr/facts/hipc.htm

also introduced different dummy variables and interaction variables[21] to control for these effects and also to take into account changes in the macroeconomic policies in place at this time. Further details regarding these dummy variables are reported in Table A.1. Results[22] show that dummy variables are not significant, meaning that the impact of currency misalignments on the foreign currency-denominated debt - growth relationship has not been affected by the HIPC initiative.

1.5 Conclusion

The aim of this article was to evaluate, for the CFA zone countries, the effects of real exchange rate's misalignments on growth, by distinguishing different transmission channels. More precisely, the baseline idea was to look at whether the relationship between currency misalignment and growth could be mitigated when taking into account the foreign currency-denominated debt.

Relying on a BEER approach to derive currency misalignments, and using a panel smooth transition model, we first confirm the existence of nonlinearities in the relationship between currency misalignments and growth, with a positive and significant relationship between undervalued real exchange rates and economic growth. On the contrary, real overvaluation negatively affects growth. In that sense, our study is in accordance with the existing literature on this subject. But our analysis goes further by taking account not only a competitiveness channel but also a debt channel - through valuation effects - in the nonlinear relationship between currency misalignments and growth. Indeed, we also evidence that, in the regime of undervaluation, the foreign-currency denominated debt exerts a negative impact on growth, while this impacts tends to diminish when the undervaluation decreases. We can interpret this finding as a valuation effect reflecting the tendency of the foreign currency-denominated debt to rise with a real undervaluation. Moreover our results prove to be robust to an alternative measure of currency misalignments and after controlling for the potential impact of the HIPC initiative. Thus, for the CFA zone countries, it seems that the positive impact of a real undervaluation on economic growth can be effective only if the improved export performance, induced by com-

[21] Interactions between the dummies and the debt stock.
[22] Available upon request to the author.

petitiveness gains, can offset the increase in the foreign currency value of the debt or if the path of the foreign currency-denominated debt is sufficiently sustainable in order to limit negative valuation effects.

Finally our study, by giving a more nuanced vision of the relationship between misalignments and growth, has some policy implications. Even if a consensus seems to emerge on the positive impact exerted by undervaluations on growth, one should however be cautious when extolling the benefits of undervaluations. Indeed, we evidence for the CFA zone countries a foreign debt channel through which undervaluations could hamper growth. These economies should therefore avoid periods of long lasting exchange rate misalignments, by adopting economic policies able to keep the exchange rate as close as its equilibrium level.

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Appendix

A.1. Data description

Table A.1 — Data description

Variables	Source
Real effective exchange rate (*reer*) Calculated as a weighted average of real bilateral exchange rates against each partner: $$reer_i = \sum_{j=1,j\neq i}^{m} w_{i,j}\ (s_{j\$} - p_j - (s_{i,\$} - p_i))$$ where $s_{j\$}$ (resp. $s_{i\$}$) is the currency j (resp. i)'s bilateral exchange rate. p_j (resp. p_i) is the country j (resp. i)'s consumer price index (CPI). The variables are taken in logarithms. W_{ij} is the weight of the currency j in the country i's real effective exchange rate and m the number of trading partners.[23]	OECD, WEO, WDI
The productivity differential (*rprod*) Measured by the ratio of GDP PPP per capita in the country and the weighted average GDP per capita PPP of partner countries. The weights are the same than those used for the calculation of the real effective exchange rate. $$rprod_{i,t} = \frac{GDP\ PPP_{per\ capita\ i,t}}{\sum_{j=1,j\neq i}^{m} GDP\ PPP_{per\ capita\ j,t}}$$	WDI
Net Foreign Assets* (*nfa*): in percentage of GDP	Lane and Milesi-Ferretti
Life expectancy at birth (*life*): expressed in logarithms	WDI
Population growth rate (*pop*)	WDI
Inflation rate (*inflation*)	WEO
Investment (*invest*): in percentage of GDP	WEO
External debt service (*PPG debt serv*): in percentage of GDP	WDI
Government consumption (*gov*): in percentage of GDP	WDI
Openness (*open*): in percentage of GDP	WDI
Terms of trades (*tot*): expressed in logarithms	WDI
Aid (*aid*): in percentage of GDP	WDI
Per capita GDP annual growth	WEO
Dummy variables Debt break (*debt_ break*): scores 1 for the break's year in the PPG debt dynamics HIPC initiative: *HIPC_ strict*: scores 1 (0 otherwise) from the decision point year till the completion point year; *HIPC*: scores 1 (0 otherwise) from the decision point year till the end of the studied period	

Note: *Updated by adding current account balances in the last years where data on net foreign assets were not available. Data relative to current account balance are from WDI database.
WDI: World Development Indicators (World Bank
WEO: World Economic Outlook (International Monetary Fund)

[23] We follow Couharde et al. (2011) and consider only the top ten trading partners for each country (weights are given in the paper).

A.2. Debt

Variable *debt* in our analysis required particular attention. We built it using the external debt stocks, public and publicly guaranteed (PPG) and his currency composition (in euro and French franc). Both data are from the WDI World Bank database. The public and publicly guaranteed debt comprises long-term external obligations of public debtors, including the national government, political subdivisions (or an agency of either), and autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity. Once the series extracted, we multiplied the PPG debt stock by his foreign currency composition (more specifically, we used the euro and French franc composition). This allows us to have the stock of PPG debt denominated in foreign currency (but expressed in current US $). We then reported it to the GDP (also expressed in current US $) in order to have the stock of PPG debt (denominated in foreign currency) as a percentage of GDP. The formula used is as follows:

$$Debt_{i,t} = \frac{stock\ PPG_{i,t} \times [1 - (\%french\ Franc_{i,t} + \%euro_{i,t})]}{GDP_{i,t}} \tag{A.2}$$

Table A.2.1 — PPG debt currency composition (in %)

	U.S. Dollars	Pound Sterling	Swiss Franc	Japanese Yen	Deutsche Mark	Other currencies*
Benin	41.02	0.61	...	2.15	0.23	21.88
Burkina Faso	48.07	0.39	...	...	0.06	17.74
Central African Rep.	50.79	0.08	2.45	0.57	0.55	9.53
Cameroon	15.41	1.9	0.82	0.53	15.35	7.01
Chad	53.01	0.05	...	...	0.88	16.97
Cote d'Ivoire	32.43	0.74	1.02	1.15	3.76	6.06
Congo, Rep.	29.44	5.01	0.33	0.19	2.63	13.38
Gabon	21.34	4.92	0.49	0.78	7.98	8.53
Mali	27.22	1.57	2.04	1.95	0.46	27.44
Niger	38.5	1.02	0.45	2.42	0.17	23.4
Senegal	38.4	0.2	0.5	2.38	2.5	21.82
Togo	47.3	1.6	8.84	4.16	2.02	6.79

Note: Values reported correspond to averages over the sample. Data are from the WDI database.
* : Except French Franc and euro.
"..." denotes missing value.
Source: Author's calculations

Table A.2.2 — CFA zone countries foreign currency denominated PPG debt

	Benin	Burkina Faso	Central Africa	Cote d'Ivoire	Cameroon	Congo Rep.	Gabon	Mali	Niger	Senegal	Chad	Togo	Average
1985	0.574	0.202	0.221	0.54	0.196	0.585	0.155	0.658	0.243	0.487	0.164	0.797	0.402
	(0.82)	(0.63)	(0.55)	(0.56)	(0.72)	(0.3)	(0.46)	(0.57)	(0.37)	(0.59)	(0.7)	(0.65)	(0.58)
1986	0.516	0.196	0.235	0.564	0.196	0.806	0.218	0.616	0.212	0.428	0.178	0.647	0.401
	(0.8)	(0.63)	(0.56)	(0.59)	(0.7)	(0.46)	(0.57)	(0.61)	(0.35)	(0.57)	(0.76)	(0.68)	(0.61)
1987	0.524	0.209	0.284	0.611	0.196	0.765	0.301	0.633	0.22	0.444	0.198	0.636	0.418
	(0.78)	(0.61)	(0.55)	(0.58)	(0.68)	(0.44)	(0.38)	(0.61)	(0.36)	(0.57)	(0.73)	(0.67)	(0.58)
1988	0.504	0.197	0.303	0.562	0.21	0.81	0.274	0.641	0.248	0.437	0.183	0.574	0.412
	(0.78)	(0.61)	(0.58)	(0.58)	(0.71)	(0.48)	(0.36)	(0.61)	(0.4)	(0.56)	(0.68)	(0.72)	(0.59)
1989	0.493	0.212	0.34	0.593	0.274	0.73	0.293	0.635	0.277	0.41	0.228	0.606	0.424
	(0.58)	(0.74)	(0.63)	(0.57)	(0.7)	(0.46)	(0.38)	(0.59)	(0.5)	(0.61)	(0.78)	(0.85)	(0.62)
1990	0.418	0.201	0.377	0.611	0.324	0.718	0.239	0.611	0.29	0.385	0.244	0.578	0.416
	(0.56)	(0.7)	(0.81)	(0.56)	(0.7)	(0.44)	(0.39)	(0.68)	(0.51)	(0.61)	(0.75)	(0.83)	(0.63)
1991	0.403	0.228	0.461	0.665	0.301	0.726	0.275	0.657	0.289	0.381	0.273	0.616	0.439
	(0.55)	(0.71)	(0.78)	(0.56)	(0.61)	(0.46)	(0.4)	(0.7)	(0.51)	(0.6)	(0.69)	(0.85)	(0.62)
1992	0.511	0.332	0.461	0.62	0.359	0.662	0.255	0.66	0.308	0.379	0.29	0.582	0.454
	(0.76)	(0.93)	(0.77)	(0.53)	(0.59)	(0.45)	(0.39)	(0.65)	(0.54)	(0.61)	(0.6)	(0.83)	(0.61)
1993	0.402	0.375	0.538	0.608	0.292	1.194	0.33	0.729	0.482	0.419	0.406	0.797	0.458
	(0.57)	(0.82)	(0.78)	(0.52)	(0.49)	(0.73)	(0.51)	(0.71)	(0.8)	(0.64)	(0.69)	(0.88)	(0.67)
1994	0.615	0.51	0.893	0.828	0.577	1.429	0.462	1.121	0.537	0.652	0.564	1.087	0.773
	(0.61)	(0.98)	(0.86)	(0.55)	(0.56)	...	(0.46)	(0.9)	(0.62)	(0.69)	(0.77)	(0.89)	(0.70)
1995	0.494	0.446	0.723	0.659	0.702	1.196	0.422	0.869	0.467	0.546	0.511	0.903	0.662
	(0.65)	(0.81)	(0.87)	(0.54)	(0.62)	...	(0.46)	(0.84)	(0.57)	(0.68)	(0.77)	(0.9)	(0.70)
1996	0.46	0.432	0.757	0.573	0.621	0.981	0.374	0.841	0.464	0.532	0.516	0.826	0.615
	(0.67)	(0.84)	(0.82)	(0.53)	(0.63)	(0.46)	(0.47)	(0.82)	(0.6)	(0.69)	(0.79)	(0.88)	(0.68)
1997	0.464	0.45	0.765	0.648	0.605	1.042	0.377	0.886	0.512	0.595	0.543	0.76	0.637
	(0.68)	(0.83)	(0.86)	(0.64)	(0.64)	(0.47)	(0.49)	(0.84)	(0.61)	(0.71)	(0.8)	(0.9)	(0.71)
1998	0.46	0.444	0.792	0.609	0.672	1.224	0.465	0.89	0.508	0.604	0.52	0.783	0.664
	(0.7)	(0.83)	(0.9)	(0.63)	(0.66)	(0.46)	(0.47)	(0.88)	(0.64)	(0.73)	(0.81)	(0.8)	(0.71)
1999	0.464	0.433	0.779	0.572	0.589	0.989	0.399	0.91	0.548	0.575	0.632	0.77	0.638

Continued on next page

Table A.2.2 – *Continued from previous page*

	Benin	Burkina Faso	Central Africa	Cote d'Ivoire	Cameroon	Congo Rep.	Gabon	Mali	Niger	Senegal	Chad	Togo	Average
	(0.72)	(0.83)	(0.9)	(0.64)	(0.64)	(0.43)	(0.49)	(0.88)	(0.65)	(0.74)	(0.83)	(0.83)	(0.72)
2000	0.484	0.457	0.864	0.653	0.661	0.705	0.439	0.947	0.632	0.605	0.691	0.896	0.669
	(0.74)	(0.85)	(0.96)	(0.66)	(0.72)	(0.43)	(0.57)	(0.9)	(0.71)	...	(0.83)	(0.87)	(0.75)
2001	0.471	0.445	0.798	0.545	0.313	0.705	0.352	0.842	0.559	0.525	0.552	0.754	0.572
	(0.73)	(0.84)	(0.79)	(0.59)	(0.34)	(0.36)	(0.41)	(0.92)	(0.66)	(0.74)	(0.81)	(0.69)	(0.63)
2002	0.467	0.423	0.948	0.542	0.286	0.666	0.339	0.542	0.6	0.529	0.555	0.747	0.561
	(0.74)	(0.87)	(0.98)	(0.61)	(0.33)	(0.37)	(0.39)	(0.88)	(0.68)	(0.78)	(0.81)	(0.7)	(0.63)
2003	0.361	0.367	0.766	0.481	0.241	0.596	0.152	0.49	0.55	0.454	0.493	0.727	0.478
	(0.7)	(0.82)	(0.79)	(0.6)	(0.4)	(0.29)	(0.2)	(0.90)	(0.79)	(0.83)	(0.82)	(0.67)	(0.63)
2004	0.352	0.359	0.712	0.33	0.158	0.732	0.227	0.462	0.519	0.388	0.333	0.664	0.442
	(0.74)	(0.78)	(0.65)	(0.39)	(0.26)	(0.37)	(0.35)	(0.87)	(0.88)	(0.82)	(0.83)	(0.67)	(0.61)
2005	0.317	0.336	0.63	0.293	0.125	0.569	0.216	0.49	0.467	0.359	0.272	0.552	0.385
	(0.75)	(0.76)	(0.61)	(0.34)	(0.24)	(0.53)	(0.4)	(0.93)	(0.9)	(0.79)	(0.81)	(0.67)	(0.64)
2006	0.119	0.16	0.569	0.29	0.029	0.476	0.198	0.203	0.157	0.16	0.257	0.562	0.269
	(0.69)	(0.71)	(0.58)	(0.34)	(0.18)	(0.48)	(0.47)	(0.95)	(0.82)	(0.73)	(0.87)	(0.62)	(0.57)
2007	0.13	0.174	0.492	0.261	0.028	0.363	0.146	0.207	0.158	0.159	0.236	0.516	0.242
	...	(0.79)	(0.6)	(0.35)	(0.24)	(0.37)	(0.34)	(0.95)	(0.85)	(0.68)	(0.91)	(0.48)	(0.57)
2008	0.124	0.158	0.406	0.199	0.029	0.274	0.104	0.192	0.152	0.149	0.197	0.393	0.198
	(0.46)	(0.67)	(0.53)	(0.26)	(0.31)	(0.4)	(0.5)	(0.89)	(0.92)	(0.62)	(0.84)	(0.44)	(0.54)
2009	0.14	0.181	0.139	0.201	0.035	0.287	0.14	0.216	0.167	0.19	0.234	0.399	0.194
	(0.51)	(0.69)	(0.37)	(0.3)	(0.33)	(0.5)	(0.53)	(0.89)	(0.83)	(0.56)	(0.77)	(0.54)	(0.57)
2010	0,152	0,185	0,143	0,163	0,044	0,171	0,110	0,233	0,172	0,199	0,194	0,293	0.171
	(0,51)	(0,68)	(0,36)	(0,25)	(0,36)	(0,72)	(0,44)	(0,79)	(0,98)	(0,56)	(0,75)	(0,60)	(0,58)
2011	0,148	0,174	0,118	0,182	0,041	0,139	0,094	0,228	0,169	0,207	0,156	0,089	0.145
	(0,50)	(0,60)	(0,32)	(0,27)	(0,30)	(0,62)	(0,45)	(0,74)	(1,02)	(0,51)	(0,58)	(0,19)	(0,51)
Average	0,391	0,308	0,538	0,496	0,300	0,724	0,272	0,615	0,369	0,415	0,356	0,650	0.452
	(0,66)	(0,77)	(0,70)	(0,50)	(0,51)	(0,46)	(0,43)	(0,83)	(0,70)	(0,66)	(0,77)	(0,71)	(0,64)

Note: Values reported correspond to the ratio of the external debt stocks, public and publicly guaranteed in foreign currencies (except French Franc and euro) to GDP. Numbers in parenthesis are the share of the PPG in the total public debt. Data on total public debt are from the IMF Historical Public Debt Database. "..." denotes missing value.

Source: Author's calculations

Table A.2.3 — HIPC initiative in the CFA zone countries (key dates and debt reduction)

Countries	Decision point – completion point	Debt reduction (long-term reduction)	Break in the FCD debt
Benin	July 2000 - March 2003	265 million $US, NPV 1998	2006
Burkina Faso	July 2000 – April 2002	552.6 million $US , NPV 2001	2006
Cameroon	October 2000- May 2006	1.27 billion $US, NPV 1999	2006
Central African Rep.	September 2007 - June 2009	578.2 million $US, NPV 2006	2009
Chad	May 2001 –	170.1 million $US, NPV 2000	–
Congo, Rep	March 2006 - January 2010	1.575 billion $US, NPV 2004	–
Cote d'Ivoire	March 2009 - June 2012	3004.9 million $US, NPV 2007	–
Gabon		Not eligible	
Mali	September 2000 - March 2003	417 million $US, NPV 1998	2006
Niger	December 2000 - April 2004	520.6 million $US, NPV 1999	2006
Senegal	June 2000 – April 2004	488 million $US, NPV 1998	2006
Togo	November 2008 – December 2010	282 million $US, NPV 2007	2011

Note: NPV stands for Net Present Value. FCD debt: foreign currency-denominated debt

Source: Informations on the HIPC initiative are from the African Development Bank

A.3. Panel unit root and cointegration tests results

Table A.3.1 — Unit root test results

		Δgdp	***debt***	***pop***	***invest***	***inflation***	***gov***	***aid***	***life***	***reer***	***rprod***	***open***	***nfa***	***tot***	***debt serv***
CIPS*	level	-2.68	-2.18	-2.01	-2.42	-5.17	-2.38	-2.56	-1.95	- 2.15	- 1.88	- 2.53	- 2.36	- 1.90	-2.61
		(0.13)	(0.61)	(0.78)	(0.34)	(0.01)	(0.04)	(0.21)	(0.83)	(0.66)	(0.91)	(0.20)	(0.39)	(0.90)	(0.01)
	1st diff.	-3.66	-2.60	-2.83	-3.96	-5.90	-2.61	-4.46	-3.06	- 4.43	- 3.44	- 3.87	- 3.80	- 3.62	-4.06
		(0.01)	(0.01)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Choi ***Pm***	level	21.07	-0.91	9.10	1.41	13.26	5.45	5.60	0.73	-2.23	- 2.12	4.31	- 1.44	0.21	5.72
		(0.00)	(0.82)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)	(0.23)	(0.98)	(0.98)	(0.00)	(0.92)	(0.41)	(0.00)
	1st diff.	22.97	20.43	16.15	23.79	28.44	27.24	20.01	4.38	21.10	13.32	25.45	26.39	19.40	27.12
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi ***Z***	level	-9.85	2.15	-3.65	-1.72	-8.06	-3.48	-2.68	2.08	2.37	3.04	- 3.55	1.90	0.16	-3.13
		(0.00)	(0.98)	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)	(0.98)	(0.99)	(0.99)	(0.00)	(0.97)	(0.56)	(0.00)
	1st diff.	-10.71	-10.41	-7.55	-11.40	-12.88	-12.52	-9.69	-1.31	- 10.86	- 7.34	- 12.12	- 12.31	- 10.32	-12.48
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.09)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi ***L****	level	-13.09	2.96	-4.65	-1.61	-9.18	-3.97	-2.51	3.31	2.22	3.33	- 3.65	2.29	0.14	-3.91
		(0.00)	(0.99)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.99)	(0.98)	(0.99)	(0.00)	(0.98)	(0.55)	(0.00)
	1st diff.	-14.36	-13.16	-9.29	-15.01	-17.59	-16.93	-12.65	-2.04	- 13.61	- 8.99	- 16.01	- 16.51	- 12.66	-16.86
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: We allow for individual deterministic trends and constants for all variables except *debt*, *GDP percap, life* and *pop* (only individual intercepts). *p.values* are given in parentheses. Appropriate lag orders are determined by running auxiliary ADF test regressions for each of the cross-sections units. We also referred to the lag order that minimizes the Schwarz criterion. Conclusions are robust to change in model's specifications.

Table A.3.2 — Westerlund cointegration test results

Specification		***reer*** ***rprod, tot, nfa, gov***		
Statistic	Value	Z-value	p-value	Robust p-value
Gt	-2.515	-3.180	0.001	0.010
Ga	-9.452	-1.644	0.050	0.030
Pt	-7.708	-2.114	0.017	0.098
Pa	-7.580	-2.922	0.002	0.023

Note: Optimal lag and lead length determined by Akaike Information Criterion. Width of Bartlett-Kernel window set to 3. We only allow for a constant in the cointegration relationship. Robust p.values obtained after 800 bootstraps.

B. Graphs appendix

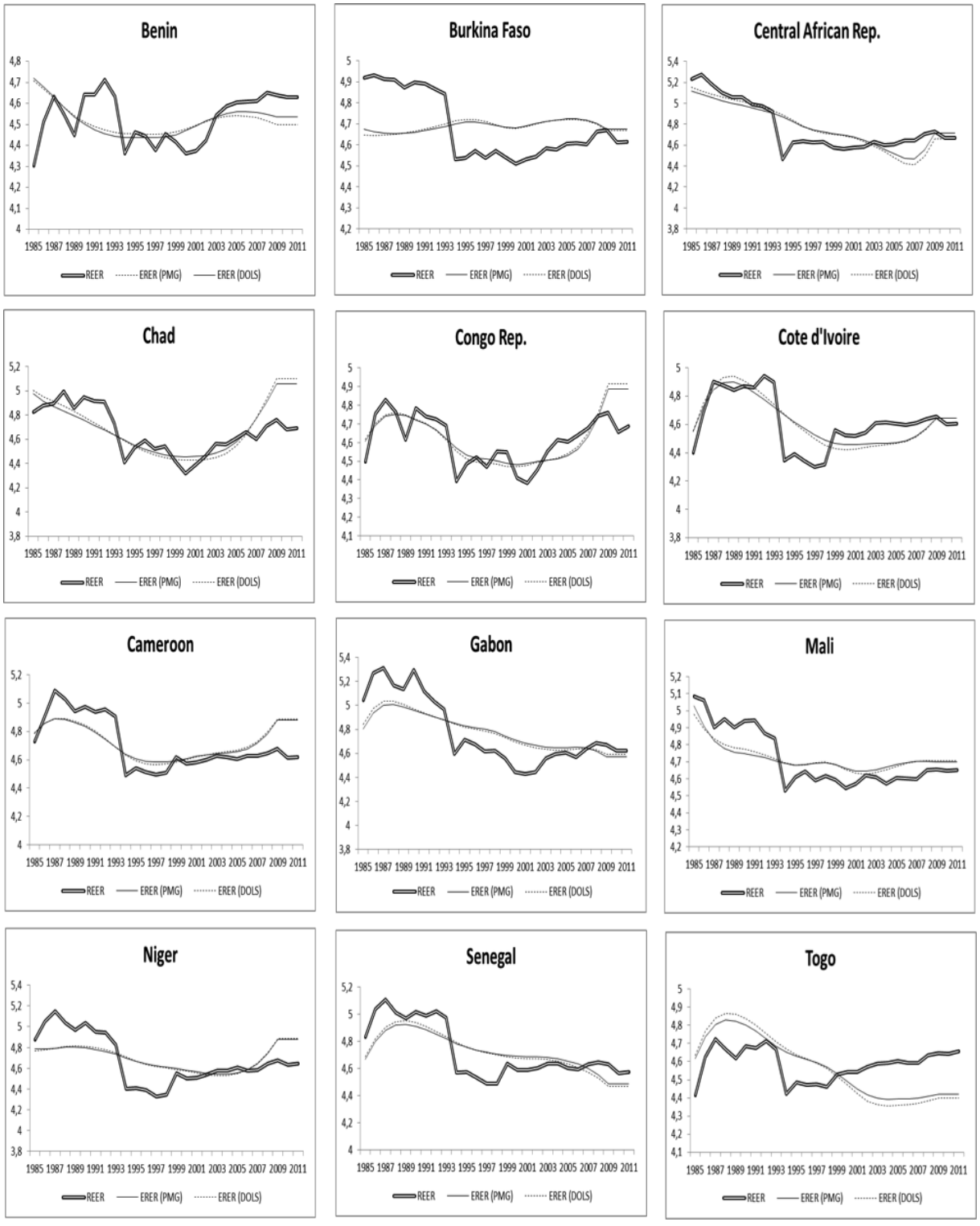

Figure B.1 — REER vs. ERER

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

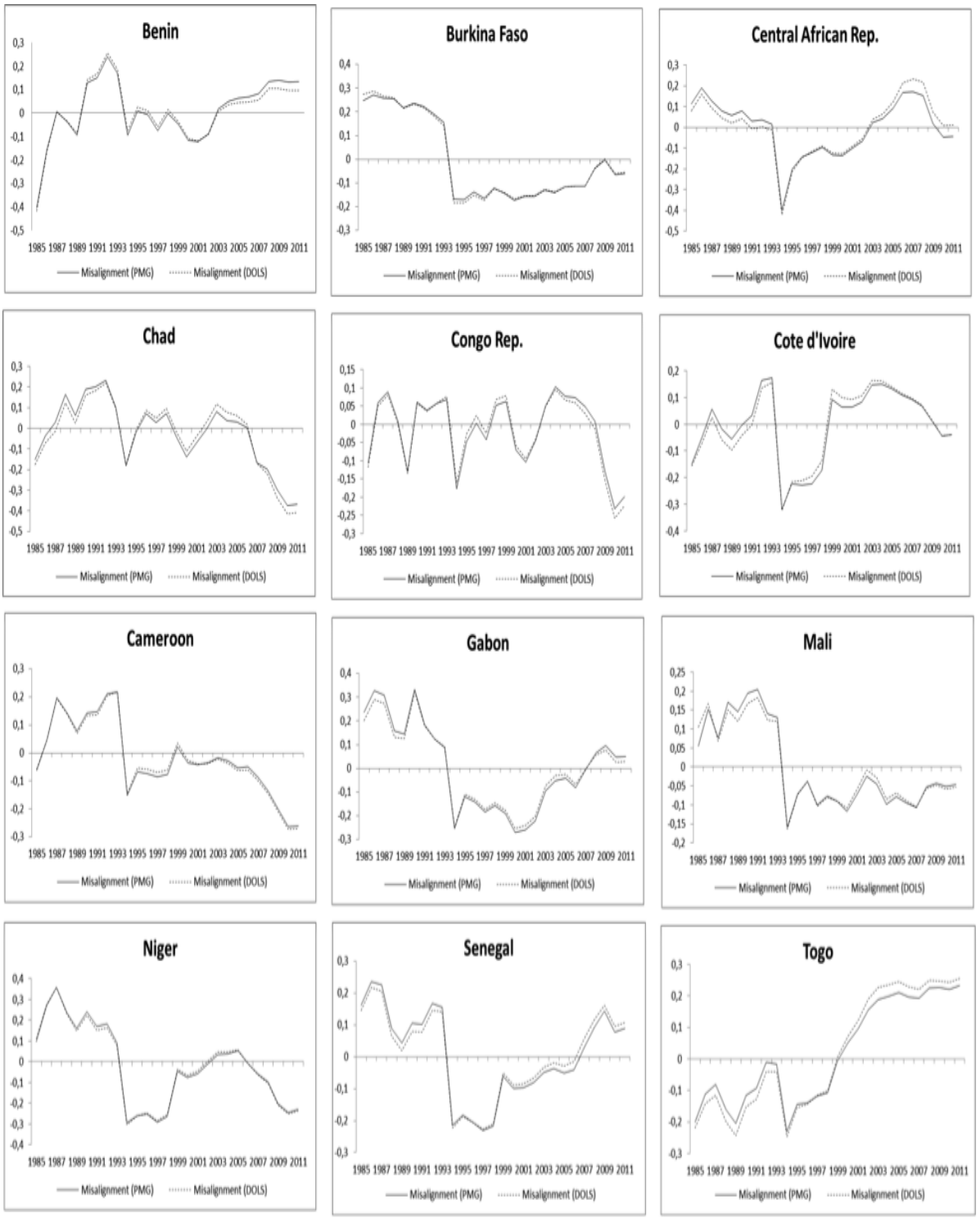

Figure B.2 — Real exchange rate misalignments

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

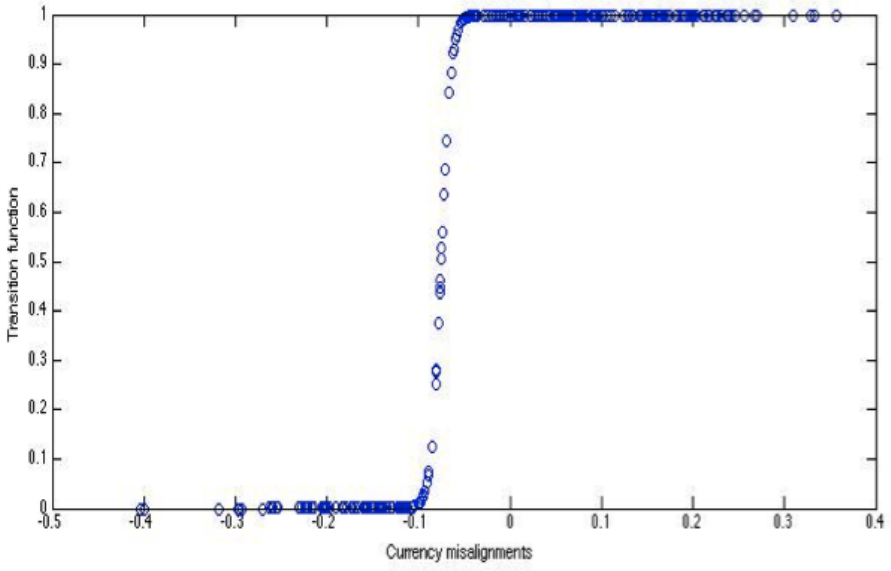

Figure B.3 — Estimated transition function of the PSTR model

Note: Each circle represents an observation.

Chapter 2

Currency misalignments and economic growth: the foreign currency-denominated debt channel*

Abstract

Relying on a panel of 72 developing and emerging countries, we evidence in this paper the existence of a foreign currency-denominated debt channel through which currency misalignments impact economic growth. Compared to the traditional competitiveness channel, this channel works in the opposite direction. In particular, we show that, unlike overvaluations, undervaluations are more likely to cause valuation effects that tend to dampen the competitiveness effect. We also evidence that fixed exchange rate regimes play an important role in the diffusion of these valuation effects.

Keywords: Currency misalignments; Economic growth; Exchange Rate Regime, Foreign currency-denominated debt.

JEL Classifications: F3, F43, C33, O11.

*Note: Under review in the *Oxford Bulletin of Economics and Statistics*. A former version has been published as "Grekou, C., 2015. Currency misalignments and economic growth: the foreign currency-denominated debt channel. EconomiX Working Papers 2015-23, University Paris Ouest - Nanterre La Défense, EconomiX".

2.1 Introduction

There is an ongoing debate on whether the level of the real exchange rate (RER) is truly a potential impediment to economic growth. There is as yet no agreement, and two positions can be identified. The so-called *Washington Consensus* (WC, thereafter), coined by Williamson (1990), considers that the RER level should be consistent in the medium-run with macroeconomic objectives to promote growth. It should therefore be sufficiently competitive to ensure external balance without exceeding a threshold above which it could lead to internal imbalances (such as inflation, resource depletions). Thus, the WC view argues in favor of a real exchange rate close to its equilibrium level, i.e. that satisfying both external and internal balances. Any misalignment, i.e. any deviation from this equilibrium level, is considered as prejudicial for growth. The export-led growth theory, on the contrary, highlights the asymmetrical nature of currency misalignments, positing that economic growth tends to be dampened by overvaluations while fostered by undervaluations. This view is supported by several economists who illustrate the positive impact of undervaluations on growth through several transmission channels. For example, Elbadawi et al. (2009), Levy-Yeyati and Sturzenegger (2007), Rodrik (2008) explain this positive effect by respectively an increase in exports, an expansion of savings, of capital accumulation, and of investment as well as through learning-by-doing externalities in the tradable sector.

More recently, open economy models, based on the Bernanke-Gertler-Gilchrist (1999) financial accelerator, have highlighted a transmission channel, ignored until now, that can reconcile these two different approaches. Indeed, this literature shows, that, if a country's debt is denominated in foreign currency, the real exchange rate affects the country's net worth through a balance sheet effect and, in the presence of financial imperfections, also the cost of capital. This channel is particularly relevant for developing and emerging economies given their relatively large share of foreign currency-denominated debt and the presence of financial imperfections. In an earlier work, Grekou (2015) extends the empirical literature on the growth effect of currency misalignments by taking account these valuation effects – stemming from the variation in the foreign currency-denominated (FCD) debt – and finds, for the

CFA zone countries over the 1985-2011 period, that the competitiveness channel is dampened by the increase in the foreign currency-denominated debt due to valuation effects.

In this paper we investigate this issue further by examining *(i)* if currency misalignments —and under which circumstances— affect the FCD debt through valuation effects, *(ii)* how this FCD debt channel interacts with the traditional competitiveness channel on economic growth, and *(iii)* whether the exchange rate regime plays a role in the diffusion of these valuation effects underlying the FCD debt channel. Accordingly, our empirical analysis proceeds in four steps. As a first step, we resort to the Behavioral Equilibrium Exchange Rate (BEER) approach to assess currency misalignments. We then examine the channels through which currency misalignments may influence economic growth, by distinguishing a direct transmission channel, the competitiveness channel, and an indirect one, the FCD debt channel, through which currency misalignments affect the FCD debt and economic growth. To this end, we rely on panel estimators (fixed/random effects) and test the robustness of our results using system generalized method of moments (SGMM). After identifying the existence of valuation effects, we analyze to what extent they are influenced by the exchange rate regime in place. In a final step, we refine our analysis by addressing more adequately the issue of heterogeneity among the countries of our sample. To tackle this last issue, we rely on least squares dummy variable (LSDV) models with country-specific effects — on the variables of interest.

Considering a panel of 72 emerging and developing countries over the 1980-2012 period, our empirical analysis provides mixed results regarding the competitiveness channel. Indeed, while results derived from panel estimation argue in favor of the *Washington Consensus* view —i.e. a negative impact of both under and overvaluations on growth—, results derived from LSDV models with country-specific effects are less clear-cut. However, the most striking feature of our results is that both approaches support the existence of a FCD debt channel. Finally, we also found that valuation effects are more prominent in the undervaluation's regime and that fixed exchange rate regimes tend to magnify these valuations effects.

The paper proceeds as follows. In the next section, we review the main arguments

that motivate our analysis. Section 3 presents our methodologies and describes the data. The results of our econometric analysis are given and discussed in Section 4. The last section provides concluding remarks.

2.2 Currency misalignments and the foreign currency-denominated debt channel

Empirical studies do not provide clear-cut answers to the question of whether real undervaluations foster economic growth. As mentioned in the introduction, the presence of valuation effects, through the foreign currency-denominated (FCD thereafter) debt, can reverse the conventional competitiveness channel from which an undervalued currency should lead to economic expansion. This channel has been yet empirically examined by focusing on the expansionary effect of currency's depreciations (see for example Céspedes, 2005; Frankel, 2005; Galindo et al., 2003). However, empirical studies on the possible presence and magnitude of valuation effects when currencies are misaligned are extremely limited. To our knowledge the only work that deals with this issue is that of Grekou (2015) who finds, on a sample of CFA countries, that the increase of the FCD debt burden stemming from an undervalued currency tends to dampen the expansionary effect stemming from the competitiveness channel.

These valuation effects are particularly at stake in developing and emerging countries due to their currency variations and their important FCD debt stocks (Calvo and Reinhart, 2001; Céspedes et al., 2004). Indeed, these countries generally cannot borrow in their own currencies —phenomenon referred to as "original sin" (see Eichengreen and Hausmann, 1999)— and have therefore an important FCD debt stock. The causes of this situation are manifold but are primarily related to underdeveloped financial markets, the low credibility of national macroeconomic policies and to weak institutional factors (Ul Haque, 2002; Goldstein and Turner, 2004).

With the inclusion of a FCD debt channel, two antagonistic effects, in those countries, can be associated to currency misalignments. Taking account the potential asymmetric effect that currency misalignments may have on economic growth, it can be expected that an overvaluation entails a competitiveness loss and therefore

hampers growth (competitiveness channel), while at the same time it also fosters growth by reducing the value of the FCD debt (FCD debt channel; positive valuation effects). In a similar way, an undervaluation could also be associated with an increase in the FCD debt burden (negative valuation effects). This FCD channel may in turn lead to another type of asymmetry which affect economic growth. Indeed, financial accelerator theories and the literature on liquidity constraints show that changes in net wealth and liquidity constraints should be more important when the debtor's situation worsens (Bernanke and Gertler, 1989). Thus, ignoring these interactions between currency misalignments and the FCD debt could considerably blur the perception of the overall effect of currency misalignments on economic growth.

A related question is whether the extent of a currency misalignment affects economic growth more than proportionally, that is, if its impact is nonlinear. If the answer is yes, this may have a bearing on the choice of the exchange rate regime (ERR, hereafter) since there may be no need to worry about small currency misalignments but only about large ones. Such non-linearity could be expected on the basis of the same arguments as before since large misalignments should induce large changes not only in competitiveness but also in the FCD debt much more binding than relatively smaller ones.

Based on the equilibrium exchange rate literature, Dubas (2009) and Coudert and Couharde (2009) show that fixed ERR countries and more specifically pegged currencies are more prone to exhibit relatively important misalignments. They can therefore amplify valuation effects related to movements in the anchor currency. Another argument for fixed ERR to be more prone to valuation effects is that, as countries can benefit from credibility —conventionally associated to their irrevocable commitment to a fixed ERR— and guaranteed convertibility of their currency, they are more likely to borrow on international financial markets and to accumulate more FCD debt. On the other hand, floating ERR are generally associated with higher short-term volatility of nominal exchange rates —due to their sensitivity to expectations and news. Furthermore, medium-term swings can also be quite large as deviations are not necessarily corrected in the short-medium run and may even be exacerbated by further irrational behaviors. These wide swings in exchange rates

can be an important source of exchange rate misalignments, which may, under some circumstances, be even greater than under fixed ERR (Edwards, 1987).

The ERR can also have a direct impact on the FCD debt. Indeed one can infer that valuation effects might be weaker for pegged ERR if a part of the debt is denominated in the anchor currency. As a matter of fact, the extent to which the debt is denominated in foreign currency(ies) is often seen as one of the sources of "fear of floating" (Calvo and Reinhart, 2002). Indeed, due to the peg of the domestic currency (this is especially true in case of hard peg), the debt denominated in the anchor currency does not vary; so the larger the FCD debt composition in the anchor currency, the lower the valuation effects. However, valuation effects also depend on the credibility of the peg (Bleaney and Ozkan, 2011) and on the variations of the anchor currency vis-à-vis third currencies —in case of debt libeled in multiple currencies. Fixed ERR can thus isolate the economy from these valuation effects if the composition of the foreign currency-denominated debt is coherent with the anchor currency or the basket peg and if the ERR is credible enough. Conversely, for floats, valuation effects are total. These evidence show that the ERR may play a catalytic or an isolating role regarding the diffusion of the valuation effects underpinning the FCD debt channel. The issue of its role is therefore a question that must be tackled empirically.

2.3 Estimation strategy and data

2.3.1 Assessing equilibrium exchange rates and currency misalignments

As a first step, we rely on the Behavioral Equilibrium Exchange Rate (BEER; see Clark and MacDonald, 1998) approach to assess the equilibrium exchange rates —and thus currency misalignments.[1] Simply put, the BEER approach relies on a modelling approach that attempts to explain the actual behaviour of the real exchange rate in terms of relevant economic variables. To assess the equilibrium

[1]For brevity, the BEER approach is not presented in this section. For further details and related concepts (e.g. PPP, FEER, DEER, NATREX), we refer to Edwards and Savastano (2000) and Driver and Westaway (2005).

real exchange rate (ERER), the BEER approach consists in estimating a long-run relationship between the observed real exchange rate and a set of *fundamentals*, i.e. variables influencing the real exchange rate in the long run. This set of fundamentals derives from various theoretical models. Among many, the works of Edwards (1988), Elbadawi (1994), Hinkle and Montiel (1999) and Elbadawi and Soto (2008) have provided suitable theoretical and empirical frameworks to investigate equilibrium real exchange rates and their fundamentals in developing and emerging countries. Following Grekou (2014), we consider the three fundamentals that have found to be the most significant among a set of potential fundamentals of real effective exchange rates for emerging and developing countries: *(i)* the terms of trade, *(ii)* the relative productivity of the tradable sector, and *(iii)* the net foreign assets position.[2] As documented by previous studies, an improvement in the terms of trade and in the net foreign assets position as well as an increase in the relative productivity is expected to appreciate the real effective exchange rate. As a result, the long-run relationship to be estimated is the following:

$$reer_{i,t} = \mu_i \ + \ \beta_1 \ tot_{i,t} \ + \ \beta_2 \ rprod_{i,t} \ + \ \beta_3 \ nfa_{i,t} \ + \ \varepsilon_{i,t} \tag{2.1}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ respectively indicate the individual and temporal dimensions of the panel. $reer_{i,t}$ is the real effective exchange rate (in logarithms), an increase in the index indicates a real appreciation; $tot_{i,t}$ is the logarithm of terms of trade, an increase indicates an improvement; $rprod_{i,t}$ stands for the relative productivity against country i's main trading partners (the Balassa-Samuelson effect) also expressed in logarithm; and $nfa_{i,t}$ is the net foreign asset position (in percentage of GDP). μ_i are the country-fixed effects and $\varepsilon_{i,t}$ is an error term.

Currency misalignments are then obtained from the difference between the observed real effective exchange rate ($reer_{i,t}$) and its equilibrium level ($reer^*_{i,t}$) —i.e. the fitted value of the real effective exchange rate derived from the estimation of

[2]Grekou (2014) conducts a Bayesian analysis to select relevant real exchange rate fundamentals for a panel of 40 developing and emerging countries. Among a set of 8 potential —and commonly used— fundamentals (terms of trade, government spending, foreign direct investment, net foreign asset position, official development aid, openness, investment, and a measure of relative productivity) the terms of trade, the net foreign assets position and the relative productivity have proved to be the most significant fundamentals. Besides their robustness, results provided by this approach limit the collinearity/endogeneity/simultaneity problems coming from the inclusion of some determinants of the real effective exchange rate in growth equations.

equation (2.1):

$$Mis_{i,t} = reer_{i,t} - reer^*_{i,t} \tag{2.2}$$

Following this definition and the definition of the real effective exchange rate, a negative sign indicates an undervaluation (i.e. $reer_{i,t} < reer^*_{i,t}$) whereas a positive sign indicates an overvaluation (i.e. $reer_{i,t} > reer^*_{i,t}$) of the real effective exchange rate.

2.3.2 Investigating the existence of the FCD debt channel

We now specify the different channels through which currency misalignments may influence economic growth. To investigate this empirically, we adopt a gradual and sequential approach.

As a starting point, we begin by testing whether currency misalignments impact growth in a linear equation framework, considering both levels and absolute values of currency misalignments. The equation is as follows:

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta Mis_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.3}$$

where $i = 1, \ldots, N$ denotes the country, and $t = 1, \ldots, T$ the time. $\Delta y_{i,t}$, the dependent variable is the growth rate of real GDP per capita. $Mis_{i,t}$ is the currency misalignments and $X_{i,t}$ is a $k-$dimensional vector of growth determinants including the FCD debt. μ_i represent the fixed individual effects, and $u_{i,t}$ is an independent and identically distributed error term.

We then extend equation (2.3) by adding a non-linear effect of currency misalignments on economic growth, accounted by the square of the misalignments variable. The equation under consideration here is as follows:

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Mis_{i,t} \;+\; \beta_2 Mis^2_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.4}$$

We also examine the asymmetric effect of misalignments on economic growth by splitting misalignments into under- and overvaluations, and by investigating their

respective effect on growth. The equation is then:

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.5}$$

This baseline analysis is fully in line with that can be usually found in the literature. But as aforementioned, we extend this empirical literature by including a FCD debt channel through which currency misalignments may also affect growth. Our assumptions —and necessary conditions— for the existence of this FCD debt channel are as follows: *(i)* the impact of currency misalignments on growth is nonlinear; *(ii)* this impact is channelled through a competitiveness effect and a valuation effect; and *(iii)* this impact varies depending on the sign and the size of the currency misalignments.

To examine how the growth impact of the FCD debt varies as a function of misalignments, we estimate an interaction model (equation (2.6)) and then extend it by taking into account the potential asymmetric effect of currency misalignments (equation (2.7)):

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \gamma\; Debt_{i,t} * Mis_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.6}$$

$$\begin{aligned} \Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \gamma_1\; Debt_{i,t} * Under_{i,t} \\ +\; \gamma_2\; Debt_{i,t} * Over_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \end{aligned} \tag{2.7}$$

Following equations (2.6) and (2.7), β_1 and β_2 capture the direct effect that under- and overvaluations exert on economic growth, i.e. the competitiveness channel. Based upon the definition of misalignments (equation (2.2)), a negative coefficient on undervaluations (resp. overvaluations) supports the hypothesis that undervaluations (resp. overvaluations) foster (resp. harm) growth. The coefficient γ in equation (2.6) —γ_1 and γ_2 in equation (2.7)— captures the effect the FCD debt has on economic growth, conditional to currency misalignments, i.e. valuation effects. Statistically significant coefficient(s) will thus reflect the existence of valuation effects and therefore of a FCD debt transmission channel.

As mentioned in the previous section, an additional issue underlying this FCD debt channel is the role played by the exchange rate regime. Indeed, the exchange rate regime may have —or not— an amplifying/isolating effect in the diffusion of the valuation effects. To investigate this issue, we use an interaction term between the exchange rate regime (ERR), the currency misalignments, and the FCD debt variables. Doing so, the equation to be estimated can be written as follows:

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \gamma\, Debt_{i,t} * Mis_{i,t} * ERR_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.8}$$

To get deeper on this issue, we capture the type of exchange rate regime, by using a series of dummy variables and interact each country's exchange rate regime (ERR) with the currency misalignments and the FCD debt variables.[3] Doing so, the equation to be estimated can be written as follows:

$$\Delta y_{i,t} = \mu_i \;+\; \beta_1 Under_{i,t} \;+ \beta_2 Over_{i,t} + \gamma_j \sum_{j=1}^{m} Debt_{i,t} * Mis_{i,t} * Dum_j * ERR_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{2.9}$$

where Dum_j is a dummy variable scoring 1 for regime j (0 otherwise), and m the number of exchange rate regimes considered.

2.3.3 Data

Our analysis consists of a panel of 72 developing and emerging countries and covers the 1980-2012 period. We rely on annual rather than 5-years averaged data. Indeed, while working with averaged data presents the advantage to remove business cycle effects from the growth rate, it has the disadvantage to be costly in observations. We therefore opt for a relatively high number of degrees of freedom by using annual data. This choice is further motivated by the so-called Nickell's bias (1981) inherent to dynamic fixed effects model with a small time dimension (relative to

[3] As we want to examine the overall effect that any particular ERR can exert on valuation effects, their effect are not differentiated according to the nature of the misalignments (under- or overvaluations).

the individual dimension). As we rely on annual data, the time dimension of the analysis (from 1980 to 2012) is sufficiently important so that the bias resulting from the use of basic panel data estimators is very weak, if not non-existent.[4] Finally, working with annual data eliminates the need to use average data of misalignments which can generate misleading time series and in turn leads to implausible results.

As a first step, in order to assess currency misalignments, we estimate a long run relationship between the real effective exchange rate and the terms of trade, the net foreign asset position, and relative productivity. All the series are in logarithms, except the net foreign assets position which is expressed as share of GDP. The real effective exchange rate series are from the Bruegel's database and correspond to the weighted average of real bilateral exchange rate against 67 trade partners. We use the same weights and trade partners for the calculation of the relative productivity, proxied here by the relative real GDP per capita (in PPP terms).[5] The terms of trade series are from the WDI database (*World Development Indicators*, World Bank). Net foreign asset positions are extracted from the Lane and Milesi-Ferretti database and completed using information provided by IFS (*International Financial Statistics*, IMF) and WDI.

In the second stage, we estimate a set of growth equations. The dependent variable is the real GDP per capita growth rate. Regarding the selection of explanatory variables, we resort to Bayesian Model Averaging (BMA) techniques to tackle the issue of model uncertainty.[6] Based on the BMA results, we retain 9 growth determinants among an initial set of 22 different potential determinants. First, we identify a robust effect of the Solow model's determinants and human capital variables namely, investment, population growth, life expectancy, age dependency ratio, and the initial level of GDP per capita. We also identify two macroeconomic policy variables as robust namely government consumption and the foreign currency-denominated debt.[7] The FCD debt is here proxied by the total external debt which is the sum

[4]See Judson and Owen (1999) and Bun and Kiviet (2006).

[5]Due to a lack of available data at the sectoral level, PPP GDP per capita are usually used to approximate the relative productivity differentials between sectors.

[6]See Appendix C.1 in the online Appendix.

[7]The identification of the FCD debt, our key variable of interest, as a robust growth determinant further underlines the importance of the FCD debt transmission channel. Although we use two measures of the debt in the BMA analysis, we only use the debt (in real terms) expressed in

of the public, publicly guaranteed, and private non-guaranteed long-term external debt, use of IMF credit, and the short-term external debt.[8] There are various reasons for considering the total external debt.[9] First, it includes the external debt of the government, firms and banks (both guaranteed and non-guaranteed), as well as that of households —if any. In addition, for almost all the countries of our sample (except, some countries as South Africa, Thailand, China, Philippines), over three-quarters of this total external debt is the public and publicly guaranteed (PPG) debt[10] for which the currency composition is known. For the other components of the external debt (i.e. the private non-guaranteed debt and the short-term external debt), the currency composition is unknown but we can safely assume that these latter are mainly —if not totally— denominated in foreign currencies as emerging and developing countries can usually not borrow abroad in their own currency (Eichengreen et al., 2005). Finally, two additional variables are identified as robust regressors of economic growth by the BMA approach: *(i)* a measure of regional major episodes of political violence (REGCIV), and *(ii)* foreign direct investment. In addition to these determinants, we include: *(i)* a dummy variable to account for the Initiative for Heavily Indebted Poor Countries (HIPC initiative), and *(ii)* the *de facto* exchange rate regime classification to take into account the effects that might be exerted by exchange rate regimes.[11]

The list of countries and the details regarding the data (definitions, measurements, and sources) are respectively provided in Tables A.1 and A.2 in Appendix A.

logarithms —and not as share of GDP— for our analysis. This is done to purge the debt channel from the evolution of the GDP. Moreover, we use the entire FCD debt —and not a finer— measure as we seek to highlight an *exchange rate regime effect.*

[8] *"The public and publicly guaranteed debt" comprises long-term external obligations of public debtors, including the national government, political subdivisions (or an agency of either), and autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity."* World Bank, International Debt Statistics.

[9] We do not use the index of *"original sin"* built by Eichengreen et al. (2005) as this index is only available from 1993 to 2001.

[10] Source: our calculations using the WDI (World Bank) data.

[11] We choose the *de facto* exchange rate regime classification as it reflects the country observed practices (on the basis of the exchange rate's flexibility and the existence of formal or informal commitments) and is therefore more suitable to account for valuation effects. We here rely the Reinhart and Rogoff classification (see Ilzetzki et al., 2011) and extend/fill the gaps using various issues of the *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* (IMF). See Table A.3 for the classification details.

2.4 Results

2.4.1 Estimating equilibrium exchange rates and assessing currency misalignments

We rely on the Cross Sectionally Augmented Pooled Mean Group (CPMG; see Pesaran, 2006; Binder and Offermanns, 2007) procedure to estimate the long-run relationship between the real effective exchange rate and its fundamentals. This latter procedure presents very appealing features such as the consistency of the estimates in presence of cross-sectional dependencies and the better consideration of the heterogeneity among the countries.[12] However, as a condition for the efficiency of the CPMG estimator is the homogeneity of the long-run parameters across countries, we also rely on the Cross Sectionally Augmented Mean Group (CMG) approach and test the long run slope homogeneity. Table 2.1 presents the CPMG and CMG estimates as well as the Hausman test statistic examining panel heterogeneity.

According to the Hausman test, the long-run homogeneity restriction is not rejected for individual parameters and jointly in all regressions. We therefore focus on the CPMG estimates.[13] Results in Table 2.1 appear consistent with the theory —and our conjectures— since the coefficients have the expected signs. Indeed, the real effective exchange rate appreciates in the long run with the increase in the relative PPP GDP per capita, the improvement in the terms of trade and in the net foreign asset position.

Using the CPMG estimates, we calculate the equilibrium real exchange rates ($reer^*_{i,t}$) which correspond to the fitted value of $reer_{i,t}$ (see equation (2.1)). Currency misalignments are then obtained doing the difference between the observed real effective exchange rate and its equilibrium level, as indicated by equation (2.2).[14]

[12]Even if the CPMG estimator can deal with both I(0) and I(1) variables, we performed second generation unit root and cointegration tests. The results —not reported here to save space but available upon request— indicate that our series are I(1) and cointegrated.

[13]The CMG procedure provides consistent estimates of the averages of long run coefficients, although they are inefficient if homogeneity is present. Under long run slope homogeneity, the CPMG estimates are consistent and efficient (Cavalcanti et al. 2012).

[14]Figures C.2.1 and C.2.2 in online Appendix (Appendix C.2) display the evolution of the real

Table 2.1 — Estimation of the long-run relationship

Dependent variable:	D.reer			
Estimation method:	CPMG		CMG	
	Coef.	Z	Coef.	Z
Long-run dynamic				
$rprod$	0.343***	6.79	1.076*	1.94
tot	0.111***	3.65	0.015	0.10
nfa	0.233***	9.26	0.332***	2.72
$L.\overline{reer}$	0.676***	4.53	-1.454	-1.04
$\overline{rprod}$	-0.764***	-4.33	1.761**	2.52
$\overline{tot}$	0.692***	2.68	0.421	0.84
$\overline{nfa}$	0.041	0.85	-0.101	-0.54
Short-run dynamic				
$ec.$	-0.193***	-8.60	-0.569***	-17.57
$D.rprod$	-0.030	-0.23	0.004	0.02
$D.tot$	-0.059	-1.53	0.025	0.67
$D.nfa$	0.242***	5.29	0.084*	1.93
$D.\overline{reer}$	0.283***	3.34	0.349**	2.45
$D.\overline{rprod}$	0.077	1.62	-0.306**	-2.29
$D.\overline{tot}$	-0.081	-0.91	-0.191	-1.22
$D.\overline{nfa}$	0.022	0.62	0.143*	1.78
$Constant$	-0.523***	-8.58	1.513	1.23
Specification test				
Joint Hausman test[a]	13.09			
$[\chi^2(7)]$	[p-value = 0.07]			
No. Countries / No. Observations:	72 / 2296			

Notes: Symbols ***, **, and * denote significance at 1%, 5%, and at 10%. "D." (resp. "L.") is the difference operator (resp. the lag operator); "$ec.$" is the error correction term. The bars over the variables indicate the cross-sectional averages of these variables.
a: Null of long-run homogeneity

2.4.2 Misalignments and growth: the competitiveness and the FCD debt channels

In order to ensure that our results are robust, we run our different growth specifications by using system generalized method of moments (SGMM) —developed by Arellano and Bover (1995) and Blundell and Bond (1998), in addition to the fixed/random effects (FE/RE) estimators.[15] Our results are reported in Tables 2.2, 2.3 and 2.4. While they differ in magnitude, they are qualitatively the same, regardless of model specification and estimation method.

effective exchange rates (observed and equilibrium levels) and the corresponding misalignments.

[15]GMM estimator is well suited to deal with endogeneity issues —inherent to growth equation. One source of endogeneity bias is the use of the lagged dependent variable as explanatory variable. But, as aforementioned the structure of our panel (N and T) makes it difficult to take position regarding the superiority/appropriateness of FE estimator or SGMM estimator. For the more skeptical, the SGMM estimator would provide robust estimates and would thus be appropriate.

In the first set of equations, we focus only on the direct effect that currency misalignments might have on economic growth. Results derived from the linear specification (equation (2.3)) are reported in the first columns of Table 2.2 (columns 2.1 to 2.6). As can be seen, the coefficients associated to the misalignments variable —even when expressed in absolute value— are negative and significant indicating that any deviation of the real exchange rate from its equilibrium level hurts growth. Therefore this result, which is also in line with those evidenced by earlier works (Cavallo et al. 1990; Ghura and Grennes, 1991), tends to support the WC view.

In order to determine whether the effect of currency misalignments on growth is non-linear, we add the squared values of the misalignments series (columns 2.6 to 2.9). The coefficients, as can be seen, are significant, showing the existence of nonlinearity in the misalignments-growth relationship.

We then test whether the effects of currency misalignments on economic growth are asymmetric, in other words, whether overvaluations tend to dampen economic growth in the same way as undervaluations foster it. As shown in columns 2.10 to 2.12, this result —an asymmetric effect of misalignments on growth— is not supported when regressing GDP growth separately on undervaluations and overvaluations. Indeed, the coefficients associated to undervaluations and overvaluations are significant, respectively positive and negative, supporting that growth is adversely affected by misalignments, regardless of their signs. These findings are in line with those of Schröder (2013) and underscore our earlier result in support of the WC view. They thus provide some *prima facie* evidence against the "traditional" export-led growth literature. However, the coefficients associated to undervaluations are smaller than those of overvaluations, suggesting that economic growth is more negatively impacted by overvaluations.[16]

[16]We avoid, at this stage of the analysis to take position in a peremptory fashion given the smallness of the coefficients which might be due to heterogeneity between the countries in regard to the currency misalignments-growth nexus. Note however that the issue of heterogeneity will be addressed further below.

Table 2.2 — Growth regressions, the competitiveness channel

Dependent variable:	Real GDP per capita growth (Δy)					
	FE (2.1)	RE (2.2)	S.GMM (2.3)	FE (2.4)	RE (2.5)	S.GMM (2.6)
Variables of interest						
Mis	-0.022***	-0.024***	-0.041***			
	(-2.89)	(-3.60)	(-3.82)			
Mis^2						
$\|Mis\|$				-0.024***	-0.019**	-0.030**
				(-3.94)	(-2.08)	(-2.59)
$Under$						
$Over$						
$Debt$	-0.017***	-0.016***	-0.035**	-0.015***	-0.019***	-0.023**
	(-2.66)	(-2.98)	(-2.51)	(-2.65)	(-2.70)	(-2.38)
Growth determinants						
$l.y$	-0.015***	-0.004*	-0.004	-0.018***	-0.004**	-0.010
	(-2.99)	(-1.82)	(-0.56)	(-4.51)	(-1.99)	(-1.19)
$Invest$	0.112***	0.111***	0.175***	0.117***	0.111***	0.120*
	(4.93)	(5.26)	(3.29)	(5.14)	(5.12)	(1.93)
Pop	-0.259	-0.581*	-0.217	-0.212	-0.628**	-0.261
	(-0.99)	(-1.90)	(-0.61)	(-0.96)	(-1.96)	(-0.43)
$Life$	0.378***	0.448***	0.338**	0.339***	0.444***	0.471
	(2.89)	(4.10)	(2.20)	(2.62)	(4.60)	(1.24)
$age.dep$	-0.035	0.004	-0.004	-0.054***	0.003	-0.038
	(-1.61)	(0.90)	(-0.15)	(-2.86)	(0.51)	(-0.87)
Fdi	0.043	0.071*	0.028	0.059	0.098***	0.071
	(1.07)	(1.78)	(0.54)	(1.63)	(2.60)	(0.83)
Gov	-0.066	-0.068	-0.073	-0.066	-0.071	-0.196**
	(-1.39)	(-1.46)	(-0.84)	(-1.36)	(-1.48)	(-2.06)
$REGCIV$	-0.025**	-0.007	-0.004	-0.024*	-0.007	-0.013
	(-2.05)	(-0.75)	(-0.22)	(-1.92)	(-0.79)	(-0.87)
$HIPC$	-0.003	-0.006	-0.009	0.009***	0.003	0.005
	(-1.44)	(-1.47)	(-1.57)	(3.50)	(0.70)	(0.65)
$Constant$	0.293***	0.017	0.031	0.404***	0.049*	0.282
	(2.53)	(0.58)	(0.21)	(3.97)	(1.72)	(1.23)
R-sq.	0.09	0.10		0.09	0.08	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72
$\beta_{Und} - \beta_{Over} = 0$						
AR(2) test			0.21			0.18
Hansen test			0.63			1.00

Notes: ***, **, and * denote the levels of statistical significance at 1%, 5%, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

Continued on next page

We then investigate the FCD debt channel through which currency misalignments may indirectly influence economic growth —due to valuation effects. To do so, we interact the FCD debt variable with the misalignments variable, as indicated by equation (2.6). The results are displayed in Table 2.3 (columns 3.1 to 3.3). In all regressions, the associated coefficients are highly significant, suggesting that currency misalignments play an important role for the marginal effect that the FCD debt has on economic growth. We subsequently interact the undervaluations and

Table 2.2 — *Continued.*

Dependent variable:	Real GDP per capita growth (Δy)					
	FE (2.7)	RE (2.8)	S.GMM (2.9)	FE (2.10)	RE (2.11)	S.GMM (2.12)
Variables of interest						
Mis	-0.021***	-0.023***	-0.023**			
	(-2.64)	(-3.50)	(-2.05)			
Mis^2	-0.017*	-0.011*	-0.021**			
	(-1.92)	(-1.79)	(-2.09)			
$\|Mis\|$						
$Under$				0.002***	0.004*	0.002***
				(4.54)	(1.82)	(3.07)
$Over$				-0.008**	-0.006	-0.010*
				(-2.06)	(-1.46)	(-1.85)
$Debt$	-0.017***	-0.016***	-0.028**	-0.024***	-0.020***	-0.028***
	(-3.55)	(-3.84)	(-2.53)	(-2.97)	(-3.61)	(-3.06)
Growth determinants						
$l.y$	-0.015***	-0.004*	-0.008	-0.018***	-0.004**	-0.004
	(-3.02)	(-1.86)	(-1.13)	(-3.82)	(-1.96)	(-0.71)
$Invest$	0.111***	0.113***	0.129**	0.118***	0.110***	0.169***
	(4.94)	(5.35)	(2.51)	(5.09)	(5.19)	(2.72)
Pop	-0.213	-0.577*	-0.409	-0.257	-0.652**	-0.716
	(-0.80)	(-1.89)	(-0.67)	(-0.99)	(-2.07)	(-1.31)
$Life$	0.367***	0.451***	0.370	0.344***	0.443***	0.368*
	(2.70)	(4.03)	(1.27)	(2.63)	(4.65)	(1.74)
$age.dep$	-0.035	0.004	-0.015	-0.054***	0.003	-0.014
	(-1.66)	(0.85)	(-0.48)	(-2.73)	(0.55)	(-0.52)
Fdi	0.046	0.074*	0.024	0.054	0.092**	0.065
	(1.14)	(1.82)	(0.30)	(1.44)	(2.44)	(1.19)
Gov	-0.069	-0.072	-0.091	-0.068	-0.072	-0.047
	(-1.46)	(-1.54)	(-1.23)	(-1.39)	(-1.49)	(-1.03)
$REGCIV$	-0.029**	-0.008	-0.006	-0.021	-0.006	0.004
	(-2.11)	(-0.87)	(-0.38)	(-1.59)	(-0.70)	(0.28)
$HIPC$	-0.002	-0.005	-0.007	0.004	0.001	0.003
	(-0.51)	(-1.34)	(-0.92)	(0.88)	(0.33)	(0.51)
$Constant$	0.262***	0.046*	0.176	0.365***	0.024	0.060
	(2.22)	(1.82)	(0.90)	(3.41)	(1.59)	(0.41)
R-sq.	0.11	0.10		0.09	0.08	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72
$\beta_{Und} - \beta_{Over} = 0$				0.02	0.02	0.03
AR(2) test			0.19			0.56
Hansen test			1.00			0.88

Notes: ***, **, and * denote the levels of statistical significance at 1%, 5%, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

overvaluations variables with the FCD debt variable, given that the impact that valuation effects have on growth may also depend on the nature of misalignments. As can be seen (columns 3.4 to 3.6), the interaction terms are significant and positive for undervaluations, reflecting a negative valuation effect: the negative impact exerted by the level of the FCD debt on economic growth tends to increase when the currency is undervalued. Conversely, overvaluations tend to reduce the negative effect of the FCD debt on economic growth. However, the coefficient is not statisti-

cally significant —at least at conventional level.[17] Valuations effects seem therefore to be more prominent in the undervaluations' regime than in the overvaluations' one.[18]

Finally, regarding our full set of control variables, we first note that the effect of the FCD debt on economic growth is negative and significant, which is in accordance with the literature (see among others, Cordella et al., 2005; Patillo et al., 2011). We also note that the *initial GDP per capita* coefficient is negative and significant —in all but SGMM's estimates—, meaning that the conditional convergence hypothesis is verified. *Investment*, through its positive impact on capital accumulation, increases growth. The coefficients are positive and highly significant, regardless the estimation method. *Life expectancy* and *foreign direct investment* —although less significant— also appear to be positively correlated with economic growth. Conversely, any increase in the demographic variables (i.e. *population growth rate* and *age dependency ratio*) tends to hamper economic growth. However, these latter variables are almost never significant.[19] The picture is also the same regarding *government consumption* and *REGCIV*. Finally, we do not find any significant impact of the HIPC initiative.

After identifying the existence of a FCD debt channel, we now analyze to what extent this channel is influenced by the exchange rate regime (ERR) in place. To do so, we first extract the ERR dummies from the Reinhart and Rogoff (2004) coarse classification and define a narrow classification that includes 3 ERR categories (instead of 6): fixed, intermediate and flexible ERR (see Table A.2.2 in Appendix A). We then create a categorical variable, ERR, ranging from 1 to 3, that capture the three types of ERR, according to the rigidity of the regime (1 being the more rigid regime). As a first step, we interact this categorical variable with the currency misalignments and the FCD debt variable (equation (2.8)). Results, reported in the first three columns of Table 2.4, suggest that the exchange rate regime plays a role

[17] A possible explanation for this could be that of two antagonistic effects: overvaluations might indeed reduce the negative effect of the debt, but, at the same time, they could significantly reduce exports earnings which in turn worse the burden of servicing external debt. As a result, the debt increases (the loss in competitiveness leads to a recurring indebtedness to finance the economy and to service debt). In the absence of statistical significance for our coefficients, one may conclude that the competitiveness/income effect outweighs the valuation effect.

[18] Note that our conclusions are also robust to the use of the PPG debt as a proxy for the FCD debt.

[19] By the way, note that the fact that some growth determinants are not significant — contrary to the Bayesian analysis results— is due to the standard errors corrections applied here.

Table 2.3 — Growth regressions, the FCD debt channel

Dependent variable:	Real GDP per capita growth (Δy)					
	FE (3.1)	RE (3.2)	S.GMM (3.3)	FE (3.4)	RE (3.5)	S.GMM (3.6)
Variables of interest						
Mis	-0.025***	-0.026***	-0.035***			
	(-2.93)	(-3.42)	(-3.29)			
Under				0.001***	0.001**	0.002**
				(3.39)	(2.06)	(2.19)
Over				-0.006**	-0.004**	(-1.77)
				(-2.08)	(-2.21)	(-1.77)
Debt	-0.017***	-0.016***	-0.028***	-0.015***	-0.014***	-0.026**
	(-2.79)	(-3.02)	(-2.78)	(-3.12)	(2.64)	(-2.42)
*Mis * Debt*	-0.037***	-0.032***	-0.035**			
	(-3.64)	(-3.53)	(-2.13)			
*Under * Debt*				0.041**	0.044**	0.056***
				(2.17)	(2.31)	(2.90)
*Over * Debt*				-0.044	-0.054	-0.036
				(-1.14)	(-1.37)	(-1.03)
Growth determinants						
l.y	-0.015***	-0.004**	-0.006	-0.016***	-0.003*	-0.006
	(-3.09)	(-1.96)	(-0.87)	(-3.43)	(-1.72)	(-0.63)
Invest	0.113***	0.111***	0.137**	0.123***	0.115***	0.142***
	(4.95)	(5.28)	(2.50)	(5.24)	(5.29)	(2.83)
Pop	-0.213	-0.554*	-0.387	-0.282	-0.628**	-0.617
	(-1.17)	(-1.78)	(-0.59)	(-1.11)	(-2.04)	(-1.13)
Life	0.364***	0.447***	0.207	0.343***	0.408***	0.364
	(2.68)	(4.05)	(0.44)	(2.87)	(3.81)	(0.99)
age.dep	0.043**	0.004	-0.010	-0.053***	0.005	-0.026
	(-2.15)	(0.82)	(-0.30)	(-2.92)	(1.08)	(-0.69)
Fdi	0.026	0.064	0.028	0.043	0.080**	0.031
	(0.59)	(1.58)	(0.37)	(1.11)	(2.07)	(0.59)
Gov	-0.074	-0.057	-0.102	-0.074	-0.067	-0.189***
	(-1.61)	(-1.22)	(-1.29)	(-1.50)	(-1.40)	(-2.68)
REGCIV	-0.029**	-0.005	-0.009	-0.019	-0.003	-0.011
	(-2.17)	(-0.63)	(-0.60)	(-1.48)	(-0.42)	(-0.67)
HIPC	-0.004	-0.006	-0.009	0.003	-6E-4	-2E-4
	(-0.89)	(-1.50)	(-1.33)	(0.65)	(-0.17)	(-0.04)
Constant	0.265**	0.018	0.146	0.336***	0.017	0.154
	(2.19)	(0.63)	(0.86)	(3.21)	(0.56)	(0.72)
R-sq.	0.12	0.11		0.10	0.09	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2219/72
$\beta_{Und} - \beta_{Over} = 0$				0.02	0.06	0.04
AR(2) test			0.19			0.29
Hansen test			1.00			0.99

Notes: ***, **, and * denote the levels of statistical significance at 1%, 5%, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

in the diffusion of the valuation effects underlying the FCD debt channel —as the coefficients associated with the interaction term are statistically significant.[20] To get results more easily interpretable, we use dummy variables, "$Fix.$", "$Interm.$", and "$Flex.$" that take the value of one when an observation is classified respectively as a fixed, intermediate and flexible regime. We then interact each of these exchange

[20]This result is robust to the use of the coarse classification that include 6 ERR categories.

rate regimes' dummy variable with the currency misalignments and the FCD debt variables (equation (2.9)). Results are reported in the last three columns of Table 2.4.[21]

Table 2.4 — Investigating the exchange rate regime effect

Dependent variable:	Real GDP per capita growth (Δy)					
	FE	RE	S.GMM	FE	RE	S.GMM
	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
Variables of interest						
Under	0.002***	0.001**	0.002***	0.002***	0.001***	0.002***
	(4.72)	(2.02)	(3.21)	(5.20)	(3.92)	(2.83)
Over	-0.007***	-0.005*	-0.008**	-0.006**	-0.005**	-0.008**
	(-2.75)	(-1.90)	(-2.31)	(-2.31)	(-2.07)	(-2.03)
Debt	-0.016***	-0.015***	-0.027***	-0.017***	-0.015***	-0.018**
	(-3.01)	(-2.57)	(-2.64)	(-2.60)	(-2.63)	(-2.25)
$Mis * Debt * ERR$	-0.013***	-0.018***	-0.014***			
	(-3.53)	(-4.15)	(-2.81)			
$Mis * Debt * Fixed$				-0.053***	-0.042***	-0.056***
				(-4.37)	(-4.76)	(-3.26)
$Mis * Debt * Interm.$				-0.016	-0.021	-0.017
				(-1.15)	(-1.47)	(-0.31)
$Mis * Debt * Flex.$				-0.038***	-0.040***	-0.045
				(-2.71)	(-2.78)	(-1.48)
Growth determinants						
l.y	-0.016***	-0.003***	-0.001	-0.017***	-0.003***	-0.006
	(-3.27)	(-3.52)	(-0.05)	(-3.38)	(-4.24)	(-0.97)
Invest	0.115***	0.109***	0.176***	0.112***	0.109***	0.119***
	(4.89)	(5.12)	(3.68)	(5.34)	(5.13)	(2.74)
Pop	-0.283	-0.625**	-0.349	-0.306	-0.592**	-0.664
	(-1.10)	(-2.06)	(-0.69)	(-1.17)	(-2.00)	(-1.13)
Life	0.404***	0.460***	0.433	0.377***	0.445***	0.361
	(4.04)	(4.44)	(1.21)	(3.31)	(5.34)	(1.00)
age.dep	-0.048**	0.003	-0.016	-0.050***	0.003	-0.008
	(-2.53)	(0.69)	(-0.52)	(-2.85)	(0.67)	(-0.33)
Fdi	0.035	0.074*	0.012	0.020	0.066	0.023
	(0.82)	(1.75)	(0.20)	(0.47)	(1.63)	(0.22)
Gov	-0.072	-0.075*	-0.048	-0.079*	-0.081*	-0.055
	(-1.55)	(-1.67)	(-1.04)	(-1.72)	(-1.80)	(-0.88)
REGCIV	-0.021	-0.006	-0.007	-0.012	-0.005	-0.010
	(-1.63)	(-0.72)	(-0.50)	(-1.04)	(-0.58)	(-0.78)
HIPC	-1.2E-4	-0.002	-0.005	-0.004	-0.004	-0.010
	(-0.03)	(-0.52)	(-0.96)	(-0.81)	(-1.11)	(-1.46)
Constant	0.337***	0.019	-0.007	0.340***	0.020	0.129
	(3.56)	(0.58)	(-0.06)	(3.08)	0.020	(0.67)
R-sq.	0.11	0.09		0.12	0.11	
Obs./ Countries	2219/72	2219/72	2219/72	2219/72	2219/72	2219/72
$\beta_{Und} - \beta_{Over} = 0$	0.00	0.02	0.00	0.00	0.03	0.03
AR(2) test			0.66			0.58
Hansen test			0.96			1.00

Notes: ***, **, and * denote the levels of statistical significance at 1%, 5%, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

While the coefficients associated with the interaction terms for the intermediate ERR appear not significant, those associated with fixed and flexible ERR are

[21]It should be noted, before going further, that we have more or less equivalent FCD debt level for the different exchange rate regimes —regardless of the classification used. See Table A.3.

significant. Thus, intermediate exchange rate regimes, compared to the two other ones, seem to isolate economic growth from valuation effects induced by currency misalignments. The reason may be linked to the fact that intermediate exchange rate regimes, when credible, combine the best of the two other extreme regimes. Indeed, in such regimes, the soft peg against the value of an anchor currency or a basket of currencies limits the volatility and reduce the possibility that exchange rates will overshoot their long run equilibrium —while allowing for a considerable degree of flexibility. These two features, naturally, limit valuation effects. Another possible explanation for the insulation property of intermediate ERR may come from a consistent choice of the anchor(s) with the composition of both trade and capital flows.

On the contrary, fixed and flexible ERR do not insulate from valuation effects. Moreover, valuation effects tend to be higher in fixed ERR than in flexible ERR.[22] As discussed in section 2, two reasons may justify this result. The first is related to the level of the FCD debt and the incoherence in its composition. The second is related to the dynamics of the real exchange rate. For fixed ERR, an important and non-consistent —with the anchor(s)— FCD debt entails valuation effects in case of misalignments. However, for hard peg, if the FCD debt is nearly or completely denominated in the anchor currency, valuation effects will be low or even non-existent in some cases. Pegging the currency to a basket of foreign currencies can induce valuation effects but these are somehow dampened since the peg to a portfolio of foreign currencies tends to weaken foreign exchange rate exposure. Whatever be the case, these valuation effects are the result of misalignments which are themselves driven by movements in the country's real exchange rate —relative to its equilibrium level— and the movements in the anchor(s) currency(ies). This latter source of currency misalignments is not present in flexible ERR. Moreover, a flexible nominal exchange rate may act as a shock absorber, thus limiting valuation effects. This may explain why the coefficients associated with the valuation effects are weaker under flexible ERR than under fixed ERR.[23]

[22]This assertion is based on the comparison tests between the coefficients associated to Fixed and Flexible ERR. The coefficients associated with the Flexible ERR (in columns 4.4 and 4.6) are significantly different from those associated with the Fixed ERR.

[23]These results do however not mean that *flexible ERR* are preferable to *fixed ERR*, since valuation effects can impact positively or negatively GDP growth. They instead show that *inter-*

2.4.3 Sensitivity analysis

As the countries of our sample differ in many respects (GDP per capita, degree of financial and economic integration, trade specialization, ...), they are likely to be heterogeneous in the way economic growth is affected by changes in their currency misalignments and in their FCD debt. Allowing for this heterogeneity may then explain some of our previous results. In particular, the finding of a weak effect of under- and overvaluation's on economic growth can be explained by "aggregate" coefficients stemming from panel estimation. Allowing for heterogeneity can also be useful to discriminate between the export led growth view and the WC view and can therefore gives more insight on the relationship between undervaluations and growth. To allow for cross-country difference, we use a LSDV (Least Squares Dummy Variable) model with country-specific effects in order to observe, for each country, the direct and indirect effects of both under- and overvaluations.

Consequently, we first rerun equation (2.5) by interacting undervaluation (resp. overvaluation) with country dummies in order to estimate, for each considered country, the growth effects of under- and overvaluations.[24] Results are reported in the first two columns of Table B.2 (Appendix B.2). Relaxing the assumption of homogenous coefficients for both under- and overvaluations affects our previous results, particularly those found for undervaluations. As can be seen, the impact of undervaluations on growth is found not significant for most countries. But the most striking finding is that, while our previous results indicated that undervaluations had, on average, a negative effect on GDP growth supporting the WC view, this finding is now significant for only 8 countries. We find more statistical evidence supporting the export-led growth theory, i.e. an expansionary effect of undervaluations, with 14 countries exhibiting a negative and significant coefficient. Taking a closer look on differences between these two groups of countries, we observe that, countries, in which undervaluations affect negatively GDP growth, have registered either important and often persistent undervaluations (e.g. El Salvador), either

mediate ERR are significantly less likely to be associated with valuation effects driven by currency misalignments than the bipolar alternatives.

[24] In other words, we relax the assumption of homogenous coefficients for both under- and overvaluations. The coefficients associated with the other variables are however constrained to be homogenous (as in general panel estimation procedures).

structural weaknesses leading to recurrent devaluations (e.g. Dominican Rep., Mexico). In contrast, countries, in which the positive effects of undervaluations on GDP growth are the greatest, exhibit relatively low levels of undervaluations (e.g. China, Panama, Mozambique, Guinea-Bissau).[25] Thus, there is some evidence that the effect of undervaluations on GDP growth depends on the size of the misalignment, suggesting the existence of threshold effects that are not captured, by definition, by an aggregate homogeneous coefficient. Evidence provided by the impact of overvaluations on GDP growth is more in accordance with our earlier findings. Indeed, when significant, our results similarly indicate that overvaluations are mostly detrimental for growth.

To examine whether the FCD debt channel is robust to heterogeneity, we also rerun equation (2.7) by interacting the undervaluation (resp. overvaluation), the FCD debt variable and the country dummies. Results are reported in the last two columns of Table B.2 (Appendix B.2).

Our results clearly indicate that currency misalignments have a significant impact on GDP growth through the FCD debt channel. Indeed, we find statistical significance of valuation effects for about half of the 72 considered countries in our sample, with more prevalent/prominent evidence in the undervaluation's regime. Moreover, coefficients have in most cases the expected signs: undervaluations increase the negative effects that the FCD debt exerts on GDP growth; overvaluations affect the FCD debt in the opposed direction, by reducing the negative impact of the FCD debt. Few countries exhibit an opposite sign. This non-expected sign may be explained by two antagonistic effects. The fact that undervaluations can be associated with a positive valuation effect on growth can come from a rise in export earnings sufficiently enough to ensure the debt's service (the positive income effect outweighs the negative valuation effects). Similarly, a positive sign of the coefficient in the case of overvaluations can be explained by a negative income effect outweighing the positive valuation effects. Finally, it is important to emphasize that valuation ef-

[25]China is, undoubtedly, the best example supporting the export-led growth theory. Indeed, for a long time, the authorities have been accused to maintain the exchange rate at low levels —i.e. undervaluations— to boost the competitiveness. We also observe for this country a considerable GDP growth rate during this period.

fects are higher in countries under fixed ERR —throughout the studied period or for a long time.[26] Within this group, valuation effects are clearly larger in countries that have registered sizeable or repetitive nominal exchange rate adjustments. This is especially the case for Botswana, which, between 1980 and 2012, experienced 7 devaluations. This observation is also valid for Latin American countries (e.g. Argentina, Brazil, El Salvador, Ecuador, Mexico, Panama, and Venezuela), Asian countries (e.g. India, Malaysia, Thailand, Philippines) and a number of African countries namely the CFA zone countries (e.g. Benin, Burkina Faso, Cameroon, Mali). For countries experiencing intermediate or flexible ERR, valuation effects seem to be weaker, thus confirming our previous results derived from panel data analysis.

Overall, our results clearly indicate that the FCD debt channel is more robust to heterogeneity, comparatively to the competitiveness channel. Indeed, GDP growth seems to be related to misalignments through movements in competitiveness only for few countries of our sample, while there is more significant evidence of the existence of valuation effects. This can therefore explain why panel estimation leads to an indirect effect of misalignments on GDP growth, through the FCD channel, higher than their direct effect stemming from changes in competitiveness. This also suggests that, in emerging and developing countries, currency misalignments impact economic growth mainly through the FCD debt channel rather than the traditional competitiveness one.

2.5 Conclusion

The aim of this paper was to investigate, for a sample of developing and emerging countries, the existence of a foreign currency-denominated debt channel through which currency misalignments can impact economic growth. By so doing, we contributed to the ongoing debate on the effects of currency misalignments on economic growth, by considering this indirect transmission channel in addition to the direct competitiveness channel.

[26]This assertion is based on the average of the ERR followed by the country (three-way classification).

We provide evidence that misalignments have a significant and prominent indirect effect on GDP growth through valuation effects, suggesting the existence, in emerging and developing countries, of an additional transmission channel related to the existence of a foreign currency-denominated debt. In particular, through this channel, misalignments affect economic growth in the opposite direction to that of the traditional competitiveness channel. Moreover, our findings evidence a higher effect for undervalued currencies and highlight the role of exchange rate policies in shaping the effects of misalignments on these valuations effects.

Our results have then important policy implications. The misalignment of the real exchange rate, especially if large, is something to worry about in developing and emerging countries. This is because it tends to impact economic growth not only through a competitiveness channel but also through a foreign currency-denominated debt channel. Moreover, as this latter channel seems to play a prominent role in developing and emerging countries, policy makers should also pay closer attention to the composition of the FCD debt as well as its consistency with the exchange rate regime.

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Appendices

A. Data appendix

A.1 Sample

Table A.1 – List of countries (72)

Algeria	Congo Rep.^{H}	Indonesia	Paraguay
Angola	Costa Rica	Jordan	Peru
Argentina	Cote d'Ivoire^H	Kenya	Philippines
Bangladesh	Dominican Rep.	Lesotho	Rwanda^H
Benin^H	Ecuador	Madagascar^H	Sao Tome & Principe^H
Bolivia^H	Egypt	Malawi^H	Senegal^H
Botswana	El Salvador	Malaysia	South Africa
Brazil	Ethiopia^H	Mali^H	Sri Lanka
Burkina Faso^H	Fiji	Mauritania^H	Sudan
Burundi^H	Gabon	Mauritius	Swaziland
Cabo Verde	Gambia^H	Mexico	Tanzania^H
Cameroon^H	Ghana^H	Morocco	Thailand
Central African. Rep^H	Guatemala	Mozambique^H	Togo^H
Chad	Guinea^H	Nicaragua^H	Tunisia
China	Guinea-Bissau^H	Niger^H	Turkey
Colombia	Haiti^H	Nigeria	Uganda^H
Comoros^H	Honduras^H	Pakistan	Venezuela, RB
Congo Dem. Rep.^{H}	India	Panama	Zambia^H

Note: "H" indicates the countries that benefited from the HIPC initiative and reached the completion point.

A.2 Data description

Table A.2.1 — Variable definitions and sources

Variable	Definition	Source
Exchange rate fundamentals		
rprod	Relative productivity: measured by the ratio of GDP per capita (PPP) in the country and the trade-weighted average GDP per capita PPP of the top 67 partner countries.	Author calculations
nfa	Net Foreign Asset position (%GDP)	Lane & Milesi-Ferretti
tot	Net barter terms of trade index (2000 = 100), expressed in logarithm	WDI
Variables used for the BMA analysis		
Dependent variable		
Δy	GDP per capita growth (annual %)	WDI
Solow determinants & human capital		
l.y	Initial real GDP per capita	WDI
invest	Total investment (%GDP)	WEO
pop	Total population (expressed in logarithm)	WDI
$life$	Life expectancy at birth (total years), expressed in logarithm	WDI
age.dep	Age dependency ratio (% of working-age population)	WDI
Macroeconomic variables		
fdi	Foreign direct investment, net inflows (% of GDP)	UNCTAD
open	Exports plus Imports as share of GDP	WDI
oda	Net official development assistance and official aid received (%GDP)	WDI
gov	General government final consumption expenditure (% of GDP)	WDI
tot	Net barter terms of trade index (2000 = 100), expressed in logarithm	WDI
$inflation$	Inflation (consumer price), expressed in logarithm	WEO
debt	External debt stocks, public and publicly guaranteed (expressed in logarithm and %GDP)	WDI
debt.serv	Public and publicly guaranteed debt service (% of GDP)	WDI
exports	Exports of goods and services (% of GDP)	WDI
$gfcf$	Gross fixed capital formation (% of GDP)	WDI
money	Broad money (% of GDP)	WDI
remit.	Personal remittances, received (% of GDP)	WDI
Socio-political indicators		
CL	Civil liberties; measured on a scale from 1 to 7, 7 being the lowest level of freedom.	Freedom House
PR	Political rights; measured on a scale from 1 to 7, 1 being the highest degree of freedom.	Freedom House
Democ	Democracy; measured on a 0-to-1 scale, 1 being the highest level of democracy.	CSP
$CIVWAR$	Magnitude score of episode(s) of civil warfare involving the state; measured on a scale from 0 to 1, 1 being the highest degree.	CSP
$REGCIV$	Magnitude scores of all societal (civil or ethnic) Major Episodes of Political Violence; measured on a scale from 0 to 1.	CSP
Other variables		
$de\ facto$	*de facto* exchange rate regime classification	IRR
$HIPC$	Dummy variable for the HIPC initiative: scores 1 from the completion point till the end of the studied period. Coded using informations provided by the IMF, the African Development Bank and the Club de Paris.	

Notes: WDI: *World development Indicators* (World bank); WEO: *World Economic Outlook* (International Monetary Fund) CSP: *Center for Systemic Peace*; UNCTAD: *United Nations Conference on Trade and Development*; IRR: Ilzetzki, Reinhart, Rogoff (2011)

Table A.2.2 — Exchange rate regime classification

IRR *de facto* classification		**Our re-classification**	
Regime	**Code**	**Regime**	**Code**
No separate legal tender	1		
Pre announced peg or currency board arrangement	1		
Pre announced horizontal band that is narrower than or equal to +/-2%	1		
De facto peg	1	Fixed ERR	1
Pre announced crawling peg	2		
Pre announced crawling band that is narrower than or equal to +/-2%	2		
De facto crawling peg	2		
De facto crawling band that is narrower than or equal to +/-2%	2		
Pre announced crawling band that is wider than or equal to +/-2%	3		
De facto crawling band that is narrower than or equal to +/-5%	3		
Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)	3	Intermediate ERR	2
Managed floating	3		
Freely floating	4		
Freely falling	5	Flexible ERR	3
Dual market in which parallel market data is missing	6		

A.3 Sample consistency

Table A.3 — Sample consistency: exchange rate regime and FCD debt level

	Exchange Rate Regime (three-way[a] *de facto* classification)		
	Fixed	*Intermediate*	*Flexible*
Mean	21.833	22.556	22.661
Std. Dev.	1.625	1.667	1.492
	Exchange Rate Regime (six-way[b] *de facto* classification)		
	de facto 1	*de facto 2*	*de facto 3*	*de facto 4*	*de facto 5*	*de facto 6*
Mean	21.511	22.178	22.556	22.249	22.983	20.122
Std. Dev.	1.537	1.647	1.667	1.592	1.261	1.217

Notes: a: Our re-classification; b: IRR classification (see Table A.2.2).

B. Additional results

B.1 Causality tests

Results displayed in Table B.1 are those obtained from the test proposed by Dumitrescu and Hurlin (2012). For brevity, we do not present the technical details. Note however that under the null of Homogenous Non Causality (HNC), there is no causal relationship for all the cross-units of the panel. Under the alternative, there is a causal relationship for at least for one cross-unit.

Table B.1 — Causality test results

	$Mis_{i,t} \rightarrow \Delta y_{i,t}$			$Debt_{i,t} \rightarrow \Delta y_{i,t}$		
	K=1	*K=2*	*K=3*	*K=1*	*K=2*	*K=3*
W_{HNC}	2.615	4.891	5.934	1.122	2.217	3.358
Z_{HNC}	9.276***	23.490***	29.194***	0.694	1.739*	3.506***
$\tilde{Z}_{HNC}$	7.835***	9.560***	7.418***	0.256	0.218	0.293
	$Mis_{i,t} \rightarrow Debt_{i,t}$			$Mis_{i,t} * Debt_{i,t} \rightarrow \Delta y_{i,t}$		
	K=1	*K=2*	*K=3*	*K=1*	*K=2*	*K=3*
W_{HNC}	6.559	7.626	9.136	1.659	3.477	4.933
Z_{HNC}	31.692***	45.361***	60.588***	3.699***	11.726***	18.793***
$\tilde{Z}_{HNC}$	27.648***	18.965***	16.142***	2.914***	4.515***	4.545***

Notes: ***, **, and * indicate rejection of the null at the 1%, 5%, and 10% levels, respectively. K stands for the lag order. $X \rightarrow Y$ indicates that we test the null hypothesis of Homogenous Non Causality (HNC) from X to Y.

B.2 Sensitivity analysis

Table B.2 — Sensitivity analysis results

	Competitiveness channel		***Valuation effect***	
	Under.	*Over.*	*Under.* $*$ *Debt*	*Over.* $*$ *Debt*
Algeria	0.012 (1.27)	**-0.038*****(−4.43)	0.290 (1.06)	**-0.294***(−1.72)
Angola	-0.094***(−3.38)	-0.404***(−4.52)	-0.279**(−2.45)	-0.512***(−5.17)
Argentina	-0.008 (-0.18)	-0.038 (-1.09)	**0.805*****(5.95)	**-3.225*****(−3.19)
Bangladesh	-0.009 (-0.08)	-0.045 (-0.41)	1.822 (1.43)	**-8.741*****(−3.06)
Benin	0.023 (0.50)	-0.133 (-1.46)	**0.321*****(4.36)	-0.674 (-1.39)
Bolivia	**-0.070*****(−3.74)	**-0.099*****(−6.00)	-0.124 (-1.33)	**-0.497*****(−6.63)
Botswana	-0.164 (-1.30)	**0.102****(2.35)	**18.033*****(6.51)	0.000 (0.00)
Brazil	0.005 (0.14)	-0.007 (-0.19)	**1.932***(1.66)	**-2.726*****(−2.72)
Burkina Faso	**-0.071***(−1.80)	-0.042 (-0.97)	**1.278*****(3.15)	-1.320 (-1.32)
Burundi	0.041 (0.96)	**-0.175*****(−2.87)	0.297 (1.58)	-0.056 (-0.15)
Cabo Verde	0.278 (1.17)	0.011 (0.06)	**-16.349****(−1.99)	**-3.973****(−1.96)
Cameroon	0.036 (1.06)	**-0.223*****(−3.80)	**0.271****(2.41)	-0.559 (-0.75)
Central Af. Rep	-0.049 (-1.12)	-0.120 (-1.38)	0.062 (0.34)	**-3.082****(−2.29)
Chad	0.032 (0.37)	0.015 (0.15)	2.155 (1.19)	-8.038 (-1.88)
China	**-0.194*****(−4.09)	0.063 (1.79)	2.319 (0.57)	0.089 (0.05)
Colombia	0.005 (0.19)	**-0.100*****(−7.21)	-0.188 (-0.38)	-0.612 (-0.70)
Comoros	0.035 (0.75)	-0.069 (-0.96)	**1.088****(2.31)	**0.595****(2.05)
Congo Dem. Rep.	**-0.119*****(−4.81)	-0.025 (-1.50)	**0.153****(1.83)	**0.032*****(2.82)
Congo Rep.	-0.012 (-0.24)	0.055 (0.51)	**0.548*****(3.04)	-0.513 (-1.45)
Costa Rica	-0.098 (-1.02)	**0.078***(1.73)	**1.397*****(8.63)	-0.402 (-0.55)
Cote d'Ivoire	0.002 (0.02)	-0.009 (-0.18)	0.333 (0.65)	-0.283 (-0.66)
Dominican Rep.	**0.001*****(3.18)	-0.001 (-0.87)	-0.008 (-1.03)	-0.019 (-1.23)
Ecuador	0.061 (1.31)	-0.038 (-1.30)	**0.831*****(2.73)	-0.712 (-1.53)
Egypt	-0.017 (-0.90)	-0.003 (-0.21)	**0.537*****(3.22)	-0.027 (-1.20)
El Salvador	**0.139***(1.79)	-0.056 (-1.16)	**3.370*****(4.78)	-0.985 (-1.19)
Ethiopia	**-0.034***(−1.86)	—	0.088 (0.99)	—
Fiji	0.027 (0.28)	-0.151 (-1.58)	1.940 (0.43)	**-6.112****(−2.52)
Gabon	**0.100****(2.24)	-0.121 (-1.30)	-0.127 (-0.24)	**-1.347*****(−3.65)
Gambia	0.020 (0.59)	0.049 (1.26)	0.007 (0.04)	-0.138 (-0.90)
Ghana	**-0.029****(−2.30)	**-0.028***(−1.93)	-0.019 (-0.43)	**-0.827****(−2.29)

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses.

Continued on next page

Table B.2 — *Continued*

	Competitiveness channel		***Valuation effect***	
	Under.	*Over.*	*Under.* $*$ *Debt*	*Over.* $*$ *Debt*
Guatemala	**0.057*****(3.55)	**-0.129*****(−4.36)	**0.355****(2.03)	-1.001 (-1.38)
Guinea	0.010 (1.48)	—	-0.026 (-1.34)	—
Guinea-Bissau	**-0.132*****(−3.04)	-0.001 (-0.01)	**0.172****(2.02)	-0.207 (-1.02)
Haiti	-0.218 (-0.54)	**-0.118****(−2.13)	0.356 (0.52)	2.219 (0.52)
Honduras	**0.090****(2.31)	**-0.066****(−2.20)	**0.535****(2.44)	0.341 (0.53)
India	-0.054 (-1.59)	0.007 (0.37)	**1.899*****(2.76)	-0.720 (-0.53)
Indonesia	0.052 (0.98)	-0.039 (-1.43)	**0.497*****(11.36)	-0.396 (-0.82)
Jordan	-0.055 (-0.46)	0.058 (0.96)	**1.473*****(7.00)	**-1.777****(−1.86)
Kenya	0.071 (1.52)	**-0.078***(−1.80)	**0.225***(1.74)	-0.786 (-0.59)
Lesotho	0.048 (0.87)	**-0.237****(−2.24)	**0.571*****(2.82)	**-2.298*****(−3.20)
Madagascar	**0.072***(1.75)	**-0.104*****(−2.79)	0.227 (1.19)	-0.715 (-1.48)
Malawi	-0.009 (-0.32)	-0.050 (-0.82)	-0.092 (-1.36)	**-0.530***(−1.74)
Malaysia	-0.031 (-0.58)	-0.007 (-0.25)	**4.627*****(4.91)	**-1.536*****(−4.06)
Mali	0.028 (0.86)	-0.077 (-1.08)	**0.383*****(3.61)	**-1.467*****(−2.61)
Mauritania	-0.056 (-1.21)	0.003 (0.09)	**0.533*****(3.45)	-0.145 (-0.97)
Mauritius	-0.004 (-0.91)	**0.029***(1.86)	0.112 (0.60)	-0.224 (-0.55)
Mexico	**0.188*****(4.46)	**-0.118*****(−3.46)	**0.867*****(2.86)	**-2.401****(−2.54)
Morocco	0.067 (0.78)	-0.111 (-1.09)	**2.679*****(2.62)	**-2.792****(−2.30)
Mozambique	**-0.085****(−2.22)	**-0.040***(−1.87)	**0.457*****(5.19)	0.100 (0.42)
Nicaragua	-0.006 (-0.73)	—	**0.016*****(2.84)	—
Niger	0.066 (1.26)	**-0.169****(−2.29)	0.446 (1.44)	-0.911 (-0.90)
Nigeria	-0.005 (-0.13)	**-0.063****(−2.52)	0.162 (1.10)	-0.146 (-1.38)
Pakistan	-0.011 (-0.25)	**0.044*****(2.97)	**2.480*****(3.64)	0.121 (0.50)
Panama	**-0.142*****(−2.86)	0.006 (0.11)	**2.793*****(5.57)	**-3.711*****(−2.95)
Paraguay	0.070 (2.07)	**-0.085*****(−3.35)	0.865 (1.46)	0.090 (0.30)
Peru	0.044 (1.50)	-0.008 (-0.31)	**0.556*****(5.02)	0.645 (0.91)
Philippines	-0.006 (-0.15)	**-0.144****(−2.02)	1.275 (2.11)	**-4.904*****(−4.71)
Rwanda	**-0.082*****(−2.61)	-0.224 (-1.15)	0.101 (0.67)	**-2.315*****(−12.04)
Sao Tome & Principe	**-0.082*****(−3.26)	0.007 (0.07)	-0.016 (-0.52)	0.471 (1.00)
Senegal	0.030 (0.87)	-0.066 (-1.46)	0.302 (1.12)	-0.908 (-1.04)
South Africa	-0.012 (-0.33)	0.009 (0.11)	-0.286 (-0.33)	0.179 (0.32)
Sri Lanka	-0.121 (-1.23)	**0.139*****(3.32)	1.401 (1.32)	-0.240 (-0.32)
Sudan	**-0.098*****(−3.73)	**0.080*****(3.52)	-0.070 (-0.59)	-0.300 (-0.96)
Swaziland	**0.083****(2.04)	0.101 (0.92)	-0.026 (-0.06)	**-2.463***(−1.74)
Tanzania	-0.019 (-1.24)	**-0.814*****(−51.20)	0.309 (0.97)	—
Thailand	-0.002 (-0.02)	0.029 (1.01)	**10.051*****(11.36)	**-0.799*****(−4.81)
Togo	-0.121 (-1.29)	**-0.157****(−2.50)	-0.139 (-0.33)	-1.100 (-1.62)
Tunisia	-0.066 (-1.36)	-0.073 (-1.54)	0.584 (1.29)	-0.462 (-0.30)
Turkey	0.029 (0.46)	0.062 (1.13)	**1.709*****(2.88)	**-6.871*****(−3.75)
Uganda	**-0.072*****(−2.94)	0.042 (0.86)	**0.232***(1.90)	**-1.596****(−2.02)
Venezuela, RB	0.009 (0.15)	**-0.182*****(−4.50)	**1.907*****(4.25)	-1.046 (-0.55)
Zambia	-0.048 (-1.62)	0.013 (0.45)	**0.064*****(2.82)	-0.077 (-0.94)

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses.

C. Selecting the growth determinants

This Appendix is devoted to the presentation of the Bayesian analysis on which we rely on to select the growth determinants used in the paper. We begin by a brief presentation of the Bayesian Model Averaging (BMA) methodology followed by that of the data and finally conclude with the results.

The Bayesian Model Averaging (BMA) methodology

To deal with the issue of model uncertainty plaguing a number of growth equations —due to the lack of clear theoretical guidance—, we resort to Bayesian Model Averaging techniques. Before going into technical details —although the BMA is briefly presented here[27]—, note that the starting point of the BMA methodology is the finding that there are different possible models, each of them defined by a different combination of regressors, and by a probability of being the "true" model. It proceeds by estimating these different models and constructing a weighted average of all of them.

Considering X potential determinants, one obtains 2^X possible combinations of determinants and thus 2^X potential models M_j with $j = 1, \ldots, 2^X$. Denoting D, the dataset available, and considering θ a function of θ^j parameters to be estimated, the posterior density of the parameters for all the models under consideration is given by:

$$p(\theta|D) = \sum_{j=1}^{2^X} P(M_j|D)\ p(\theta|D, M_j) \tag{C.1}$$

Thus, the posterior density of the parameters is defined by the weighted sum of the posterior density of each considered model, with weights being their posterior model probability.

Given the prior model probability $p(M_j)$, the posterior model probability is cal-

[27] See Hoeting et al. (1997, 1999), Fernàndez et al. (2001) and Moral-Benito (2012) for further details.

culated using the Bayes theorem as follows:

$$P(M_j|D) = \frac{p(D|M_j)\ p(M_j)}{\sum_{j=1}^{2^X}\ p(D|M_j)\ p(M_j)} \tag{C.2}$$

where $p(D|M_j) = \int p(D|\theta^j, M_j)\ p(\theta^j|M_j)\ d\theta^j$ is the marginal likelihood of the data given the model M_j; $p(\theta^j|M_j)$ is the prior density of the parameter θ^j under the model M_j, $p(D|\theta^j, M_j)$ is the likelihood and $p(M_j)$ is the prior probability that M_j is the "true" model.

Summing the posterior model probabilities for all the models including a specific regressor (determinant), we derive the *posterior inclusion probability* (PIP), i.e. the probability that this regressor belongs to the "true" model. It is calculated as:

$$p(\theta_h \neq 0|D) = \sum_{\theta_h \neq 0} p(M_j|D) \tag{C.3}$$

We base the inclusion of a variable —in our growth equation— on this statistic. In general, a variable is considered as robust if its posterior inclusion probability is greater or equal to 0.50. We here follow the same strategy. Regarding the BMA methodology, we follow the Fernàndez, Ley and Steel (2001a) (hereafter, FLS) BMA approach as we have no preference for any specific model.[28] We use improper non-informative priors for the parameters that are common to all models, and a g-prior structure for the slope parameters (with two values for the latter, identified as "*Prior 1*" and "*Prior 9*" as discussed in FLS (2001b)). Since the FLS approach as originally proposed is a cross-section analysis, we follow the methodology proposed by Moral-Benito (2012) for its implementation in the panel data context. For brevity, we do not report the details. Note however that in practice we will work with demeaned data.

The data

Since the aim of this section (nor that of the paper) is not to revisit the growth determinants, we surveyed the vast literature on growth analysis with a particular

[28]The FLS methodology assumes equal probabilities for all models, i.e. $p(M_1) = p(M_2) = \ldots = p(M_{2^X}) = 1/2^X$.

emphasis on studies that use Bayesian techniques and retained 22 different potential determinants. We restrain ourselves to these determinants which have proven to be important/robust growth determinants.

We consider five broad categories of potential determinants of growth. Following the neoclassical theory (Solow-Swan model), we retain the following variables: *(i)* investment and *(ii)* gross fixed capital formation to capture the effects of physical capital; *(iii)* life expectancy to proxy the human capital development[29]; and *(iv)* population and *(v)* age dependency ratio to take into account the effect of the population. We also include *(vi)* the initial income per capita (conditional convergence).

The impact of macroeconomic stability/policies is captured by *(i)* inflation, *(ii)* government consumption, *(iii)* debt (external debt stocks, public and publicly guaranteed[30]), *(iv)* debt service, and *(v)* broad money.

The trade regime is taken into account through *(i)* openness, *(ii)* export revenues, and *(iii)* terms of trade.

The socio-political context is proxy by *(i)* civil liberties, *(ii)* political rights, *(iii)* democracy, *(iv)* civil warfare, and *(v)* REGCIV (magnitude scores of all societal (civil or ethnic) major episodes of political violence).

Finally, we include *(i)* the foreign direct investment, *(ii)* the remittances, and *(iii)* the official aid received as measures of the external environment.

All data are annual and cover the period 1980-2012. The definitions, main sources and calculation details of the data are reported in Table A.2.

The results

Table C.1 presents the results of the estimations (the posterior inclusion probabilities) based on a universe of 2^{23} — i.e. 8,388,608 — possible models. For comparison purpose, we also report results obtained using uniform model prior. Since the main analysis of the paper will be done with annual data, we accordingly perform the Bayesian analysis with annual data rather than 5-year averaged data as it is often

[29]We do not include school enrollment variables since these variables are not available for all the considered countries.

[30]We use two measures of the debt: the debt to GDP ratio and the debt (in real terms; we use the GDP deflator) expressed in logarithm.

done. Doing so, we ensure a sample size that allows enough degree of freedom for estimations and purge the estimates from the Nickell (1981) bias.

Overall, the BMA analysis identified ten robust determinants with posterior inclusion probability higher than 0.50. Except "Gross fixed capital formation", all the Solow-Swan determinants are identified as robust variables. Furthermore, in most cases, these latter belong to the top 3 ranked models.

Table C.1 — Posterior Inclusion Probabilities

Variable	Posterior Inclusion Probability				
	Model prior				
	Uniform	Fixed		Random	
		Prior 1	*Prior 9*	*Prior 1*	*Prior 9*
Initial GDP level	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
Age dependency ratio	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
Broad money	0.050	0.007	0.036	0.021	0.054
Civil liberties	0.026	0.001	0.019	0.010	0.028
Civil warfare (CIVWAR)	0.040	0.002	0.023	0.013	0.038
Debt (ln)	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
Debt (%GDP)	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
Debt service	0.317	0.144	0.255	0.199	0.311
Democracy	0.023	0.002	0.021	0.008	0.026
Exports	0.083	0.003	0.046	0.021	0.083
Foreign Direct Investment	**0.989**^{1,2,3}	**0.807**^{1,2,3}	**0.983**^{1,2,3}	**0.963**^{1,2,3}	**0.989**^{1,2,3}
Government consumption	**0.899**^{1,2,3}	0.311^{2,3}	**0.877**^{1,2,3}	**0.804**^{1,2,3}	**0.890**^{1,2,3}
Gross fixed capital formation	0.461	0.206^{2}	0.473^{1}	0.408^{1}	0.487^{1}
Inflation	0.036	0.001	0.022	0.012	0.037
Investment	**0.679**^{2,3}	**0.797**^{1,3}	**0.611**^{2,3}	**0.633**^{2,3}	**0.658**^{2,3}
Life expectancy	**0.916**^{1,2,3}	0.393^{2,3}	**0.896**^{1,2,3}	**0.842**^{1,2,3}	**0.911**^{1,2,3}
Official Dev. Assist. & Aid	0.030	0.002	0.018	0.011	0.031
Openness	0.136	0.011	0.092	0.050	0.137
Political rights	0.068	0.001	0.051	0.029	0.076
Population	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
REGCIV	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}	**1.000**^{1,2,3}
Remittances	0.155	0.058	0.119	0.085	0.153
Terms of trade	0.407^{2}	0.085	0.329^{3}	0.213^{3}	0.387

Note: The dependent variable is the real GDP per capita growth rate. The results are based on 100,000 burn-ins and and 200,000 draws. Simulations made using birth-death MCMC sampler. The number over the posterior inclusion probability —e.g. "1" — indicates that the variable belongs to the nth best model among the top 2000 models.

Regarding macroeconomic policies and the external environment variables, only the "foreign direct investment", the "government consumption" and the two measures of the "debt" enter with sufficiently high probabilities. These variables also belong to the top 3 models. Finally, the last robust variable suggested by the BMA is REGCIV.

Results being robust to priors' choice (see Figure C.1), we retain the 9 different determinants highlighted in Table C.1, i.e. the initial real GDP ($l.y$), the age dependency ratio ($age.dep$), the debt ($debt$), the foreign direct investment (fdi), the government consumption (gov), the investment ($invest$), the life expectancy ($life$), the population growth rate (pop), and $REGCIV$.

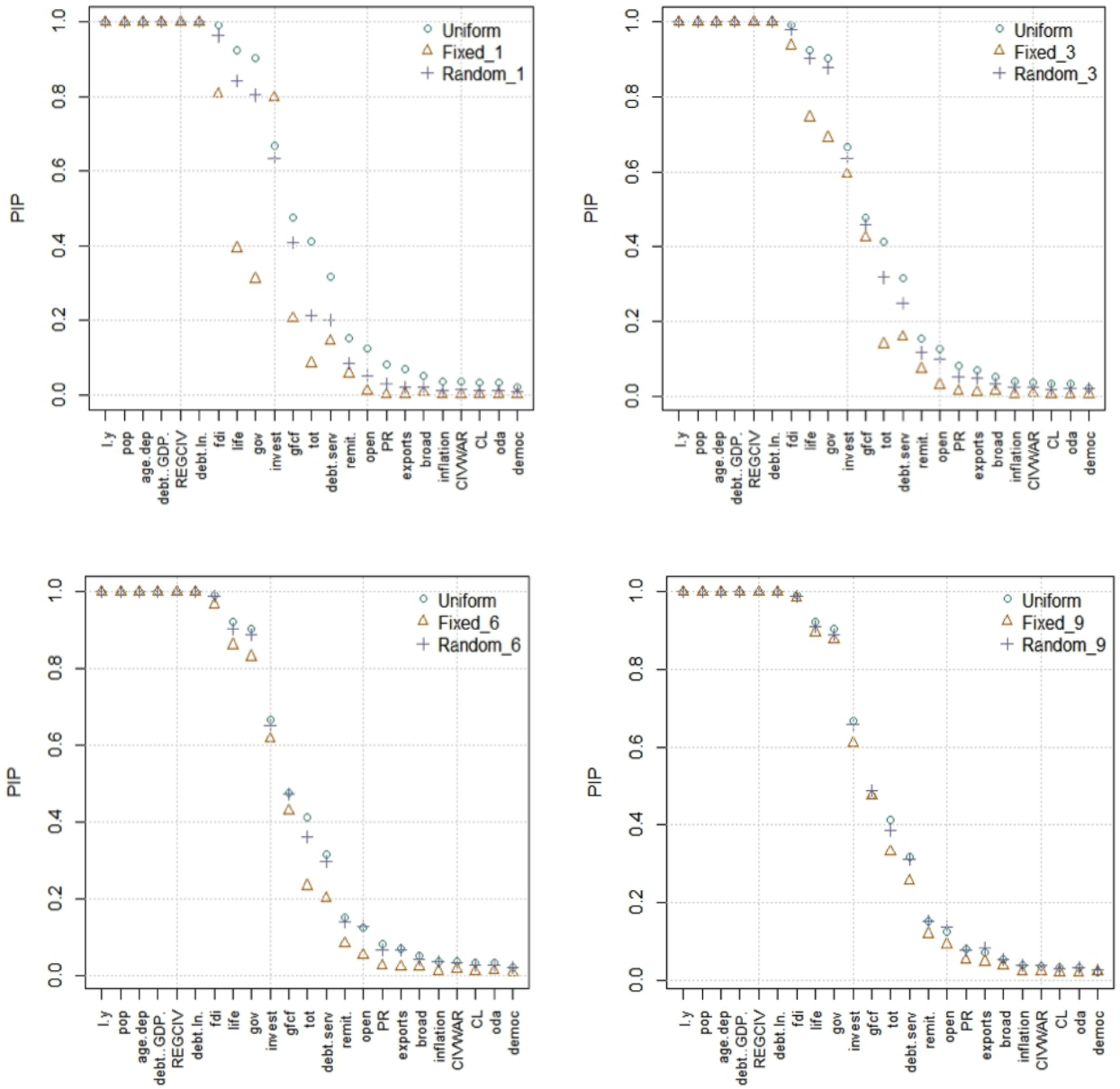

Figure C.1 — PIPs' sensitivity to priors' choice

D. Figures

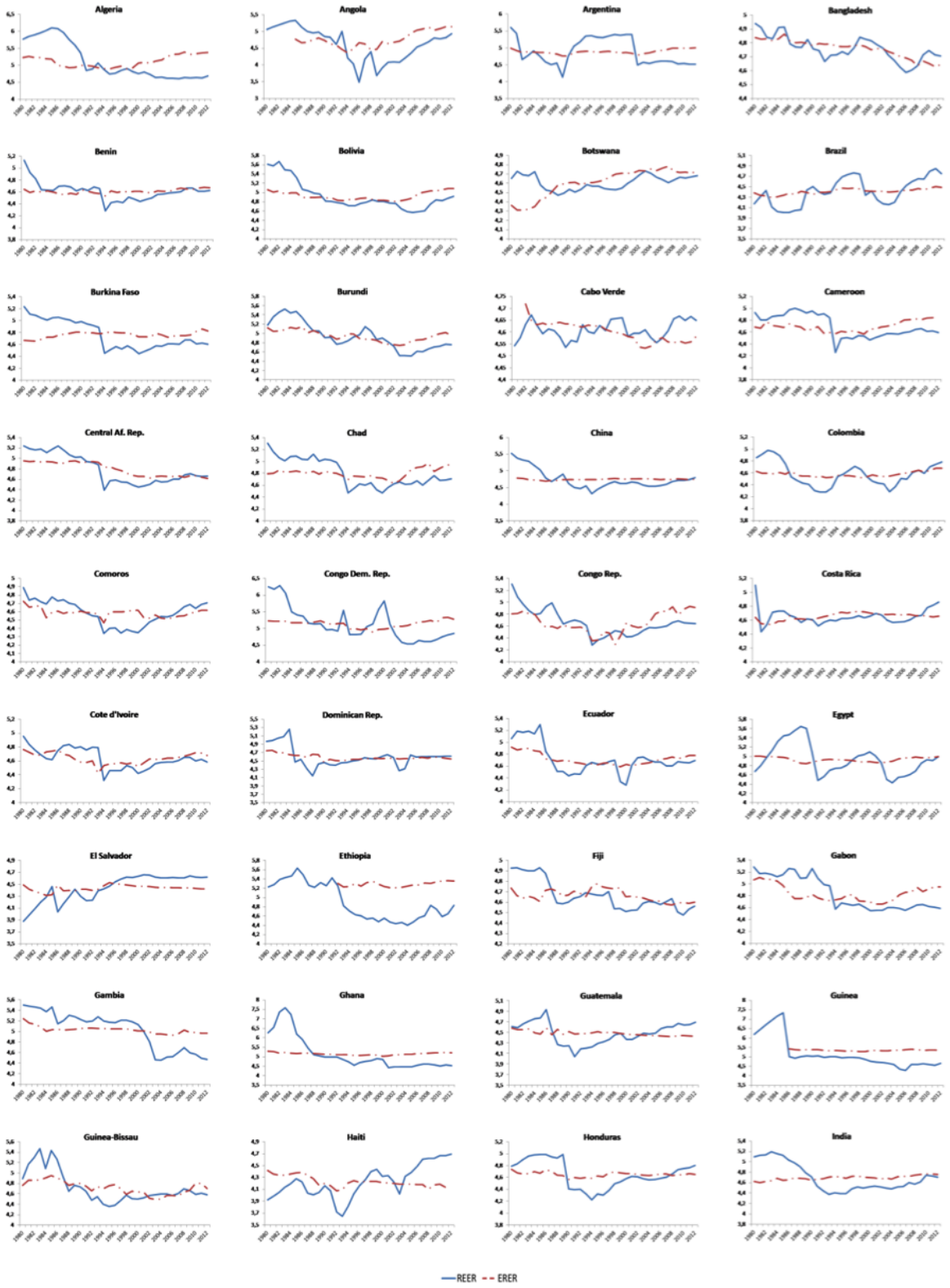

Figure D.1 — Real and Equilibrium Effective Exchange Rate (REER and ERER)

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

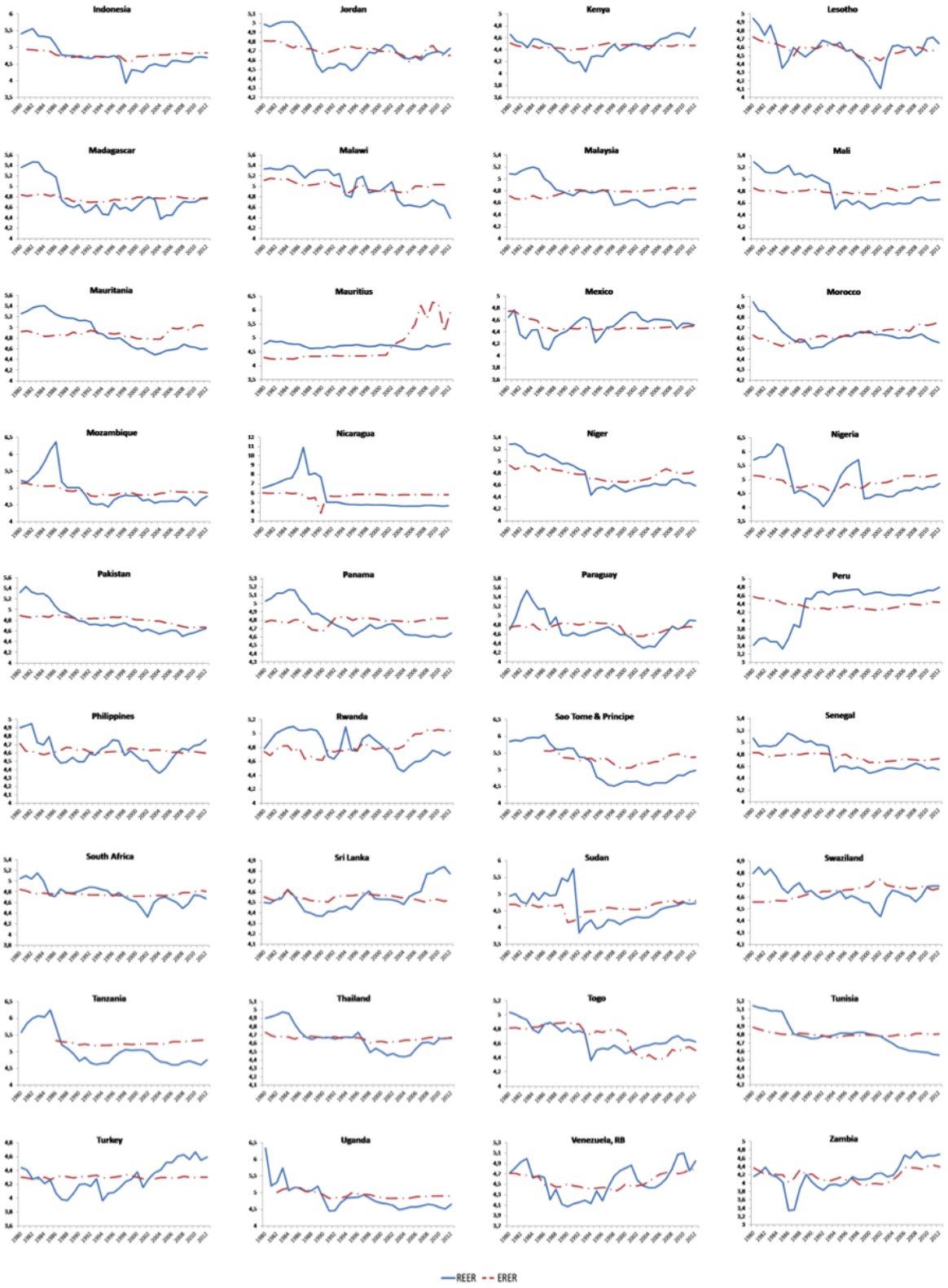

Figure D.1 — *Continued.*

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

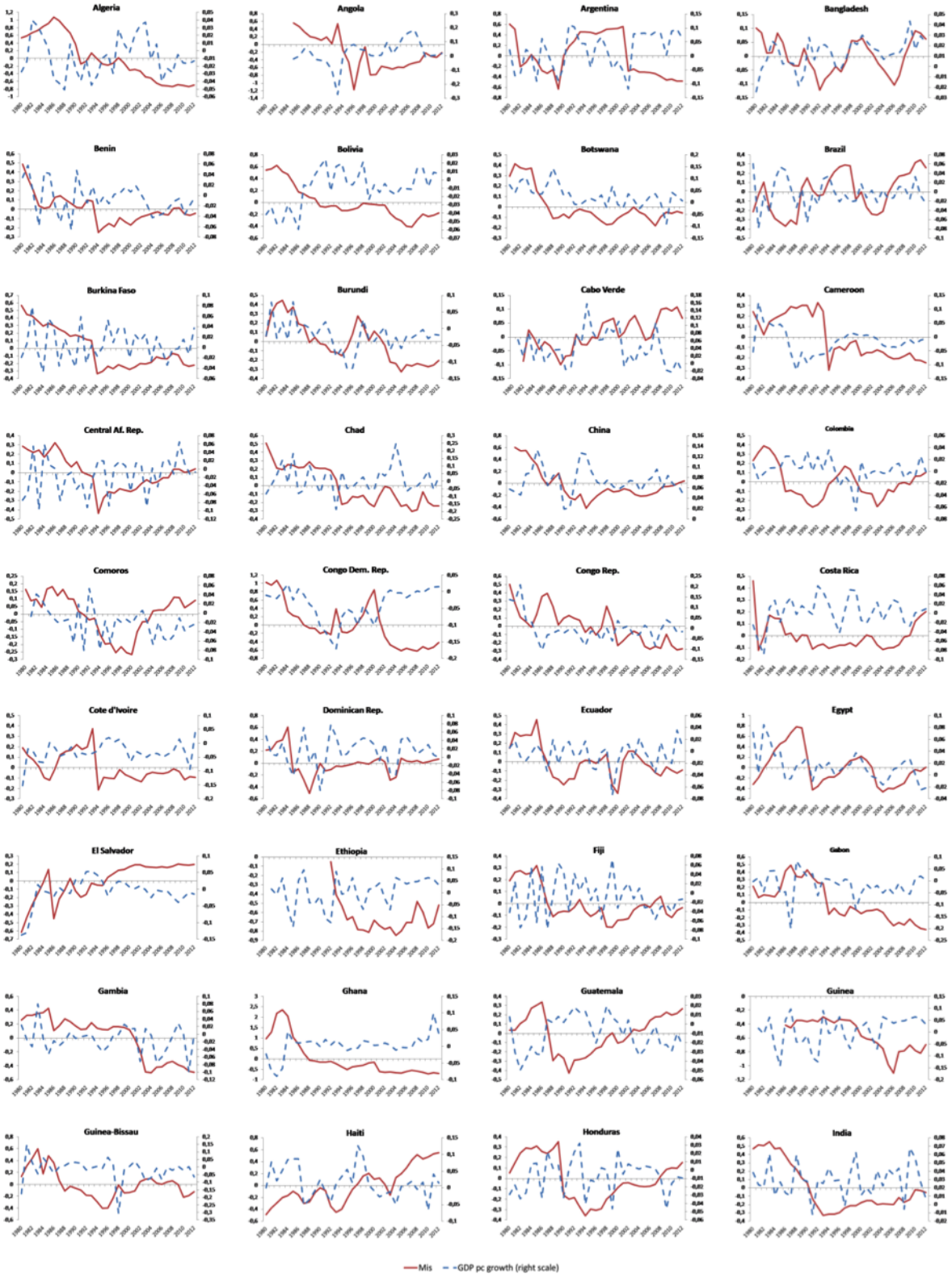

Figure D.2 — Currency misalignments (Mis) and growth

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

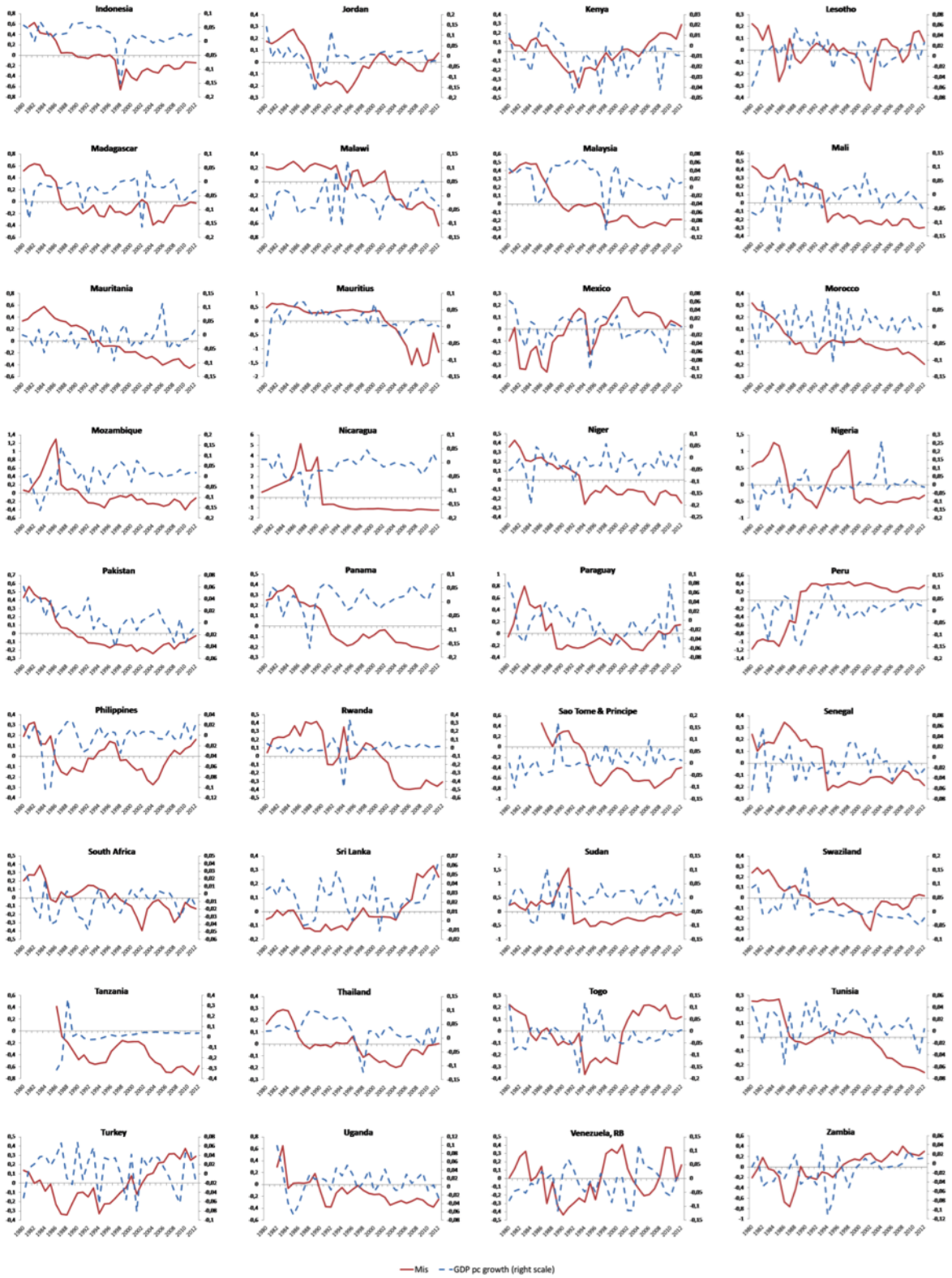

Figure D.2 — *Continued.*

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

Part II

Currency misalignments, exchange rate regimes and the adjustment of the economies

Chapter 3

Currency misalignments in emerging economies and developing countries: reassessing the role of exchange rate regimes*

Abstract

This paper re-examines empirically the relationship between exchange rate regimes and currency misalignments in emerging and developing countries. Using alternative de facto exchange rate regime classifications over the period 1980-2012, it finds strong evidence that performance of exchange rate regimes is conditional on the *de facto* classification. In particular, this paper shows that the effect of monetary arrangements on currency misalignments depends critically on the ability of these classification schemes to capture adequately dysfunctional monetary regimes.

Keywords: Currency misalignments; Exchange rate regimes; Emerging and developing countries.

JEL Classifications: C23, F31, F33.

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3.1 Introduction

Since the last decades, the macroeconomic policy framework in emerging and developing countries has involved a certain set of features: financial crises in the 1990s and early 2000s (e.g. Mexico 1994–5, East Asia 1997–9, Russia and Brazil in the late 1990s, Argentina 2002), and more recently greater dispersion in net foreign asset positions, with several countries exhibiting accumulation of large foreign exchange reserves or emerging as net debtors (Lane and Milesi-Ferretti, 2002).

The financial crises made apparent that macroeconomic and financial instability in the hit countries had been driven in part by sustained departures of real exchange rates from their equilibrium value[1] and underlined the importance of avoiding such currency misalignments. More recently, concerns about unsustainable current account imbalances have again prompted calls to redirect macroeconomic policy towards correcting exchange rate misalignments (Blanchard and Milesi-Ferretti, 2011).

One of the critical questions associated with this issue is which monetary regime offers a better insulation to such currency misalignments. Classical models of international monetary transmission usually argue in favor of floating exchange rate regimes. Indeed, in these models, exchange rate movements act as a substitute for product price flexibility in fostering international relative price adjustment vis-à-vis macroeconomic shocks, in accordance with the adjustment mechanism presented by Friedman (1953). However, models based on what has started to be known as the "New Open Economy Macroeconomics" have challenged this classical view. For relative price adjustment via exchange rate to be efficient, a high pass-through on import prices and complete financial markets are required. As these assumptions are likely to be not fully met, a free float does not necessarily lead to efficient levels of exchange rates (Corsetti et al., 2010; Berka et al., 2012).

On the empirical side, the role of the exchange rate regime on currency misalignments has not been intensively studied and furthermore no consensus emerges from

[1]The main arguments are the following. First, keeping the RER at the wrong levels may create distortions in the relative price of traded to non-traded goods, thus, leading to sub-optimal allocation of resources across sectors and result to greater economic instability (Edwards, 1989). Second, as currency misalignments arise from no-sustainable macroeconomic policies, they can lead to unsustainable pressure on the exchange rate and currency crises (Kaminsky et al., 1998; Goldfajn and Valdes, 1998).

the studies dealing with this issue. Dubas (2009) derives a measure of misalignments from the estimation of a cointegrating relationship between the real effective exchange rate and a set of standard fundamentals (terms of trade, productivity, openness, government consumption, capital flows, and excess credit) and regresses it on the exchange rate regime (ERR). Using data on 102 countries and the official International Monetary Fund (IMF) classification (the *de jure* regime) over the post-Bretton Woods era, he finds that fixed ERR perform better than flexible ERR, but that currency misalignments are weaker in countries with intermediate ERR. Caputo (2015) examines whether the nature of a country's nominal exchange rate regime significantly affects the adjustment process of the real exchange rate toward its equilibrium level. Using data on 54 countries (developed and developing economies) over the 1980-2011 period and the *de facto* classification scheme of Shambaugh (2004), he finds that real exchange rates of developing countries in floating regimes exhibit significantly greater mean reversion — i.e. lower currency misalignments — than in fixed regimes. But, as these two analyses ignore the issue of regime classification in their empirical strategy, their findings are not necessarily robust. This is particularly true with regard to Caputo's finding. Indeed, using different *de facto* classifications of exchange rate regimes, Chinn and Wei (2013) show that, on average, real exchange rates in floating regimes do not appear to exhibit significantly greater mean reversion than in fixed regimes. Thus, omitting the issue of regime classification makes impossible to know whether results are driven by genuine differences in performance across regimes or simply reflect idiosyncrasies in the classification schemes.

In fact, there is a strand of empirical research that typically examines the differences across classification schemes on the performance of exchange rate regimes.[2] Indeed, it is now well recognized that classifications of exchange rate regimes differ from one another, not only in terms of cross-countries and time coverage but also in terms of classification schemes. The most notable difference is that between the *de jure* classification based on officially announced exchange rate regimes and the *de facto* classifications based on exchange rates followed in practice (Calvo and

[2]See, for example, Gosh et al. (2014) on current imbalances; Klein and Shambaugh (2008) on exchange rate stability; Aghion et al. (2009) on productivity growth; and Rose (2011) on inflation.

Reinhart, 2002; Levy-Yeyati et al., 2013).[3] But, there are also disagreements across the *de facto* systems (see Klein and Shambaugh, 2006 for an extensive discussion). Consequently differences in the way to measure monetary regimes lead to different result across classifications, so that it is often not possible to conclude with certainty that one exchange rate regime performs better than others (Rose, 2011).

In this paper, we question the presumed performance of exchange rate regimes by re-examining empirically the relationship between exchange rate regimes and currency misalignments. Like the previously mentioned studies, we seek to determine which ERR category performs the best in minimizing such currency misalignments in developing and emerging economies. But, we also address the problem of differences across classifications schemes omitted by this literature. Exchange rate regimes are defined according to the two well-established *de facto* ERR classifications: *(i)* the "natural" classification proposed by Reinhart and Rogoff (2004, thereafter RR), and *(ii)* the classification of Levy-Yeyati and Sturzenegger (2003, thereafter LYS). In order to ensure that our results are robust, we perform additional checks, including controlling for differences in cross-country and time coverage, for alternative assessments of currency misalignments and by addressing two main methodological issues that are usually discussed in the literature, the omitted variable bias and the simultaneity bias. Finally we examine the nature of differences across *de facto* classifications to determine how they affect the performance of exchange rate regimes in terms of currency misalignments.

Using data on 73 developing and emerging countries over the period 1980-2012, our analysis fails to establish any robust relationship between currency misalignments and exchange rate regimes. More specifically, the fixed exchange rate regime seems to be associated with lower currency misalignments but only when using the RR classification and for developing countries. This result holds up under a variety of standard robustness tests. However, it is no longer valid when idiosyncratic

[3]Explanations on the sources of this discrepancy include the "fear of floating", i.e. recurrent *de facto* exchange rate intervention in officially floating regimes in order to avoid a depreciation of the currency (Calvo and Reinhart, 2002) and more recently the "fear of appreciation" (Levy-Yeyati et al., 2013), i.e. interventions in Forex markets to keep the currency undervalued.

(country-year) observations of the RR classification are excluded. Our findings thus provide strong evidence that the implications of the exchange rate regime on currency misalignments is conditional on the *de facto* classification. In particular, the effect of exchange rate regimes on currency misalignments depends critically on the ability of these classification schemes to capture adequately dysfunctional monetary regimes.

In what follows, section 2 outlines our empirical framework —i.e. methodology and data. Sections 3 and 4 present the estimation results and the sensitivity analysis. In section 5, we provide evidence about the role played by differences across classification schemes in determining performances across exchange rate regimes. Finally, Section 6 concludes.

3.2 Empirical framework

3.2.1 Equilibrium exchange rate and currency misalignments

The currency misalignment usually refers to a prolonged departure of the actual real exchange rate from its equilibrium level. This latter level is typically assessed on the basis of a particular equilibrium exchange rate approach.[4] In this paper, we use the Behavioral Equilibrium Exchange Rate (BEER; see Clark and MacDonald, 1998) approach. This approach consists in assessing the equilibrium level of the real exchange rates through an estimated long-run relationship between the observed real exchange rate and a set of *fundamentals*, i.e. variables influencing the real exchange rate in the long run. This set of fundamentals derives from various theoretical models. Among many, the works of Edwards (1988), Elbadawi (1994), Hinkle and Montiel (1999) and Elbadawi and Soto (2008) have provided suitable theoretical frameworks to determine fundamentals that drive the equilibrium real exchange rates of developing and emerging countries. In particular, the terms of trade, the relative productivity of the tradable sector and the net foreign assets position are usually identified as the most influential fundamentals. We follow this literature and

[4]For further details on equilibrium exchange rates' approaches (e.g. PPP, FEER, DEER, NATREX), see Edwards and Savastano (2000) and Driver and Westaway (2005).

estimate the equilibrium level of the real exchange rate on the basis of the following long-run relationship:

$$reer_{i,t} = \mu_i + \beta_1\ tot_{i,t} + \beta_2\ rprod_{i,t} + \beta_3\ nfa_{i,t} + \varepsilon_{i,t} \tag{3.1}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ respectively indicate the individual and temporal dimensions of the panel. $reer_{i,t}$ is the real effective exchange rate (in logarithms), an increase in the index indicates a real appreciation; $tot_{i,t}$ is the logarithm of terms of trade, an increase indicates an improvement; $rprod_{i,t}$ stands for the relative productivity of the tradable sector of country i's against its main trading partners (the Balassa-Samuelson effect) also expressed in logarithm; and $nfa_{i,t}$ is the net foreign assets position (in percentage of GDP). μ_i are the country-fixed effects and $\varepsilon_{i,t}$ is an error term. As documented by the existing literature, an improvement in the terms of trade and in the net foreign assets position as well as an increase in the relative productivity of the tradable sector are expected to appreciate in the long run the equilibrium level of the real exchange rate.

The currency misalignments of each country i ($Mis_{i,t}$) are then obtained from the difference between the observed real effective exchange rate ($reer_{i,t}$) and its equilibrium level ($reer^*_{i,t}$) —i.e. the fitted value of the real effective exchange rate derived from the estimation of equation (3.1):

$$Mis_{i,t} = reer_{i,t} - reer^*_{i,t} \tag{3.2}$$

Following this definition and the definition of the real effective exchange rate, a negative sign indicates an undervaluation (i.e. $reer_{i,t} < reer^*_{i,t}$) whereas a positive sign indicates an overvaluation (i.e. $reer_{i,t} > reer^*_{i,t}$) of the real effective exchange rate.

3.2.2 Assessing the effects of exchange rate regimes

We then explore, for developing and emerging countries, whether one ERR category performs better than the others in limiting currency misalignments. To the extent that real undervaluations and overvaluations might compensate each other, we focus on the absolute values of currency misalignments. Then, we define dummy

variables to capture the effect of the various regime categories. To avoid multicollinearity, we exclude one category which is thus considered as the reference regime. Adopting this approach, the equation of interest can be specified as follows:

$$|Mis_{i,t}| \;=\; \mu_i \;+\; \eta_t \;+\; \Phi_j \sum_{j=1}^{m-1} Dum_j * ERR_{i,t} \;+\beta_i\; X_{i,t} \;+\; u_{i,t} \qquad (3.3)$$

where $|Mis_{i,t}|$ is the absolute value of currency misalignment; Dum_j is a dummy variable scoring 1 for regime$j$ (0 otherwise); m is the number of regimes category considered in the exchange rate regime classification $ERR_{i,t}$ and $X_{i,t}$ is is a set of control variables. μ_i and η_t represent the country fixed effects and the year fixed effects. $u_{i,t}$ is an independent and identically distributed error term.

In estimating equation (3.3), we control for crises and financial openness. Indeed, as these variables can act as other possible determinants of currency misalignments, ignoring them could lead to a misspecification of our empirical model. Controlling for crises is particularly important to avoid biased estimates as crises are generally associated with considerable changes in exchange rates. No less importantly, we also take into account the openness in capital account transactions since the removal of capital controls may expose countries to massive inflows and outflows which usually translate into important exchange rates' variations.

Furthermore, as exchange rate regimes' performance might be affected by several characteristics, such as financial development and openness, that differ between emerging and developing economies, we also estimate equation (3.3) by considering separately these two groups of countries. Finally, since countries that have maintained their exchange rate regime during the period under consideration may bias our results, we also consider a subsample (panel B) which excludes those countries.[5]

[5]The full sample (Panel A) includes long lasting exchange rate regimes. However, the fact that exchange rate policies do not vary over time in several groups of countries (as the former French colonies, OPEC members, small financial centers, etc...) may bias our results. We then drop these observations in Panel B to avoid such bias.

3.2.3 Data: key variables

The first set of data required covers data needed for the estimation of the equilibrium exchange rates and assessments of the currency misalignments. These data have been compiled from different sources. Real effective exchange rate (REER) statistics are provided by the Bruegel's database and correspond to the weighted average of real bilateral exchange rate against 67 trade partners. We use the same weights and trade partners for the calculation of the relative productivity, proxied here by the relative real GDP per capita (in PPP terms).[6] The terms of trade series are taken from the WDI database (World Development Indicators, World Bank). The net foreign asset positions are extracted from the Lane and Milesi-Ferretti (2007) database and updated using information provided by IFS (*International Financial Statistics*, IMF). All the series are in logarithms, except the net external positions which are expressed as share of GDP.

The exchange rate regime variables come from the two traditional *de facto* classifications, i.e. the Reinhart and Rogoff (2004; thereafter RR) "Natural" classification and the Levy-Yeyati and Sturzenegger (2003; thereafter LYS) classification. We opt to work with both classification schemes as they have much disagreement over how to classify a given country in a given year. Indeed, the LYS classification relies on a cluster analysis based on country–year changes in the exchange rate, in the rate of change of the exchange rate and in official reserves. The RR classification also relies on exchange rate's variations, but these are based on monthly observations and averaged over five-year rolling windows. Moreover, this classification takes into account, as indicator of the underlying monetary policy, the existence of non-unified exchange rate markets (multiple exchange rates and parallel markets), instead of the behavior of foreign exchange reserves. The RR (coarse) index range from 1 to 6, from more to less fixity, while the LYS index ranges from 1 to 5, from less to more fixity. We also use a more usual typology —the coarser official classification—, by collapsing the regime categories listed by each classification into three broader categories: fixed,

[6]Due to a lack of available data at the sectoral level, PPP GDP per capita are usually used to approximate the relative productivity differentials between sectors and countries.

intermediate, and flexible ERR.[7] Both six- and three-way RR classifications cover the 1980-2012 period while the LYS classifications cover the 1980-2004 period.[8]

Regarding control variables, we construct a *Crisis* dummy variable —that scores 1 for crisis years; 0 otherwise— based on data from Laeven and Valencia (2012). We restrict the cases of crisis to systemic banking, currency and sovereign debt crises. The proxy for financial openness is the Chinn-Ito *KAOPEN* index (Chinn and Ito, 2008), which is measured on a scale from 0 to 1; 1 being the highest financial openness degree.[9]

Finally, our panel consists of 73 countries classified as developing and emerging countries.[10] All data are annual and cover the period 1980-2012 —1980-2004 when using the LYS classification.[11]

3.3 Results

3.3.1 Assessing currency misalignments

To estimate the cointegrating relationship between the real effective exchange rate and its fundamentals (equation (3.1)), we use the Cross-sectionally augmented Pooled Mean Group (CPMG) estimator[12] which corrects the Pooled Mean Group (PMG) estimator (Pesaran, 2006) for cross-sectional dependencies. Like the PMG, the CPMG allows the short-run dynamic to differ from country to country while constraining the long-run coefficients to be the same (Binder and Offermanns, 2007). Thus this approach leads to correct inference and consistent estimates in presence

[7]The category "1" in the LYS classification corresponds to inconclusive determination. This latter category exists only in the 5-way classification.

[8]We extend/fill the gaps in the RR classification using Ilzetzki, Reinhart and Rogoff (2011) and various issues of the *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* (IMF). The details regarding the RR and LYS classifications are reported in Tables A.3 and A.4 —Appendix A.

[9]We focus only on these two control variables (Crisis and financial openness) to minimize endogeneity and simultaneity problems.

[10]See Table A.2. for the list of countries. We have followed the IMF classification, as Gosh et al. (2014).

[11]The sources and definitions of the data are provided in Appendix A.1.

[12]Even if the CPMG estimator can deal with both I(0) and I(1) variables, we performed unit root and cointegration tests. The results —not reported here to save space but available upon request— indicate that all series are I(1) and cointegrated.

of cross-sectional dependencies and better captures heterogeneity across countries —compared to the DOLS and FMOLS procedures. Table 3.1 presents the CPMG estimates as well as the Hausman Chi-square test statistic which examines the null hypothesis of the homogeneity in the long-run coefficients.

Table 3.1 — Estimation of the long-run relationship

Long-run dynamic			***Short-run dynamic***		
	Coef.	Z		Coef.	Z
$rprod$	0.332***	7.28	$\Delta rprod$	-0.026	-0.23
tot	0.141***	3.82	Δtot	-0.075	-1.53
nfa	0.231***	7.44	Δnfa	0.198***	5.17
$L.\overline{reer}$	0.622***	4.31	$\Delta\overline{reer}$	0.261***	3.38
$\overline{rprod}$	-0.438***	-4.00	$\Delta\overline{rprod}$	0.077	1.62
$\overline{tot}$	0.673***	3.18	$\Delta\overline{tot}$	-0.081	-0.91
$\overline{nfa}$	0.040	0.83	$\Delta\overline{nfa}$	0.021	0.62
			$ec.$	-0.188***	-8.43
			$Constant$	-0.493***	-8.21
Specification test				11.43	
Joint Hausman test [a]				[$p.value$=0.12]	
No. Countries / No. Observations:				73 / 2360	

Notes: Symbols ***, **, and * denote significance at 1%, 5%, and at 10%. "Δ" (resp. "$L.$") is the difference operator (resp. the lag operator); "$ec.$" is the error correction term. The bars over the variables indicate the cross-sectional averages of these variables.
a: Null of long-run homogeneity

According to the Hausman test, the long-run homogeneity restriction is not rejected for individual parameters and jointly in all regressions. The CPMG estimates are thus consistent and efficient (see Cavalcanti et al. 2012). The estimated coefficients are statistically significant and have the expected positive signs: the real effective exchange rate appreciates in the long run with the increase in the relative productivity per capita, the improvement in the terms of trade and in the net foreign assets position.

The equilibrium exchange rates ($reer^*_{i,t}$) are derived by applying the permanent components of the fundamentals (estimated with the Hodrick-Prescott filter) in the estimated cointegrating relationship. Currency misalignments are then calculated as the difference between the observed real effective exchange rates and their equilibrium value, as indicated by equation (3.2).[13]

[13]Figures C.1 and C.2 in Appendix C display the evolution of observed and equilibrium real

3.3.2 Exchange rate regimes and currency misalignments

Tables 3.2 and 3.3 present the results derived from the estimation of equation (3.3), based respectively on the RR and LYS classifications. Flexible regimes are the excluded category, so that the coefficients on fixed and intermediate regimes must be interpreted as the misalignments' differential relative to the flexible exchange rate regime. If one regime category is associated with lower currency misalignments, then the coefficient on the exchange rate regime (Φ_j in equation (3.3)) should be negative and statistically significant.

In Table 3.2, the RR classification is used to categorize the different regimes. The estimation results of equation (3.3) for the full sample are presented in the first two columns. The estimated effect on misalignments is significant and negative under the fixed regime and becomes insignificant as the regime gets progressively more flexible. Thus, compared to the flexible ERR, the fixed ERR seems to be associated with lower currency misalignments. In particular, the estimated coefficient, around -0.15, suggests misalignments 15 percentage points lower in the fixed ERR compared to the flexible one. In contrast, the intermediate ERR is not significantly different from the flexible regime (for both panels A and B). A closer look at differences between the two sub-samples (DCs and $EMEs$) shows that the coefficient of the intermediate ERR, for the DCs group, becomes significant and negative, meaning lower currency misalignments associated with this ERR —compared to the flexible ERR (13 percentage points lower on average). The coefficient is however only significant at 10%. Thus, for the DCs group, the fixed ERR seems to perform the best, followed by the intermediate ERR, comparatively to the flexible ERR. Turning now to the EMEs group, none of the coefficients associated with the ERRs are statistically significant. It seems therefore that, for these countries, the three ERR categories do not differ significantly in terms of currency misalignments.

Turning now to the RR six-way classification, only the regime 2 (coded as a fixed exchange rate regime) —which includes "Pre announced and *de facto* crawling peg"; and "Pre announced and *de facto* crawling band (narrower than or equal to +/-2%)" — exhibits, for the full sample, a negative and significant coefficient —although not

effective exchange rates and the associated misalignments.

very robust. Thus, considering the six-way classification and the full sample, no ERR seems to perform better than the others in terms of currency misalignments. For the DCs, the picture is however different. Indeed, regimes 1 and 2 (both coded as fixed ERR in the three-way classification) as well as regime 3 (coded as an intermediate ERR) exhibit negative and significant coefficients. This last finding therefore confirms the general pattern obtained from the three-way classification: in developing countries, the more rigid the regime is, the lower the misalignment levels seem. In contrast, for the EMEs group, the exchange rate regime still doesn't seem to matter.

To check if our results are conditional to the measure of *de facto* regimes, Table 3.3 reports the results derived from the LYS classification. When the three-way classification is used, none of the coefficients associated with the ERRs are statistically significant. In other words, there are no statistically significant differences across exchange rate regimes. The five-way classification leads to similar results. Indeed, when considering the whole sample or the EMEs group, we still not find any significant relationship between currency misalignments and exchange rate regimes. For the DCs group, the coefficient associated with the regime 3 (LYS 3: "dirty float") is, however, significant and positive (around 0.07), showing that this regime is associated, on average, with misalignments 7 percentage points higher than those in the flexible regime.

Finally, regarding the control variables, similar results between the two *de facto* classifications are obtained for the variable $Crisis$. The coefficient is statistically significant —except for the EMEs subsample— and is associated, as expected, with increased currency misalignments. The coefficient associated with the $KAOPEN$ index is not significant in the RR classification, regardless of the considered sample. In contrast, when the LYS classification is used, the coefficient becomes significant and negative for the DCs group. The difference found for the variable $KAOPEN$ between the RR and LYS classifications is not surprising since, according to Reinhart and Rogoff, (2004), one consequence of the use of the parallel market rate is that their classification already includes a measure of capital mobility.

Table 3.2 — Currency misalignments and exchange rate regimes (*RR classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Six-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	1.1	1.2	1.3	1.4	1.5	1.6		1.7	1.8	1.9	1.10	1.11	1.12
ERR													
Fixed	-0.159**	-0.135*	-0.165**	-0.161**	-0.105	-0.089	*RR* 1	-0.103	-0.092	-0.258**	-0.291**	0.234	0.268
	(-2.12)	(-1.79)	(-2.04)	(-2.00)	(-0.66)	(-0.49)		(-1.17)	(-0.79)	(-1.96)	(-2.12)	(0.72)	(0.72)
Interm.	0.094	0.111	-0.127*	-0.131*	0.389	0.397	*RR* 2	-0.212*	-0.203*	-0.223*	-0.248*	-0.304	-0.286
	(0.52)	(0.53)	(-1.80)	(-1.68)	(0.90)	(0.88)		(-1.89)	(-1.82)	(-1.66)	(-1.74)	(-0.96)	(-0.89)
Flexible	—	—	—	—	—	—	*RR* 3	0.080	0.082	-0.197*	-0.233*	0.489	0.528
								(0.40)	(0.36)	(-1.64)	(-1.75)	(0.94)	(0.93)
							RR 4	-0.041	-0.104	-0.179	-0.313	0.667	0.782
								(-0.29)	(-0.59)	(-1.01)	(-1.40)	(0.92)	(0.91)
							RR 5	—	—	—	—	—	—
							RR 6	-0.102	-0.147	-0.132	-0.197	0.614	0.746
								(-0.82)	(-0.82)	(-093)	(-1.11)	(0.91)	(0.92)
Control variables													
Crisis	0.058**	0.060*	0.050**	0.057*	0.091	0.085		0.056**	0.055	0.046**	0.048	0.112	0.111
	(2.24)	(1.64)	(2.23)	(1.72)	(0.94)	(0.77)		(2.14)	(1.54)	(2.08)	(1.52)	(1.08)	(0.97)
kaopen	-0.260	-0.261	-0.028	-0.061	-0.548	-0.614		-0.252	-0.253	-0.022	-0.031	-0.484	-0.514
	(-0.99)	(-0.99)	(-0.56)	(-0.73)	(-0.92)	(-0.88)		(-0.98)	(-0.98)	(-0.47)	(-0.49)	(-0.87)	(-0.82)
Constant	0.713***	0.801***	0.485***	0.452***	1.133**	1.284**		0.697***	0.807***	0.562***	0.557***	1.014**	1.156**
	(3.37)	(3.13)	(7.82)	(8.00)	(2.09)	(2.11)		(4.11)	(3.64)	(5.40)	(5.69)	(2.41)	(2.41)
R-Sq.	0.04	0.05	0.10	0.15	0.08	0.09		0.04	0.05	0.12	0.19	0.09	0.09
Obs./ Countries	2366/73	1398/43	1580/49	777/24	786/24	621/19		2366/73	1398/43	1580/49	777/24	786/24	621/19

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table 3.3 — Currency misalignments and exchange rate regimes (*LYS classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Five-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	2.1	2.2	2.3	2.4	2.5	2.6		2.7	2.8	2.9	2.10	2.11	2.12
ERR													
Flexible	—	—	—	—	—	—	*LYS* 1	-0.007	-0.007	-0.014	-0.013	-0.501	-0.503
								(-0.10)	(-0.09)	(-0.41)	(-0.38)	(-1.54)	(-1.53)
Interm.	0.043	0.041	0.011	0.010	0.037	0.022	*LYS* 2	—	—	—	—	—	—
	(0.70)	(0.68)	(0.37)	(0.34)	(0.30)	(0.20)							
Fixed	0.301	0.296	-0.014	-0.015	1.070	1.071	*LYS* 3	0.121	0.117	0.070**	0.068**	0.099	0.083
	(0.98)	(0.99)	(-0.46)	(-0.50)	(1.05)	(1.05)		(1.10)	(1.09)	(2.18)	(2.15)	(0.56)	(0.51)
							LYS 4	4E-4	-0.002	-0.021	-0.021	0.013	4E-4
								(0.01)	(-0.04)	(-0.57)	(-0.58)	(0.12)	(0.00)
							LYS 5	0.305	0.301	-0.006	-0.007	1.076	1.077
								(0.99)	(1.00)	(-0.20)	(-0.24)	(1.05)	(1.05)
Control variables													
Crisis	0.095*	0.100*	0.059*	0.063*	0.123	0.169		0.087*	0.092*	0.053*	0.056*	0.117	0.164
	(1.84)	(1.79)	(1.84)	(1.84)	(1.05)	(1.09)		(1.83)	(1.78)	(1.67)	(1.67)	(1.04)	(1.09)
kaopen	-0.019	0.009	-0.135*	-0.123*	-0.101	-0.108		-0.014	0.013	-0.123*	-0.111*	-0.086	-0.093
	(-0.24)	(0.10)	(-1.96)	(-1.75)	(-0.47)	(-0.46)		(-0.18)	(0.14)	(-1.98)	(-1.75)	(-0.41)	(-0.40)
Constant	0.329**	0.361***	0.358***	0.364***	0.485*	0.640***		0.324**	0.356***	0.348***	0.354***	0.514**	0.673***
	(2.31)	(2.83)	(9.62)	(9.36)	(1.96)	(3.72)		(2.24)	(2.74)	(9.43)	(9.14)	(2.11)	(3.91)
R-Sq.	0.04	0.04	0.09	0.09	0.11	0.11		0.04	0.04	0.10	0.10	0.11	0.12
Obs./ Countries	1376/60	1253/55	920/41	847/38	456/19	406/17		1399/60	1276/55	939/41	866/38	460/19	410/17

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Overall, our results suggest that there is no robust relationship between currency misalignments and exchange rate regimes. The RR classification (three-way) barely suggests that fixed ERR perform the best in limiting currency misalignments —at least in developing countries, but this finding is not confirmed when the LYS classification is used. In contrast, for the EMEs group, the two classification lead to the same result the ERR choice does not seem to matter at all.[14]

3.4 Sensitivity analysis

Methodological limitations may explain in part why any relationship between currency misalignments and exchange rate regimes cannot be reliably determined. To tackle this problem, we conduct a variety of additional tests.

3.4.1 The sample issue

To assess the importance played by the discordance between the RR and LYS classifications results, we first ensure that our previous findings are not driven by differences between the samples covered by these two classifications. Indeed, the RR classification differs from the LYS classification in terms of cross-country and time coverage. Accordingly, we re-estimate our benchmark specification using the RR classification for the sample of countries and over the shorter period covered by the LYS classification. Results reported in Table B.1 —Appendix B— are similar to those reported in Table 3.2. This obviously indicates that the discrepancy between the two classifications results is not due to their different datasets.

3.4.2 The currency misalignment issue

In addition to the sample issue, we now check that our baseline results do not depend on our measure of currency misalignments.

[14]The finding that the disagreements among the ERR classifications are more prevalent in DCs is also found by Eichengreen and Razo-Garcia (2013).

An alternative measure of currency misalignments

Given the degree of uncertainty surrounding empirical estimates of equilibrium exchange rates, we derive new assessments of currency misalignments from an alternative estimation-based approach, the Atheoretical Permanent Equilibrium Exchange Rate (APEER) approach. In this approach a filter (Hodrick-Prescott in our case) is used to obtain the permanent component of the real exchange rate —which is considered as the equilibrium exchange rate. The real exchange rate misalignment is then computed as the deviation of the real exchange rate from its permanent equilibrium level (Driver and Westaway, 2004). Thus, we re-estimate equation (3.3) using this new measure of currency misalignments. Results are reported in Tables B.2 (RR classification) and B.3 (LYS classification) —see Appendix B.[15]

Looking first at the RR three-way classification, we note that, with this new measure of misalignments, results are not much affected for the full sample and for the DCs group. More importantly, the coefficient associated with the fixed ERR in the EMEs group, which was negative but insignificant before, now becomes statistically significant. However, the effect of the fixed ERR in the EMEs (around -0.05) is more than twice lower than that in the DCs (between -0.12 and -0.13). The coefficients associated with the intermediate ERR now display a negative sign in all regressions, but they are still not significant. The results derived from the six-way classification appear slightly different from those reported in Table 3.2. Indeed, regime 2 is associated with significantly lower misalignments followed by regime 1 then regime 3 for the DCs group. For the EMEs group, only regimes 1 and 2 seem to matter. However, the coefficients associated with these regimes are significant at lower significance levels than before. Overall, the only notable effect is still the one observed for regime 2 —when considering the whole sample and the DCs sample while, for the EMEs group, results again fail to show a clear pattern between the ERR and currency misalignments.

Turning now to the LYS classification, the results in Table B.3 echo those obtained in Table 3.3. Indeed, looking at the three-way classification, we still not

[15]Note that we also tried to derive PPP-based currency misalignments —à la Rodrik (2008). No significant effects were observed. This result could stem from the too short time dimension of the analysis. Results are not reported in the paper to save space but are available upon request.

observe any significant relationship between the ERR and currency misalignments. Considering the five-way classification, regime 3 is still the only regime with a significant positive coefficient, which is now significant also for the DCs group and the whole sample. Note however that despite its high significance, the coefficient is still weak, ranging from 0.05 for the whole sample to 0.06 for the DCs subsample.

To sum up, using an alternative measure of currency misalignments does not modify the general patterns noted hitherto.

Asymmetric effects

Exchange rate regimes may have a different effect on currency misalignments depending on whether these latter reflect over- or under-valuations of the real exchange rate. Asymmetric effects may then explain the lack of a strong relationship that we have found between the two variables. To test this hypothesis, we re-estimate equation (3.3) by considering alternatively undervaluations and overvaluations as the dependent variable. Results are reported in Tables B.4 (RR classification) and B.5 (LYS classification).

First we notice that the coefficients associated with the fixed exchange regime are no more significant in the RR classification (Table B.4). This suggests that over- or under-valuations of the real exchange rate are equally distributed across exchange rate regimes listed by this classification. Second, the result derived from the LYS classification that the intermediate ERR is associated with higher currency misalignments in developing countries is confirmed (Table B.5). Then asymmetrical effects matter under this category regime: overvaluations in developing countries are higher under this regime (9 percentage points higher on average) than in the flexible regime. However, these coefficients are only significant at 10%.

Thus, taking into account a potential asymmetrical effect of the ERR on currency misalignments does not fundamentally improve our baseline results.

Outliers

Finally, the effect of the exchange rate regime may be sensitive to the presence of extreme values of currency misalignments. In order to verify that our results, when significant, are not driven by outliers, we re-estimate specification (3) after having

winsorised the tails of the distribution of currency misalignments to correct for the highest values.[16] We consider two thresholds: the 99^{th} and 98^{th} percentiles. Results are reported in Tables B.6 (RR classification) and B.7 (LYS classification).[17]

Looking first at the RR classification (Table B.6), we note that the effects of the fixed ERR are qualitatively the same when considering the full sample as well as the DCs group. As expected the coefficients associated with this monetary regime, when excluding the top percentile of currency misalignments, are lower than in Table 3.2; but they are still negative and significant. Results found for the intermediate regime seem more sensitive to outliers. Indeed, the intermediate regime now displays a negative and significant sign not only when considering the DCs group as in Table 3.2 but also when considering the full sample. Then, when adjusting for outliers, the average misalignments seem to be far lower in countries classified as intermediate by the RR classification. In the case of the EMEs group, results remain unchanged: in these countries, no exchange rate regime seems to perform better than the others regarding the currency misalignment levels. Looking now at the results derived from the LYS classification (Table B.7), they appear again consistent with those in Table 3.3: there is no significant relationship between the ERR and currency misalignments, regardless the considered country sample. Then, our baseline results do not seem to be driven by extreme values of currency misalignments.

3.4.3 The omitted variable bias: inflation

While our analyses are based on two-way fixed effects models —which control for the possibility that there are omitted variable(s) affecting both the degree of currency misalignments and the choice of the ERR, we now explicitly address this issue. In particular, given that fixed exchange rates can allow countries to record lower inflation rates and that countries with lower inflation rates are also more prone to have smaller currency misalignments, we test whether our estimates are not biased

[16] Winsorisation consists in limiting extreme values in the data to a particular percentile to reduce the effect of possibly "spurious" outliers. This strategy is here preferred to data trimming as it does not result in a loss of observations. We here focus on the highest values since currency misalignments are taken in absolute values. As supplementary information, the maximum value of currency misalignment when considering the 99th percentile (resp. 98th percentile) is 255% (resp. 119%).

[17] To save space, we reported only the results of the three-way classifications.

by the omission of the inflation rate. We therefore extend our baseline specification by adding the inflation rate —$inflation$— measured as the log difference in the CPI (Consumer Price Index).

Results, displayed in Tables B.8 (RR classification) and B.9 (LYS classification), indicate that the inclusion of the inflation rate leaves the story largely unchanged. Indeed, results derived from the RR classifications (both three- and six-way) largely resemble those from the estimations in Table 3.2. $Inflation$ exhibits a positive and significant coefficient only in the Panel B of the DCs group. Looking at the LYS three-way classification, exchange rate regimes still do not display any significant impact on currency misalignments. Interestingly however, when considering the five-way classification and the DCs group, regime 3 has no more a significant positive coefficient. Indeed, the inflation rate in these countries has a significant and positive impact on their currency misalignments, suggesting that their higher currency misalignments are not driven by this ERR regime, but by their higher inflation. Thus, when controlling for the inflation rate, the LYS classification (both three- and five-way) definitely fails to establish any relationship between currency misalignments and exchange rate regimes. Controlling for inflation leaves then the results derived from our benchmark specification unchanged.[18]

3.4.4 Endogeneity

So far, we have considered the exchange rate regime choice as exogenous with respect to currency misalignments. However, one can reasonably presume a reverse causality between currency misalignments and exchange rate regimes: currency misalignments may be driven by the choice of the exchange rate regime, but this latter may depend itself on currency misalignments. This holds particularly true during crises episodes as countries hit by currency crises usually switch their exchange rate regime. To test the assumption of exogenous exchange rate arrangements, we perform the Wu-Hausman test of exogeneity. Results reported in Table B.10 indicate rejection in almost all cases of the null hypothesis of exogeneity. Then, to address the endogeneity problem, we adopt two approaches. We first substitute in our base-

[18]This observation holds true for the OST classification. Similar results are also observed when we split the sample by the inflation's level —i.e. *low inflation* vs. *high inflation*. For brevity, results are available upon request.

line specification the actual exchange rate regime by the one-year lagged exchange rate regime. The second approach we rely on is a two-stage procedure. In the first stage, we estimate a multinomial probit model.[19] In the second stage, regressions are performed by replacing each ERR dummy by its fitted value derived from the multinomial probit model.

The results of the regressions including the one-year lagged exchange rate regime are reported in Tables B.11 (RR classification) and B.12 (LYS classification). As can be seen, we obtain the same patterns highlighted in Tables 3.2 and 3.3. On the one hand, estimates derived from the RR classification barely suggest the same relationship between the ERR and currency misalignments: the higher the fixity of the currency regime, the lower is the currency misalignment. But again statistical significance levels are low, except for the DCs group. On the other hand, when considering the LYS classification, there is still no exchange rate regime displaying a statistically significant impact on currency misalignments.

Looking now at the second approach (Tables B.13 and B.14), we note that our previous findings are robust to the use of predicted ERRs. However, the results based on the RR classification indicate a similar but less significant relationship than before. Looking at the three-way classification, only the coefficients associated with the fixed regime appear significant —at 10% in almost all cases— and negative but again only for the whole sample and the DCs group. For the sample limited to the EMEs group, we find again no remarkable effect of the ERRs. Turning to the six-way classification, results confirm the lower significance level. Except regime 1 (listed as a fixed ERR) —in the DCs group— no monetary regime exerts a noticeable effect. When considering the LYS classification we again fail to discern a strong relationship between exchange rate regimes and currency misalignments. Our results appear therefore robust to the endogeneity problem.

Overall the different results derived from the sensitivity analysis show the robustness of our baseline finding: there is no clear effect of the exchange rate regime

[19] In estimating probit models, we used as regressors the initial foreign reserves (in % of GDP), the GDP in PPP terms, the land area, and a dummy variable for islands (see Levy-Yeyati and Sturzenegger, 2003; Chinn and Wei, 2013). Results of the probit models are not reported to save space but are available upon request.

on currency misalignments[20], as the RR and LYS classifications still lead to the same diverging conclusions.

3.5 On the discordance between classification schemes

In what follows, we address the issue of the ERR classifications in order to understand the differences between the results obtained with the RR and LYS classifications. More specifically, we investigate whether our results, when significant, reflect significant difference in performance across regimes or simply idiosyncrasies in the classification schemes.

3.5.1 Alternative exchange rate regime classification

Most empirical studies dealing with exchange rate regimes point that the de facto classifications do not overlap well. They differ from one another, not only in terms of cross-country and time coverage, but also in terms of classification schemes. This lack of agreement occurs mainly because these *de facto* classifications do not agree on what exactly should be understood by the policies underlying each exchange rate regime. Reinhart and Rogoff (2004) provide a classification based upon the black market rate —hence merging both exchange rate choices and capital control choices. The classification developed by Levy-Yeyati and Sturzenegger (2003) accounts for official exchange rate movements as well as exchange market intervention.

To check the issue of classifications schemes, we re-estimate our baseline specification (equation (3.3)) by using a third classification, the Obstfeld, Shambaugh, and Taylor (2010; thereafter OST) *de facto* classification. Unlike the RR and LYS classifications, the OST classification differentiates the fixed, intermediate and flexible exchange rate regime on the sole basis of the exchange rate volatility. Indeed, this classification is similar in spirit to that used by Shambaugh (2004) in which only two regimes (pegs and non-pegs) are coded.[21] However, the OST classification extends

[20] We performed various other robustness analyses (e.g. grouping of countries depending on their trade openness, money supply —M2—;transitory changes in the ERR) and found again no strong relationship between the currency misalignments and the exchange rate regime. Results are not presented here to save space but available upon request.

[21] A peg spell is defined as a situation where, over the course of a calendar year, the month-end bilateral exchange rate with the base country stays within a 2% band.

this latter classification by adding a third category —soft pegs— which allows for a wider band of exchange rate movement (up to 5% bands). The three categories —peg, soft peg, and non-peg— being mutually exclusive, this classification fits the usual three-way classification, i.e. fixed, intermediate, and flexible ERR. We also use a finer typology based on a seven-way classification, by distinguishing the different sub-regimes associated to the two broader categories —i.e. peg and soft peg.[22] Results of the analysis based on the OST classification are reported in Table B.15 —Appendix B.

Looking first at the three-way classification, we note a clear absence of statistical significance in the misalignments-ERR relationship. No coefficient appears significant, regardless the considered sample. Thus, this finding is similar to the one found with the LYS classification. Turning to the seven-way classification, no regime appears with a significant coefficient, except regimes 4 and 5 —both classified as soft pegs— and only for the DCs group. Nevertheless, the coefficients are weak and only significant at 10%. Moreover, only the result associated with the regime 4 is robust to the considered panel (i.e. A and B). These results tend then to support our previous conclusions. Once again, results, when significant, appear to depend critically on the classification scheme.[23]

3.5.2 Distribution across regime categories and correlation across classification schemes

As shown by Figure 3.1, the different views on the *de facto* behavior of exchange rate regime across classification schemes translate into diverging distributions across the fixed, intermediate and flexible regimes.

[22] See Table A.5 in Appendix A for the details of the classification. The data cover the 1980-2012 period.

[23] Although our analysis does not take into account all the *de facto* classifications, the use of others *de facto* classifications would lead to more or less similar conclusions due to the correlation between the different classification schemes. This applies especially to the IMF *de facto* classification which has a high degree of consensus with the RR classification. Also, note that we performed all the previous robustness checks for the OST classification. Results —not reported here to save space but available upon request— remain unchanged compared to those in Table B.15.

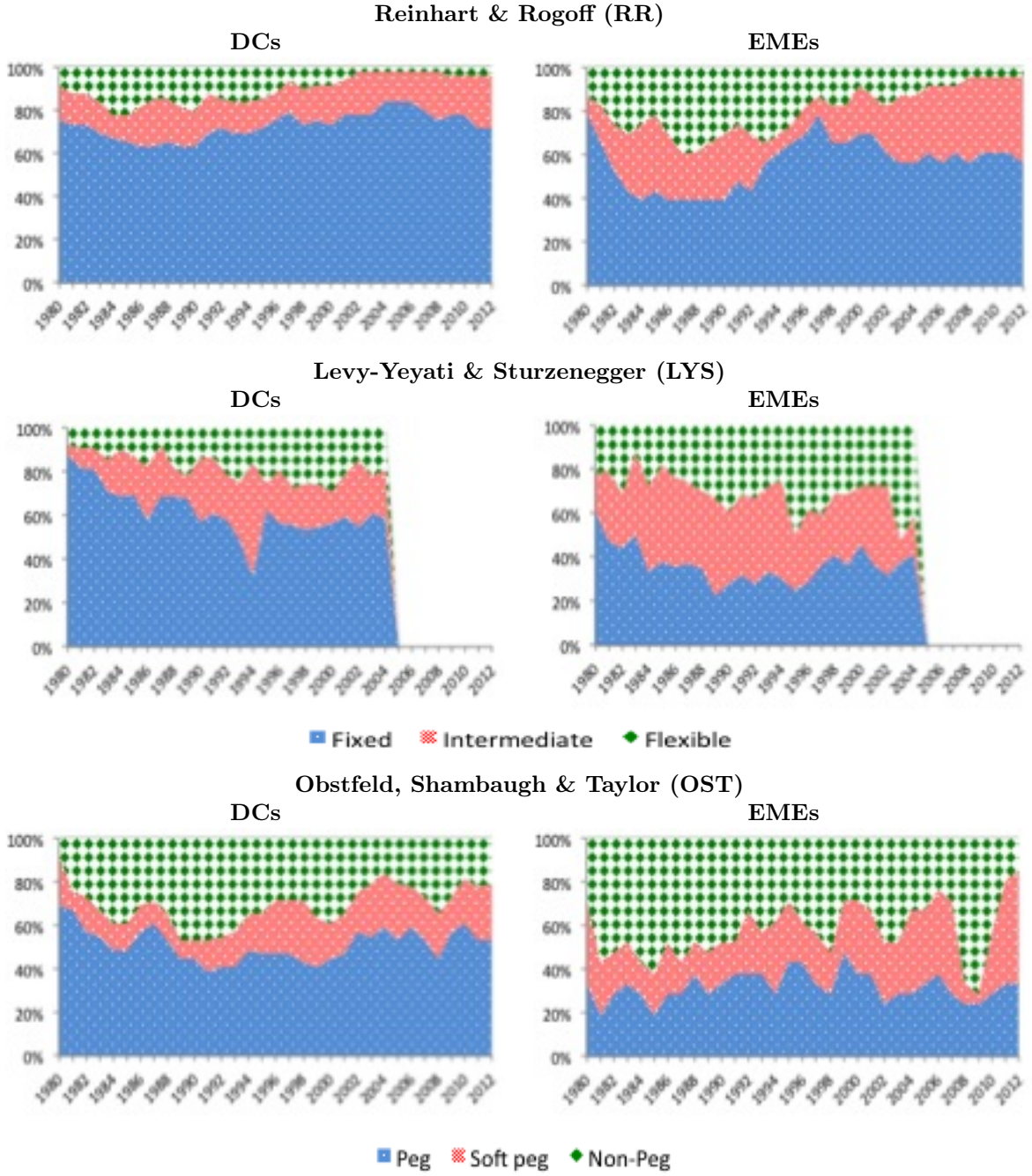

Figure 3.1 — Three-way *de facto* regime distributions over time (in % of annual observations)

On average, the LYS classification records many more intermediate regimes than the RR and OST classifications for both developing and emerging countries. This is mainly due to the use of reserve changes which allows this classification to better identify intermediate from floats. The OST classification also leads to a different distribution of ERRs —compared to the RR and LYS classifications— with, on average, a greater share to flexible ERR and a lower share to fixed ERR, for both developing and emerging countries. The latter result may be attributed to the way

the OST classification classifies pegged countries. In particular, as this classification focuses on the stability of the peg, it doesn't allow a peg spell to continue if there is a one-time discrete devaluation during a year. Consequently, this classification results, on average, in more frequent non-peg spells and fewer peg spells than the two others classification schemes.

The disagreements can be examined more formally by estimating correlations between the three *de facto* classifications. As can be seen from Table 3.4, observations differ from one classification to another, but the RR classification appears more idiosyncratic than the others. This means that —on average— for each (country-year) observation, the LYS and OST classifications agree more with each other than with the RR classification —which is consistent with our earlier findings.

Table 3.4 — ERR classifications correlation matrix

		RR		***LYS***		***OST***	
		Simple	***Weighted***	***Simple***	***Weighted***	***Simple***	***Weighted***
RR	***Simple***	1.0000					
	Weighted		1.0000				
LYS	***Simple***	0.2444		1.0000			
	Weighted		0.20760		1.0000		
OST	***Simple***	0.4966		0.5986		1.0000	
	Weighted		0.4631		0.5556		1.0000

Note: The correlations are in absolute values since the LYS classification ranks the exchange rate regimes from the more to the less flexible regime, unlike the other two classifications. In the weighted correlation, each exchange exchange rate regime is weighted according to its share in total observations.

3.5.3 Differences across classifications results: identifying the root causes

One reason that could drive the differences between the RR, LYS and OST classification results is that exchange rate regimes performance are examined relatively to the flexible exchange rate regime which is the category for which the results differ most across classification schemes. Figure 3.2 presents the mean of the currencies misalignments under each regime across classification schemes and country samples.[24]

[24]Figures are derived from statistics reported in Table A.7 in the Appendix.

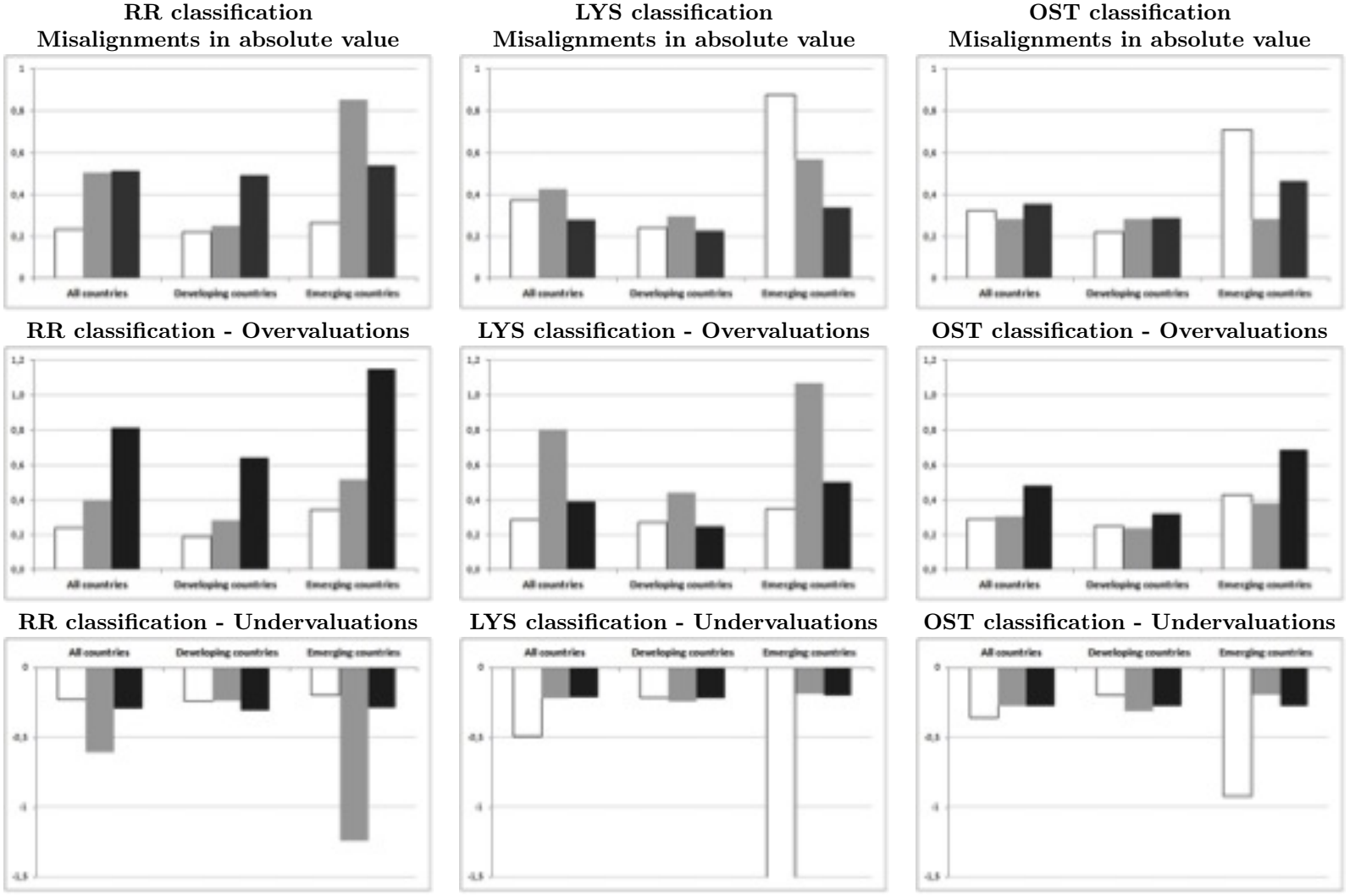

Figure 3.2 — Mean of misalignments under regime category across classification schemes and country samples

Note: The white bars are the fixed ERR, the light grey bars are the intermediate ERR and the dark grey bars are the flexible ERR.

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The figure shows that the RR classification scheme identifies the highest currency misalignments (in absolute value) for the DCs group in the flexible ERR, comparatively to the others classification schemes. These higher values are a consequence of the treatment of dual exchange rate regimes and high inflation episodes in this classification. Indeed, one feature of the RR classification is that countries with inflation rates over 40% are classified as "freely falling" and therefore as countries that have opted for a flexible regime. In particular, the use of dual exchange rate regimes makes a significant number of countries with parallel and shadow exchange rate markets being "freely falling" cases. Consequently, "freely falling" continues to be a significant category —while decreasing comparatively to the figures reported for earlier periods by Reinhart and Rogoff (2004)[25]— accounting for 9 percent of the observations when considering all the regimes and 69 percent when considering the flexible regimes —from 1980-2012 (see Table A.6b in the Appendix). Countries in the "freely falling" category are characterized by dysfunctional monetary regimes (Reinhart and Rogoff, 2004). They are then more prone to exhibit higher currency misalignments as these latter are fundamentally the symptoms of no-sustainable policies. Indeed, as shown by Figure 3.2, the RR classification scheme also involves highest real overvaluations in developing countries with the flexible regime, comparatively to the others classification schemes.

To investigate whether these points of disagreements among the three *de facto* classifications drive the differences across their results, we define a "consensus" classification based on the similarities between the RR, LYS, and OST coarser classifications —i.e. when regimes are classified as fixed, intermediate or flexible. Thus, this consensus classification includes only observations for which the three classifications agree. Given the rather small correlations between these classifications, this classification scheme drastically reduces the number of observations, particularly in the intermediate regime which now includes only eight observations. Since statistical inference is not possible for this latter regime, we drop it and consider only two regime categories: fixed vs. flexible regimes. We then perform the previous

[25] 12 percent of all regimes on the 1974 –1990 period, and 13 percent of all regimes on the 1991–2001 period (Reinhart and Rogoff, 2004).

analyses using this consensus classification. The results presented in Table B.16 suggest the absence of a significant relationship between exchange rate regimes and currency misalignments. In particular, the estimated coefficients of the fixed ERR derived from the RR classification are no longer significant, regardless the specification and the considered subsamples. This result clearly indicates that the points of disagreements among the three *de facto* classifications can be explained by their different views on the *de facto* behavior of exchange rate regimes which in turn affect the distribution of observations across the fixed, intermediate and floating regimes, more particularly in developing countries. Once these conflicting points have been removed, our results suggest that, for both developing and emerging countries, the three ERR categories do not differ significantly in terms of currency misalignments.

This last result is then consistent with the difficulty of the empirical literature to find a consensus on any consequence of exchange rate regimes. But, unlike a strand of the literature which explains these inconclusive results by the inability of the *de facto* classifications schemes to accurately define flexible ERR categories (Rose, 2011; Gosh et al., 2014)[26], our results show that, if ERR classifications have to be blamed, they should rather be blamed for their failure to adequately account for dysfunctional monetary regimes.

3.6 Conclusion

The aim of this paper was to re-examine the relationship between exchange rate regimes and currency misalignments. Relying on a panel of 73 developing and emerging countries over the period 1980-2012, our results show that there is no robust relationship between currency misalignments and exchange rate regimes. The RR classification suggests that, on average, fixed ERR perform the best in limiting currency misalignments —at least for developing countries, but when using the LYS and OST classifications this result does not hold anymore. This discrepancy across

[26]The failure of the *de facto* classifications schemes to accurately define ERR categories other than the peg category occurs either because the floating category corresponds to a non well-defined monetary policy, as suggested by Rose (2011), either because the use of existing "aggregate" regime classifications does not allow to differentiate between very heterogeneous bilateral exchange rate relationships, and as such do not adequately capture exchange rate flexibility (Gosh et al., 2014).

results has proven to be robust to various robustness checks.

This apparent lack of agreement across *de facto* exchange rate classification schemes is not surprising to the extent that classifications are "*simply measuring different things*", as rightly observed by Klein and Shambaugh (2008). In other words, the less the classifications are correlated, the lower the probability to obtain results robust across these classifications. In attempting to assess the effect of the ERR, cautious should therefore be taken as the results are likely to be sensitive to the classification scheme. We evidence indeed that using a consensus classification removes the discrepancy across classifications' results. In particular, this consensus classification leads to the conclusion that, for both developing and emerging countries, exchange rate regimes do not differ significantly in terms of currency misalignments.

While these results may be perceived as disappointing, they show, on the contrary, that in order to discriminate exchange rate regimes in terms of currency misalignments, it is important to differentiate these monetary arrangements by looking at their consistency with their underlying macroeconomic policies, as the RR classification does. Indeed, episodes of currency misalignments are not related to the trade-off between floating and fixed exchange rates, neither to the use foreign exchange reserves —which do not adequately capture policy intervention, but are mainly the result of dysfunctional monetary regimes.

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Appendices

A. Data appendix

Table A.1 — Data sources and definitions

Variables & Definitions	Sources
Exchange rate regimes	
RR: Reinhart & Rogoff de facto classification.	Ilzetzki, Reinhart & Rogoff (2011)
LYS: Levy-Yeyati & Sturzenegger *de facto* classification.	Levy-Yeyati & Sturzenegger (2005)
OST: Obstfeld, Shambaugh & Taylor de facto classification	Obstfeld, Shambaugh & Taylor (2010)
Macroeconomic indicators	
reer: Real Effective Exchange Rate (67 trading partners)	Bruegel
tot: Terms of trade index (2000 = 100), expressed in logarithm	WDI
nfa: Net Foreign Asset position (%GDP)	Lane & Milesi-Ferretti [a,b]
rprod: Relative productivity: measured by the ratio of GDP per capita (PPP) in the country and the trade-weighted average GDP per capita PPP of the top 67 partner countries.	Author calculations
inflation: Changes in the consumer price index (in logarithm)	WEO
kaopen: financial openness measured on a scale from 0 to 1, 1 being the highest financial openness degree.	Chinn & Ito
GDP (PPP): GDP based on purchasing-power-parity	WDI
Reserves: Total reserves minus gold (%GDP)	WDI
Land area: Country's total area.	WDI

WDI: *World Development Indicators* (World Bank)

WEO: *World Economic Outlook* (International Monetary Fund)

a: http://www.philiplane.org/EWN.html

b: completed using informations provided by the IFS (*International Financial Statistics*, IMF)

Table A.2 — List of countries (73)

Algeria^{E}	Costa Rica^{E}	Kenya	Rwanda
Angola	Cote d'Ivoire	Lesotho	Sao Tome & Principe.
Argentina^{E}	Dominican Rep.^{E}	Madagascar	Senegal
Bangladesh	Ecuador^{E}	Malawi	South Africa^{E}
Benin	Egypt.	Malaysia^{E}	Sri Lanka^{E}
Bolivia	El Salvador	Mali	Sudan
Botswana	Ethiopia	Mauritania	Swaziland
Brazil^{E}	Fiji	Mauritius	Tanzania
Burkina Faso	Gabon	Mexico^{E}	Thailand^{E}
Burundi	Gambia	Morocco^{E}	Togo
Cabo Verde	Ghana	Mozambique	Tunisia^{E}
Cameroon	Guatemala	Nicaragua	Turkey^{E}
Central African. Rep	Guinea	Niger	Uganda
Chad	Guinea-Bissau	Nigeria	Uruguay^{E}
China^{E}	Haiti	Pakistan	Venezuela, RB^{E}
Colombia^{E}	Honduras	Panama^{E}	Zambia
Comoros	India^{E}	Paraguay	
Congo Dem. Rep.	Indonesia^{E}	Peru^{E}	
Congo Rep.	Jordan^{E}	Philippines^{E}	

Note: "E" indicates the countries classified as "*emerging markets*"(see Gosh et al., 2014).

Table A.3 — Reinhart & Rogoff *de facto* classification

Six-way classification		***Three-way classification***
Regime	**Code**	**Regime**
No separate legal tender	1	
Pre announced peg or currency board arrangement	1	
Pre announced horizontal band that is narrower than or equal to +/-2%	1	
De facto peg	1	Fixed ERR
Pre announced crawling peg	2	
Pre announced crawling band that is narrower than or equal to +/-2%	2	
De facto crawling peg	2	
De facto crawling band that is narrower than or equal to +/-2%	2	
Pre announced crawling band that is wider than or equal to +/-2%	3	
De facto crawling band that is narrower than or equal to +/-5%	3	
Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)	3	Intermediate ERR
Managed floating	3	
Freely floating	4	
Freely falling	5	Flexible ERR
Dual market in which parallel market data is missing	6	

Table A.4 — Levy-Yeyati & Sturzenegger *de facto* classification

Five-way classification		***Three-way classification***
Regime	**Code**	**Regime**
Inconclusive determination	1	
Free float	2	Flexible ERR
Dirty float	3	Intermediate ERR
Dirty float/Crawling peg	4	
Fix	5	Fixed ERR

Table A.5 — Obstfeld, Shambaugh & Taylor *de facto* classification

Seven-way classification		***Three-way classification***
Regime	**Code**	**Regime**
0% change in the exchange rate	1	
Change in the exchange rate lesser or equal to +/-1%	2	
Change in the exchange rate lesser or equal to +/-2%	3	Pegs (Fixed ERR)
Fluctuation band that is narrower than or equal to 5% with monthly changes lesser than 1%	4	
Fluctuation band that is narrower than or equal to 5% with monthly changes lesser than 2 %	5	Soft pegs (Intermediate ERR)
Fluctuation band that is wider than 5% but monthly changes lesser than 2%	6	
Fluctuation band that is wider than 5% with monthly changes greater than 2%	7	Nonpegs (Flexible ERR)

Note: Some categories have been excluded from the original classification since they contain very few observations (namely peg type 4 and soft peg type 4).

Table A.6a — Distributions of exchange rate regimes across the *de facto* classifications and country samples, 1980-2012

Period		***Fixed***				***Intermediate***				***Flexible***			
		1980-1989	1990-1999	2000-2012	Full period	1980-1989	1990-1999	2000-2012	Full period	1980-1989	1990-1999	2000-2012	Full period
RR	*All countries*	443	495	684	1,622	142	113	216	471	145	122	49	316
		(60.68)	(67.81)	(72.08)	(67.33)	(19.45)	(15.48)	(22.76)	(19.55)	(19.86)	(16.71)	(5.16)	(13.12)
	DCs	333	352	495	1,180	79	74	120	273	78	64	22	164
		(67.96)	(71.84)	(77.71)	(72.97)	(16.12)	(15.10)	(18.84)	(16.88)	(15.92)	(13.06)	(3.45)	(10.14)
	EMEs	110	143	189	442	63	39	96	198	67	58	27	152
		(45.83)	(59.58)	(60.58)	(55.81)	(26.25)	(16.25)	(30.77)	(25.00)	(27.92)	(24.17)	(8.65)	(19.19)
LYS	*All countries*	352	264	149	765	117	146	63	326	83	150	74	307
		(63.77)	(47.14)	(52.10)	(54.72)	(21.20)	(26.07)	(22.03)	(23.32)	(15.04)	(26.79)	(25.87)	(21.96)
	DCs	287	207	114	608	52	84	38	174	39	81	40	160
		(75.93)	(55.65)	(59.38)	(64.54)	(13.76)	(22.58)	(19.79)	(18.47)	(10.32)	(21.77)	(20.83)	(16.99)
	EMEs	65	57	35	157	65	62	25	152	44	69	34	147
		(37.36)	(30.32)	(37.23)	(34.43)	(37.36)	(32.98)	(26.60)	(33.33)	(25.29)	(36.70)	(36.17)	(32.24)
OST	*All countries*	342	296	431	1,069	105	144	225	474	263	270	267	800
		(48.17)	(41.69)	(46.70)	(45.63)	(14.79)	(20.28)	(24.38)	(20.23)	(263)	(38.03)	(28.93)	(34.14)
	DCs	276	215	342	833	62	92	135	289	152	183	160	495
		(56.33)	(43.88)	(53.69)	(51.52)	(12.65)	(18.78)	(21.19)	(17.87)	(31.02)	(37.35)	(25.12)	(30.61)
	EMEs	66	81	89	236	43	52	90	185	111	87	107	305
		(30.00)	(36.82)	(31.12)	(32.51)	(19.55)	(23.64)	(31.47)	(25.48)	(50.45)	(39.55)	(37.41)	(42.01)

Note: we reported in parentheses the observations in percentage. Observations in the LYS classification go up to the year 2004.

Table A.6b — Distributions of exchange rate regimes across the *de facto* finer classifications, 1980-2012

RR six-way classification			***LYS five-way classification***			***OST seven-way classification***		
	Observations	%		Observations	%		Observations	%
RR 1	848	35.2	***LYS 1***	23	1.6	***OST 1***	672	28.7
RR 2	774	32.1	***LYS 2***	307	21.6	***OST 2***	188	8.0
RR 3	471	19.6	***LYS 3***	125	8.8	***OST 3***	115	4.9
RR 4	77	3.2	***LYS 4***	201	14.1	***OST 4***	71	3.0
RR 5	218	9.0	***LYS 5***	765	53.8	***OST 5***	443	18.9
RR 6	21	0.9				***OST 6***	26	1.1
						OST 7	828	35.3
Total	2409	100		1421	100		2343	100

Note: Observations in the LYS classification go up to the 2004.

Table A.7 — Currency misalignments across exchange rate regimes and classification schemes

	Fixed						***Intermediate***						***Flexible***					
	All countries		*DCs*		*EMEs*		*All countries*		*DCs*		*EMEs*		*All countries*		*DCs*		*EMEs*	
	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]	Obs.	Mean [Std.D]
Misalignments (in absolute values)																		
RR	1592	0.234 [0.32]	1156	0.221 [0.22]	436	0.269 [0.48]	465	0.508 [2.22]	267	0.254 [0.19]	198	0.851 [3.38]	311	0.516 [1.19]	159	0.494 [0.67]	152	0.539 [1.57]
LYS	745	0.377 [1.72]	588	0.244 [0.31]	157	0.874 [3.66]	325	0.426 [1.28]	173	0.299 [0.42]	152	0.568 [1.81]	307	0.282 [0.58]	160	0.229 [0.20]	147	0.341 [0.80]
OST	1048	0.327 [1.48]	817	0.220 [0.29]	231	0.707 [3.08]	463	0.286 [0.42]	279	0.287 [0.30]	184	0.286 [0.55]	791	0.357 [0.85]	486	0.290 [0.32]	305	0.465 [1.30]
Undervaluations																		
RR	932	-0.228 [0.24]	707	-0.238 [0.24]	225	-0.196 [0.24]	251	-0.601 [2.89]	160	-0.236 [0.17]	91	-1.243 [4.74]	177	-0.292 [0.24]	70	-0.305 [0.19]	107	-0.284 [0.26]
LYS	340	-0.486 [2.49]	271	-0.211 [0.21]	69	-1.565 [5.41]	210	-0.218 [0.23]	124	-0.243 [0.24]	86	-0.183 [0.21]	186	-0.209 [0.17]	108	-0.219 [0.16]	78	-0.196 [0.19]
OST	573	-0.359 [1.92]	443	-0.194 [0.16]	130	-0.922 [3.99]	279	-0.271 [0.31]	187	-0.311 [0.33]	92	-0.190 [0.24]	472	-0.272 [0.24]	307	-0.271 [0.21]	165	-0.274 [0.29]
Overvaluations																		
RR	660	0.242 [0.39]	449	0.193 [0.18]	211	0.348 [0.64]	214	0.398 [0.99]	107	0.281 [0.23]	107	0.517 [1.38]	134	0.811 [1.76]	89	0.642 [0.86]	45	1.146 [2.78]
LYS	405	0.285 [0.46]	317	0.273 [0.38]	88	0.332 [0.69]	115	0.803 [2.08]	49	0.443 [0.67]	66	1.070 [2.67]	121	0.395 [0.89]	52	0.250 [0.26]	69	0.504 [1.14]
OST	475	0.289 [0.60]	374	0.251 [0.39]	101	0.429 [1.04]	184	0.310 [0.54]	92	0.238 [0.22]	92	0.382 [0.73]	319	0.484 [1.29]	179	0.323 [0.45]	140	0.690 [1.87]

B. Additional results

Table B.1 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*RR classification*; 1980-2004)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Six-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.1.1	B.1.2	B.1.3	B.1.4	B.1.5	B.1.6		B.1.7	B.1.8	B.1.9	B.1.10	B.1.11	B.1.12
ERR													
Fixed	-0.339	-0.379	-0.204**	-0.223**	-0.532	-0.649	*RR* 1	-0.218*	-0.236*	-0.336**	-0.347**	0.127	0.108
	(-1.53)	(-1.48)	(-2.31)	(-2.58)	(-1.02)	(-1.02)		(-1.94)	(-1.68)	(-2.20)	(-2.39)	(0.43)	(0.29)
Interm.	0.169	0.180	-0.148**	-0.155*	0.763	0.810	*RR* 2	-0.421	-0.461	-0.300*	-0.301*	-0.707	-0.826
	(0.66)	(0.65)	(-2.05)	(-1.98)	(1.01)	(1.00)		(-1.56)	(-1.49)	(-1.90)	(-1.97)	(-1.08)	(-1.08)
Flexible	—	—	—	—	—	—	*RR* 3	0.164	0.183	-0.261*	-0.258*	1.014	1.155
								(0.54)	(0.55)	(-1.96)	(-1.90)	(1.06)	(1.07)
							RR 4	-0.059	-0.044	-0.332	-0.357	1.218	1.515
								(-0.27)	(-0.16)	(-0.44)	(-1.29)	(0.98)	(0.98)
							RR 5	—	—	—	—	—	—
							RR 6	0.022	0.063	-0.205	-0.218	1.191	1.503
								(0.12)	(0.27)	(-1.34)	(-1.34)	(0.98)	(0.99)
Control variables													
Crisis	0.031	0.029	0.039	0.038	0.015	0.005		0.029	0.027	0.028	0.027	0.087	0.107
	(1.21)	(0.71)	(1.32)	(0.94)	(0.16)	(0.04)		(1.13)	(0.64)	(0.94)	(0.66)	(0.88)	(0.85)
kaopen	0.173	0.452	-0.069	-0.053	0.634	0.969		0.189	0.470	-0.057	-0.034	0.696	1.145
	(0.83)	(0.97)	(-1.52)	(-0.65)	(1.07)	(1.10)		(0.87)	(0.97)	(-1.63)	(-0.57)	(1.11)	(1.18)
Constant	0.745***	0.798***	0.527***	0.505***	1.090**	1.292**		0.693***	0.761***	0.647***	0.611***	0.813***	0.957***
	(4.03)	(4.92)	(8.88)	(8.68)	(2.80)	(2.97)		(6.43)	(7.37)	(5.22)	(6.18)	(4.40)	(4.28)
R-Sq.	0.05	0.07	0.12	0.15	0.11	0.13		0.05	0.07	0.15	0.19	0.13	0.16
Obs./ Countries	1472/60	860/35	997/41	510/21	475/19	350/14		1472/60	860/35	997/41	510/21	475/19	350/14

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.2 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*RR classification*; APEER misalignments)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification							*Six-way classification*					
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.2.1	B.2.2	B.2.3	B.2.4	B.2.5	B.2.6		B.2.7	B.2.8	B.2.9	B.2.10	B.2.11	B.2.12
ERR													
Fixed	-0.087***	-0.083***	-0.131**	-0.122**	-0.051**	-0.052**	*RR* 1	-0.056**	-0.056**	-0.096*	-0.097*	-0.043*	-0.044*
	(-2.92)	(-2.74)	(-2.48)	(-2.27)	(-2.19)	(-2.11)		(-2.19)	(-2.14)	(-1.86)	(-1.87)	(-1.91)	(-1.89)
Interm.	-0.046	-0.044	-0.081	-0.076	-0.011	-0.001	*RR* 2	-0.106***	-0.103***	-0.158***	-0.160***	-0.055*	-0.055*
	(-1.63)	(-1.45)	(-1.59)	(-1.37)	(-0.54)	(-0.40)		(-3.00)	(-2.99)	(-2.69)	(-2.75)	(-1.76)	(-1.74)
Flexible	—	—	—	—	—	—	*RR* 3	-0.045*	-0.045*	-0.092*	-0.093*	-0.009	-0.009
								(-1.66)	(-1.64)	(-1.84)	(-1.85)	(-0.40)	(-0.38)
							RR 4	-0.012	-0.011	-0.057	-0.061	0.016	0.019
								(-0.37)	(-0.33)	(-1.31)	(-1.27)	(0.87)	(0.93)
							RR 5	—	—	—	—	—	—
							RR 6	0.044	0.043	0.061	0.063	-0.018	-0.015
								(0.32)	(0.32)	(0.27)	(0.28)	(-0.93)	(-0.73)
Control variables													
Crisis	0.045***	0.038**	0.046**	0.042	0.034	0.028		0.045***	0.042**	0.044**	0.040*	0.034	0.033
	(3.29)	(2.05)	(2.38)	(1.48)	(1.43)	(0.99)		(3.31)	(2.55)	(2.37)	(1.69)	(1.43)	(1.27)
kaopen	-0.049	-0.039	-0.096	-0.065	0.026	0.021		-0.044	-0.035	-0.086	-0.066	0.027	0.029
	(-0.99)	(-0.60)	(-1.25)	(-0.57)	(0.88)	(0.57)		(-0.92)	(-0.58)	(-1.14)	(-0.66)	(0.92)	(0.85)
Constant	0.242***	0.266***	0.308***	0.351***	0.149***	0.161***		0.230***	0.251***	0.297***	0.332***	0.147***	0.158***
	(5.76)	(5.22)	(4.66)	(4.09)	(4.60)	(4.23)		(5.74)	(5.55)	(4.40)	(4.36)	(4.46)	(4.56)
R-Sq.	0.12	0.14	0.15	0.18	0.15	0.15		0.14	0.14	0.17	0.18	0.15	0.15
Obs./ Countries	2407/73	1419/43	1615/49	792/24	792/24	627/19		2407/73	1749/53	1615/49	1056/32	792/24	693/21

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.3 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*LYS classification*; APEER misalignments)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Five-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.3.1	B.3.2	B.3.3	B.3.4	B.3.5	B.3.6		B.3.7	B.3.8	B.3.9	B.3.10	B.3.11	B.3.12
ERR													
Flexible	—	—	—	—	—	—	*LYS* 1	0.017	0.017	0.004	0.004	0.055	0.057
								(0.81)	(0.82)	(0.17)	(0.16)	(1.40)	(1.44)
Interm.	0.017	0.017	0.016	0.016	0.018	0.017	*LYS* 2	—	—	—	—	—	—
	(1.33)	(1.29)	(0.84)	(0.83)	(0.88)	(0.84)							
Fixed	0.012	0.012	0.003	0.002	0.013	0.013	*LYS* 3	0.049***	0.049***	0.063***	0.063***	0.023	0.022
	(0.93)	(0.90)	(0.15)	(0.14)	(0.59)	(0.58)		(3.42)	(3.36)	(3.16)	(3.17)	(0.94)	(0.88)
							LYS 4	4E-4	2E-4	-0.008	-0.008	0.015	0.015
								(0.03)	(0.01)	(-0.33)	(-0.32)	(0.76)	(0.74)
							LYS 5	0.016	0.016	0.010	0.010	0.013	0.013
								(1.28)	(1.24)	(0.58)	(0.56)	(0.92)	(0.59)
Control variables													
Crisis	0.051***	0.050***	0.059**	0.058**	0.024	0.026		0.048**	0.047***	0.055**	0.054**	0.024	0.026
	(3.21)	(2.98)	(2.60)	(2.41)	(0.97)	(0.99)		(3.02)	(2.79)	(2.42)	(2.23)	(0.92)	(0.95)
kaopen	-0.092	-0.091	-0.157	-0.151	0.017	0.018		-0.088	-0.086	-0.148	-0.142	0.019	0.020
	(-1.36)	(-1.30)	(-1.54)	(-1.45)	(0.54)	(0.54)		(-1.37)	(-1.30)	(-1.55)	(-1.45)	(0.60)	(0.61)
Constant	0.161***	0.167***	0.203***	0.209***	0.081*	0.085*		0.159***	0.165***	0.195***	0.201***	0.084**	0.089*
	(4.46)	(4.42)	(3.90)	(3.86)	(1.94)	(1.84)		(4.52)	(4.48)	(3.89)	(3.85)	(2.11)	(2.02)
R-Sq.	0.08	0.08	0.11	0.11	0.06	0.07		0.08	0.09	0.12	0.12	0.06	0.07
Obs./ Countries	1397/60	1274/55	941/41	868/38	456/19	406/17		1420/60	1297/55	960/41	887/38	460/19	410/17

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.4 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*Asymmetric effects; RR classification*)

Dependent variable:

	Undervaluations						*Overvaluations*					
	Whole sample		LDCs		EMEs		Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B	A	B	A	B	A	B
	B.4.1	B.4.2	B.4.3	B.4.4	B.4.5	B.4.6	B.4.7	B.4.8	B.4.9	B.4.10	B.4.11	B.4.12
ERR												
Fixed	0.009	-0.039	0.045	0.067	-0.219	-0.277	-0.419	-0.435	-0.041	-0.029	-0.640	-0.659
	(0.11)	(-0.26)	(0.74)	(1.09)	(-0.64)	(-0.70)	(-1.03)	(-1.04)	(-0.70)	(-0.31)	(-1.05)	(-1.10)
Interm.	-0.062	-0.079	0.052	0.060	-0.500	-0.527	-0.166	-0.182	0.004	-0.001	-0.194	-0.161
	(-0.42)	(-0.42)	(1.17)	(1.34)	(-0.82)	(-0.83)	(-0.84)	(-0.90)	(0.11)	(-0.03)	(-0.64)	(-0.58)
Flexible	—	—	—	—	—	—	—	—	—	—	—	—
Control variables												
Crisis	-0.022	0.002	-0.048**	-0.037	0.059	0.140	0.077*	0.114	0.050	0.062	0.099	0.089
	(-0.62)	(0.03)	(-2.31)	(-1.44)	(0.35)	(0.60)	(1.72)	(1.56)	(1.08)	(0.89)	(0.91)	(0.65)
kaopen	0.209	0.202	0.044	0.102	0.417	0.669	-0.135	-0.072	0.048	0.104	-0.219	-0.207
	(1.25)	(1.23)	(0.66)	(1.05)	(1.09)	(1.07)	(-0.72)	(-0.44)	(0.76)	(1.39)	(-0.83)	(-0.77)
Constant	-0.550***	-0.687**	-0.363***	-0.420***	-0.921*	-1.006*	0.766*	0.759**	0.293***	0.180	1.170*	1.240**
	(-3.08)	(-2.63)	(-3.73)	(-3.42)	(-1.93)	(-1.80)	(1.91)	(2.01)	(3.18)	(1.14)	(1.96)	(2.18)
R-Sq.	0.05	0.08	0.15	0.27	0.13	0.15	0.08	0.11	0.06	0.09	0.18	0.20
Obs./ Countries	1359/73	801/43	936/49	472/24	423/24	329/19	1007/71	597/42	644/47	305/23	363/24	292/19

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.5 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*Asymmetric effects; LYS classification*)

Dependent variable:	*Undervaluations*						*Overvaluations*					
	Whole sample		LDCs		EMEs		Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B	A	B	A	B	A	B
	B.5.1	B.5.2	B.5.3	B.5.4	B.5.5	B.5.6	B.5.7	B.5.8	B.5.9	B.5.10	B.5.11	B.5.12
ERR												
Flexible	—	—	—	—	—	—	—	—	—	—	—	—
Interm.	0.124	0.124	-0.004	-0.005	0.391	0.387	0.243	0.238	0.087*	0.086*	0.331	0.320
	(1.09)	(1.07)	(-0.16)	(-0.21)	(1.08)	(1.06)	(1.16)	(1.16)	(1.78)	(1.74)	(1.07)	(1.08)
Fixed	-0.155	-0.159	0.005	0.002	-0.916	-0.956	0.089	0.089	0.036	0.041	0.122	0.145
	(-0.88)	(-0.89)	(0.14)	(0.07)	(-0.99)	(-1.01)	(1.36)	(1.39)	(0.78)	(0.88)	(0.84)	(0.90)
Control variables												
Crisis	-0.041	-0.041	-0.033	-0.030	-0.154	-0.146	0.079	0.087	0.041	0.045	0.083	0.171
	(-0.98)	(-0.91)	(-1.13)	(-0.94)	(-0.82)	(-0.80)	(1.56)	(1.55)	(0.66)	(0.70)	(0.61)	(1.16)
kaopen	-0.074	-0.092	0.053	0.051	-0.195	-0.048	0.379	0.417	-0.071	-0.051	1.053	1.136
	(-0.46)	(-0.51)	(0.58)	(0.53)	(-0.43)	(-0.11)	(1.04)	(1.08)	(-0.86)	(-0.58)	(1.21)	(1.23)
Constant	-0.150	-0.179	-0.308***	-0.313***	-0.078	-0.261	0.197	0.201	0.249***	0.243**	0.136	0.139
	(-0.54)	(-0.65)	(-3.07)	(-3.13)	(-0.12)	(-0.44)	(1.14)	(1.12)	(2.81)	(2.52)	(0.31)	(0.29)
R-Sq.	0.06	0.06	0.11	0.12	0.17	0.18	0.08	0.09	0.06	0.06	0.21	0.23
Obs./ Countries	736/60	666/55	503/41	463/38	233/19	203/17	640/58	587/53	417/39	384/36	223/19	203/17

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.6 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*Outliers; RR classification*)

Dependent variable: $|Mis_{i,t}|$

Winsorisation	1%						2%					
	Whole sample		LDCs		EMEs		Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B	A	B	A	B	A	B
	B.6.1	B.6.2	B.6.3	B.6.4	B.6.5	B.6.6	B.6.7	B.6.8	B.6.9	B.6.10	B.6.11	B.6.12
ERR												
Fixed	-0.154**	-0.146**	-0.161**	-0.156**	-0.132	-0.125	-0.086***	-0.080**	-0.116**	-0.111**	-0.053	-0.052
	(-2.34)	(-2.30)	(-2.08)	(-2.03)	(-1.43)	(-1.47)	(-2.66)	(-2.24)	(-2.53)	(-2.26)	(-1.12)	(-1.00)
Interm.	-0.133**	-0.137**	-0.124*	-0.126*	-0.130	-0.133	-0.071**	-0.074**	-0.088*	-0.087*	-0.049	-0.049
	(-2.00)	(-2.01)	(-1.81)	(-1.69)	(-1.22)	(-1.18)	(-2.24)	(-2.11)	(-1.96)	(-1.71)	(-1.10)	(-0.98)
Flexible	—	—	—	—	—	—	—	—	—	—	—	—
Control variables												
Crisis	0.051***	0.062**	0.052**	0.059*	0.068	0.074	0.037***	0.037**	0.046**	0.049*	0.027	0.024
	(2.86)	(2.24)	(2.31)	(1.79)	(1.34)	(1.24)	(2.66)	(1.98)	(2.35)	(1.80)	(1.05)	(0.79)
kaopen	-0.073	-0.099	-0.025	-0.056	-0.132	-0.144	-0.041	-0.063	3E-04	-0.017	-0.092	-0.094
	(0.34)	(-1.02)	(-0.51)	(-0.69)	(-0.78)	(-0.69)	(-0.72)	(-0.85)	(0.01)	(-0.30)	(-0.74)	(-0.61)
Constant	0.489***	0.480***	0.481***	0.447***	0.495***	0.510***	0.422***	0.420***	0.437***	0.405***	0.411***	0.434***
	(8.61)	(10.04)	(8.09)	(7.98)	(5.81)	(6.65)	(11.29)	(9.53)	(9.82)	(6.93)	(6.57)	(6.30)
R-Sq.	0.06	0.07	0.11	0.16	0.06	0.06	0.10	0.13	0.13	0.21	0.08	0.08
Obs./ Countries	2366/73	1398/43	1580/49	777/49	786/24	621/19	2366/73	1398/43	1580/49	777/24	786/24	621/19

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.7 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*Outliers; LYS classification*)

Dependent variable: $|Mis_{i,t}|$

Winsorisation	1%						2%					
	Whole sample		LDCs		EMEs		Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B	A	B	A	B	A	B
	B.7.1	B.7.2	B.7.3	B.7.4	B.7.5	B.7.6	B.7.7	B.7.8	B.7.9	B.7.10	B.7.11	B.7.12
ERR												
Flexible	—	—	—	—	—	—	—	—	—	—	—	—
Interm.	0.012	0.011	0.011	0.009	0.014	0.015	-0.008	-0.009	0.015	0.014	-0.036	-0.035
	(0.37)	(0.35)	(0.36)	(0.33)	(0.20)	(0.22)	(-0.43)	(-0.45)	(0.48)	(0.46)	(-1.26)	(-1.17)
Fixed	-0.037	-0.036	-0.014	-0.015	-0.118	-0.113	-0.030	-0.029	-0.010	-0.011	-0.086	-0.082
	(-0.98)	(-0.97)	(-0.46)	(-0.49)	(-1.02)	(-1.02)	(-0.92)	(-0.90)	(-0.34)	(-0.38)	(-1.00)	(-1.01)
Control variables												
Crisis	0.065**	0.067**	0.059*	0.063*	0.108	0.118	0.054**	0.056**	0.057*	0.060*	0.073	0.078
	(2.49)	(2.42)	(1.85)	(1.84)	(1.36)	(1.34)	(2.59)	(2.52)	(1.84)	(1.84)	(1.46)	(1.44)
kaopen	-0.005	0.012	-0.136*	-0.124*	0.296	0.351	-0.024	-0.011	-0.111**	-0.098*	0.171	0.202
	(-0.06)	(0.13)	(-1.95)	(-1.74)	(1.06)	(1.09)	(-0.46)	(-0.20)	(-2.18)	(-1.89)	(1.09)	(1.16)
Constant	0.342***	0.342***	0.358***	0.364***	0.267	0.251	0.345***	0.347***	0.349***	0.355***	0.306***	0.298**
	(6.50)	(5.79)	(9.62)	(9.37)	(1.40)	(1.11)	(9.50)	(8.68)	(9.14)	(8.86)	(2.83)	(2.34)
R-Sq.	0.04	0.04	0.09	0.09	0.07	0.08	0.06	0.06	0.11	0.11	0.07	0.07
Obs./ Countries	1376/60	1253/55	920/41	847/38	456/19	406/17	1376/60	1253/55	920/41	847/38	435/19	406/17

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.8 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*RR classification*; with *inflation*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Six-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.8.1	B.8.2	B.8.3	B.8.4	B.8.5	B.8.6		B.8.7	B.8.8	B.8.9	B.8.10	B.8.11	B.8.12
ERR													
Fixed	-0.144*	-0.093	-0.144**	-0.089**	-0.118	-0.101	*RR* 1	-0.083	-0.079	-0.218**	-0.233***	0.222	0.266
	(-1.94)	(-1.21)	(-2.44)	(-2.05)	(-0.72)	(-0.54)		(-1.11)	(-0.92)	(-2.63)	(-2.81)	(0.70)	(0.74)
Interm.	0.106	0.148	-0.111**	-0.070	0.377	0.385	*RR* 2	-0.188*	-0.173*	-0.181**	-0.189**	-0.316	-0.264
	(0.59)	(0.73)	(-2.02)	(-1.45)	(0.89)	(0.87)		(-1.79)	(-1.80)	(-2.24)	(-2.38)	(-0.98)	(-0.91)
Flexible	—	—	—	—	—	—	*RR* 3	0.101	0.111	-0.160**	-0.168**	0.478	0.520
								(0.53)	(0.53)	(-2.19)	(-2.27)	(0.93)	(0.94)
							RR 4	-0.008	0.006	-0.125	-0.130	0.657	0.745
								(-0.08)	(0.05)	(-1.09)	(-1.12)	(0.91)	(0.91)
							RR 5	—	—	—	—	—	—
							RR 6	-0.072	-0.069	-0.083	-0.106	0.602	0.684
								(-0.66)	(-0.50)	(-0.87)	(-0.89)	(0.90)	(0.91)
Control variables													
Inflation	0.005	0.013	0.007	0.019*	-0.005	-0.004		0.005	0.005	0.006	0.006	-0.004	-0.004
	(0.80)	(1.39)	(0.89)	(1.83)	(-0.75)	(-0.66)		(0.81)	(0.85)	(0.89)	(0.90)	(-0.61)	(-0.55)
Crisis	0.055**	0.066*	0.047**	0.081**	0.094	0.088		0.054**	0.049	0.044**	0.038	0.114	0.111
	(2.06)	(1.66)	(2.00)	(2.07)	(0.96)	(0.79)		(2.01)	(1.57)	(1.97)	(1.30)	(1.09)	(1.01)
kaopen	-0.248	-0.224	-0.009	0.014	-0.556	-0.623		-0.241	-0.235	-0.007	-0.020	-0.491	-0.551
	(-0.94)	(-0.83)	(-0.24)	(0.25)	(-0.92)	(-0.88)		(-0.94)	(-0.92)	(-0.17)	(-0.36)	(-0.87)	(-0.86)
Constant	0.696***	0.754***	0.463***	0.371***	1.149**	1.299**		0.675***	0.733***	0.521***	0.517***	1.027**	1.090**
	(3.21)	(2.80)	(7.97)	(4.69)	(2.06)	(2.08)		(3.89)	(3.60)	(8.30)	(8.34)	(2.38)	(2.38)
R-Sq.	0.04	0.06	0.16	0.36	0.07	0.08		0.04	0.05	0.17	0.22	0.09	0.09
Obs./ Countries	2366/73	1398/43	1580/49	777/24	786/24	621/19		2366/73	1716/53	1580/49	1029/32	786/24	687/21

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.9 — Sensitivity analysis: Currency misalignments and exchange rate regimes (*LYS classification*; with *inflation*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Five-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.9.1	B.9.2	B.9.3	B.9.4	B.9.5	B.9.6		B.9.7	B.9.8	B.9.9	B.9.10	B.9.11	B.9.12
ERR													
Flexible	—	—	—	—	—	—	*LYS* 1	-0.013	-0.012	-0.018	-0.017	-0.500	-0.502
								(-0.16)	(-0.15)	(-0.55)	(-0.52)	(-1.53)	(-1.51)
Interm.	0.035	0.033	0.015	0.015	0.041	0.026	*LYS* 2	—	—	—	—	—	—
	(0.57)	(0.54)	(0.49)	(0.47)	(0.34)	(0.24)							
Fixed	0.301	0.296	-0.002	-0.003	1.072	1.072	*LYS* 3	0.083	0.080	0.042	0.041	0.115	0.098
	(0.98)	(0.99)	(-0.07)	(-0.10)	(1.05)	(1.05)		(0.76)	(0.75)	(1.22)	(1.18)	(0.68)	(0.63)
							LYS 4	0.008	0.006	8E-4	8E-4	0.014	0.001
								(0.21)	(0.16)	(0.02)	(0.02)	(0.13)	(0.01)
							LYS 5	0.303	0.298	0.002	0.001	1.079	1.080
								(0.99)	(0.99)	(0.09)	(0.05)	(1.05)	(1.05)
Control variables													
Inflation	0.015	0.015	0.019*	0.019*	-0.002	-0.002		0.015	0.015	0.019*	0.019*	-0.004	-0.004
	(1.62)	(1.64)	(1.88)	(1.88)	(-0.48)	(-0.46)		(1.54)	(1.58)	(1.86)	(1.87)	(-0.84)	(-0.76)
Crisis	0.100*	0.106	0.069*	0.071*	0.123	0.169		0.096*	0.101*	0.066*	0.068*	0.116	0.162
	(1.88)	(1.83)	(1.99)	(1.96)	(1.05)	(1.08)		(1.91)	(1.85)	(1.88)	(1.86)	(1.03)	(1.07)
kaopen	0.052	0.084	-0.038	-0.024	-0.112	-0.120		0.051	0.087	-0.034	-0.020	-0.104	-0.111
	(0.58)	(0.79)	(-0.83)	(-0.49)	(-0.52)	(-0.51)		(0.57)	(0.77)	(-0.78)	(-0.44)	(-0.49)	(-0.48)
Constant	0.305**	0.336**	0.318***	0.323***	0.488*	0.643***		0.304**	0.336**	0.314***	0.318***	0.518**	0.677***
	(2.08)	(2.54)	(6.69)	(6.44)	(1.94)	(3.68)		(2.06)	(2.51)	(6.70)	(6.44)	(2.11)	(3.89)
R-Sq.	0.05	0.05	0.32	0.32	0.11	0.11		0.05	0.05	0.32	0.33	0.11	0.12
Obs./ Countries	1376/60	1253/55	920/41	847/38	456/19	406/17		1399/60	1276/55	939/41	866/38	460/19	410/17

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.10 — Sensitivity analysis: Wu-Hausman test results

ERR classifications		Sample					
		Whole sample		LDCs		EMEs	
		A	B	A	B	A	B
RR	*Three-way*	12.50	18.10	9.56	4.73	3.05	1.98
		(0.00)	(0.00)	(0.00)	(0.01)	(0.05)	(0.13)
	Six-way	20.67	20.38	15.14	4.11	24.76	19.48
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LYS	*Three-way*	20.71	24.19	2.11	1.45	79.68	68.18
		(0.00)	(0.00)	(0.12)	(0.23)	(0.00)	(0.00)
	Five-way	27.39	32.82	6.03	3.51	51.61	45.65
		(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
OST	*Three-way*	11.77	13.69	13.36	17.47	14.24	19.62
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Seven-way	23.69	21.59	9.65	8.15	25.32	25.58
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: *p*.values are reported in parentheses. Null: exogeneity of the exchange rate regimes.

Table B.11 — Sensitivity analysis: Currency misalignments and exchange rate regimes (One-year lagged ERR; *RR classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification							*Six-way classification*					
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.11.1	B.11.2	B.11.3	B.11.4	B.11.5	B.11.6		B.11.7	B.11.8	B.11.9	B.11.10	B.11.11	B.11.12
ERR													
l.Fixed	-0.101*	-0.086	-0.154**	-0.164**	-0.006	0.018	*l.RR* 1	-0.071	-0.078	-0.257**	-0.283**	0.267	0.311
	(-1.85)	(-1.20)	(-1.98)	(-2.17)	(-0.05)	(0.10)		(-0.63)	(-0.65)	(-2.03)	(-2.28)	(0.73)	(0.76)
l.Interm.	0.105	0.111	-0.118*	-0.137*	0.411	0.433	*l.RR* 2	-0.132*	-0.123	-0.227*	-0.242**	-0.137	-0.093
	(0.53)	(0.50)	(-1.73)	(-1.90)	(0.87)	(0.85)		(-1.85)	(-1.63)	(-1.81)	(-1.97)	(-0.65)	(-0.47)
l.Flexible	—	—	—	—	—	—	*l.RR* 3	0.096	0.100	-0.202*	-0.217*	0.512	0.555
								(0.42)	(0.42)	(-1.78)	(-1.91)	(0.91)	(0.92)
							l.RR 4	-0.023	-0.007	-0.205	-0.210	0.715	0.801
								(-0.15)	(-0.04)	(-1.22)	(-1.22)	(0.98)	(0.98)
							l.RR 5	—	—	—	—	—	—
							l.RR 6	-0.088	-0.084	-0.219	-0.250	0.649	0.723
								(-0.65)	(-0.52)	(-1.35)	(-1.39)	(0.98)	(0.98)
Control variables													
Crisis	0.082**	0.089**	0.074**	0.094**	0.079	0.067		0.081***	0.084**	0.075***	0.086**	0.078	0.060
	(2.62)	(2.11)	(2.57)	(2.03)	(0.95)	(0.67)		(2.66)	(2.34)	(2.67)	(2.38)	(0.98)	(0.73)
kaopen	-0.278	-0.276	-0.043	-0.065	-0.562	-0.633		-0.274	-0.267	-0.036	-0.045	-0.510	-0.568
	(-1.02)	(-1.00)	(-0.75)	(-0.69)	(-0.92)	(-0.90)		(-1.02)	(-1.00)	(-0.67)	(-0.59)	(-0.89)	(-0.88)
Constant	0.875**	1.217**	0.479***	0.517***	0.418**	1.265**		0.873**	1.076**	0.563***	0.611***	1.582	1.760
	(2.25)	(2.04)	(6.62)	(8.54)	(2.35)	(2.10)		(2.44)	(2.25)	(4.78)	(6.60)	(1.55)	(1.52)
R-Sq.	0.04	0.05	0.11	0.16	0.07	0.08		0.04	0.04	0.13	0.18	0.08	0.09
Obs./ Countries	2303/73	1361/43	1539/49	757/24	764/24	604/19		2303/73	1670/53	1539/49	1002/32	764/24	668/21

Notes: The prefix " *l.* " indicates the one-year lagged variable. The bar indicates the reference regime. Robust *t*-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.12 — Sensitivity analysis: Currency misalignments and exchange rate regimes (One-year lagged ERR; *LYS classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification							*Five-way classification*					
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.12.1	B.12.2	B.12.3	B.12.4	B.12.5	B.12.6		B.12.7	B.12.8	B.12.9	B.12.10	B.12.11	B.12.12
ERR													
l.Flexible	—	—	—	—	—	—	*l.LYS* 1	-0.093	-0.094	-0.041	-0.041	-0.623	-0.637
								(-1.36)	(-1.35)	(-0.97)	(-0.97)	(-1.60)	(-1.60)
l.Interm.	-0.015	-0.016	-0.019	-0.020	-0.063	-0.070	*l.LYS* 2	—	—	—	—	—	—
	(-0.55)	(-0.58)	(-0.67)	(-0.68)	(-0.83)	(-0.85)							
l.Fixed	0.285	0.279	0.038	0.038	0.896	0.879	*l.LYS* 3	0.045	0.044	-0.016	-0.017	0.012	0.009
	(1.10)	(1.10)	(1.31)	(1.28)	(1.04)	(1.04)		(0.51)	(0.51)	(-0.42)	(-0.45)	(0.09)	(0.07)
							l.LYS 4	-0.049	-0.051	-0.021	-0.021	-0.092	-0.101
								(-1.59)	(-1.57)	(-0.70)	(-0.71)	(-1.05)	(-1.04)
							l.LYS 5	0.291	0.285	0.041	0.040	0.901	0.885
								(1.10)	(1.11)	(1.36)	(1.33)	(1.04)	(1.04)
Control variables													
Crisis	0.083**	0.089*	0.086*	0.091*	-0.086	-0.052		0.091**	0.098*	0.087*	0.092*	-0.040	-0.001
	(2.02)	(1.98)	(1.76)	(1.77)	(-0.57)	(-0.40)		(2.02)	(1.97)	(1.79)	(1.80)	(-0.32)	(-0.01)
kaopen	0.022	0.053	-0.079*	-0.067	-0.071	-0.070		0.027	0.057	-0.081*	-0.068	-0.047	-0.044
	(0.27)	(0.53)	(-1.98)	(-1.59)	(-0.41)	(-0.38)		(0.30)	(0.53)	(1.97)	(-1.59)	(-0.28)	(-0.24)
Constant	0.157	0.181	0.249***	0.263***	1.229**	1.452*		0.333***	0.366***	0.297***	0.307***	1.211**	1.432**
	(0.80)	(0.93)	(6.91)	(7.00)	(2.33)	(2.07)		(3.34)	(4.30)	(6.97)	(6.82)	(2.39)	(2.11)
R-Sq.	0.04	0.04	0.11	0.12	0.10	0.11		0.04	0.04	0.12	0.12	0.10	0.11
Obs./ Countries	1325/60	1205/55	888/41	816/38	437/19	389/17		1347/60	1227/55	906/41	834/38	441/19	393/17

Notes: The prefix " *l.* " indicates the one-year lagged variable. The bar indicates the reference regime. Robust *t*-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.13 — Sensitivity analysis: Currency misalignments and exchange rate regimes (Predicted ERR; *RR classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Six-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.13.1	B.13.2	B.13.3	B.13.4	B.13.5	B.13.6		B.13.7	B.13.8	B.13.9	B.13.10	B.13.11	B.13.12
ERR													
$Fixed^P$	-0.204**	-0.161*	-0.229*	-0.221*	-0.103	-0.060	$RR\ 1^P$	-0.407	-0.412	-0.655*	-0.724**	0.495	0.658
	(-2.36)	(-1.67)	(-1.93)	(-1.86)	(-0.47)	(-0.23)		(-1.53)	(-1.39)	(-1.84)	(-2.04)	(0.56)	(0.62)
$Interm.^P$	0.158	0.186	-0.168	-0.169	0.665	0.676	$RR\ 2^P$	-0.322	-0.285	-0.551	-0.587	-0.239	0.085
	(0.53)	(0.55)	(-1.64)	(-1.48)	(0.89)	(0.88)		(-1.23)	(-0.96)	(-1.48)	(-1.60)	(-0.37)	(0.13)
$Flexible^P$	—	—	—	—	—	—	$RR\ 3^P$	0.010	0.023	-0.491	-0.521	1.298	1.421
								(0.02)	(0.05)	(-1.51)	(-1.59)	(0.85)	(0.85)
							$RR\ 4^P$	-0.263	-0.251	-0.489	-0.516	2.968	3.319
								(-0.65)	(-0.58)	(-1.08)	(-1.11)	(0.90)	(0.89)
							$RR\ 5^P$	—	—	—	—	—	—
							$RR\ 6^P$	-0.426	-0.461	-0.425	-0.491	2.362	2.686
								(-1.34)	(-1.27)	(-1.23)	(-1.40)	(0.87)	(0.87)
Control variables													
Crisis	0.059**	0.063*	0.051**	0.058*	0.090	0.088		0.059**	0.054*	0.048**	0.045*	0.105	0.101
	(2.22)	(1.66)	(2.25)	(1.75)	(0.94)	(0.79)		(2.11)	(1.76)	(2.21)	(1.69)	(1.04)	(0.95)
kaopen	-0.267	-0.273	-0.029	-0.062	-0.533	-0.603		-0.307	-0.319	-0.022	-0.046	-0.623	-0.705
	(-0.99)	(-0.98)	(-0.58)	(-0.74)	(-0.92)	(-0.89)		(-0.99)	(-1.00)	(-0.51)	(-0.72)	(-0.94)	(-0.94)
Constant	0.703***	0.788***	0.482***	0.445***	1.104**	1.252**		0.738***	0.794***	0.587***	0.576***	1.046**	1.127**
	(3.63)	(3.32)	(7.46)	(7.58)	(2.16)	(2.18)		(4.32)	(3.93)	(4.62)	(5.48)	(2.34)	(2.31)
R-Sq.	0.04	0.05	0.10	0.15	0.07	0.09		0.03	0.04	0.13	0.17	0.07	0.08
Obs./ Countries	2366/73	1398/43	1580/49	777/24	786/24	621/19		2366/73	1716/53	1580/49	1029/32	786/24	687/21

Notes: The prefix " *l.* " indicates the one-year lagged variable. The bar indicates the reference regime. Robust *t*-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.14 — Sensitivity analysis: Currency misalignments and exchange rate regimes (Predicted ERR; *LYS classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Five-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.14.1	B.14.2	B.14.3	B.14.4	B.14.5	B.14.6		B.14.7	B.14.8	B.14.9	B.14.10	B.14.11	B.14.12
ERR													
$Flexible^P$	—	—	—	—	—	—	$LYS\ 1^P$	0.892	0.940	0.104	0.136	-12.79	-12.89
								(0.29)	(0.30)	(0.11)	(0.14)	(-1.30)	(-1.29)
$Interm.^P$	-0.010	-0.012	-0.029	-0.029	0.037	0.018	$LYS\ 2^P$	—	—	—	—	—	—
	(-0.09)	(-0.10)	(-0.45)	(-0.44)	(0.12)	(0.06)							
$Fixed^P$	1.502	1.497	-0.064	-0.067	2.641	2.627	$LYS\ 3^P$	2.489	2.465	2.848*	2.803*	3.252	3.095
	(1.02)	(1.02)	(-0.57)	(-0.59)	(1.03)	(1.03)		(0.72)	(0.72)	(1.92)	(1.89)	(0.58)	(0.57)
							$LYS\ 4^P$	-1.199	-1.237	-0.881	-0.844	-2.090	-2.444
								(-0.85)	(-0.86)	(-1.27)	(-1.19)	(-0.52)	(-0.58)
							$LYS\ 5^P$	15.643	15.58	0.209	0.189	25.63	25.69
								(1.02)	(1.02)	(0.12)	(0.10)	(0.99)	(0.99)
Control variables													
Crisis	0.112*	0.117*	0.062*	0.065*	0.108	0.149		0.098*	0.103*	0.060*	0.063*	0.065	0.104
	(1.74)	(1.71)	(1.81)	(1.81)	(1.02)	(1.07)		(1.88)	(1.82)	(1.76)	(1.76)	(0.75)	(0.93)
kaopen	-0.053	-0.029	-0.134**	-0.121*	-0.028	-0.029		-0.043	-0.016	-0.125*	-0.114*	-0.002	-0.011
	(-0.67)	(-0.33)	(2.02)	(-1.80)	(-0.14)	(-0.13)		(-0.67)	(-0.22)	(-1.97)	(-1.75)	(-0.02)	(-0.08)
Constant	0.404***	0.421***	0.352***	0.357***	0.716***	0.801***		0.447***	0.460***	0.341***	0.346***	0.865***	0.954***
	(5.31)	(5.42)	(9.99)	(9.48)	(6.56)	(6.33)		(8.97)	(8.51)	(9.44)	(8.95)	(4.79)	(4.35)
R-Sq.	0.05	0.05	0.09	0.09	0.11	0.11		0.04	0.05	0.09	0.10	0.10	0.10
Obs./ Countries	1376/60	1253/55	920/41	847/38	456/19	406/17		1399/60	1276/55	939/41	866/38	460/19	410/17

Notes: The prefix " *l.* " indicates the one-year lagged variable. The bar indicates the reference regime. Robust *t*-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.15 — Currency misalignments and alternative classification schemes (*OST classification*)

Dependent variable: $|Mis_{i,t}|$

	Three-way classification						*Seven-way classification*						
	Whole sample		LDCs		EMEs			Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B		A	B	A	B	A	B
	B.15.1	B.15.2	B.15.3	B.15.4	B.15.5	B.15.6		B.15.7	B.15.8	B.15.9	B.15.10	B.15.11	B.15.12
ERR													
Fixed	0.111	0.111	0.025	0.024	0.432	0.439	*OST* 1	0.415	0.421	0.043	0.047	1.532	1.532
	(1.07)	(1.07)	(0.92)	(0.85)	(0.95)	(0.95)		(1.05)	(1.06)	(0.89)	(0.95)	(1.00)	(1.00)
Interm.	-0.013	-0.011	0.001	0.001	0.023	0.030	*OST* 2	0.177	0.180	0.030	0.33	0.461	0.465
	(-0.54)	(-0.46)	(0.05)	(0.06)	(0.36)	(0.43)		(1.06)	(1.06)	(1.03)	(1.09)	(0.87)	(0.87)
Flexible	—	—	—	—	—	—	*OST* 3	-0.202	-0.201	0.032	0.033	-0.515	-0.510
								(-0.95)	(-0.95)	(1.47)	(1.50)	(-1.04)	(-1.04)
							OST 4	-0.059	-0.059	-0.127*	-0.129*	-0.103	-0.099
								(-1.06)	(-1.03)	(-1.78)	(-1.79)	(-0.48)	(-0.46)
							OST 5	-0.036	-0.037	0.032*	0.031	-0.086	-0.084
								(-0.62)	(-0.63)	(1.71)	(1.62)	(-0.61)	(-0.59)
							OST 6	0.006	0.007	-0.228	-0.230	0.093	0.095
								(0.08)	(0.09)	(-1.59)	(-1.57)	(0.53)	(0.53)
							OST 7	—	—	—	—	—	—
Control variables													
Crisis	0.080**	0.076**	0.064***	0.068**	0.113	0.112		0.060***	0.060***	0.061**	0.065**	0.041	0.048
	(2.57)	(2.34)	(2.67)	(2.17)	(1.10)	(1.03)		(3.02)	(2.87)	(2.61)	(2.60)	(0.58)	(0.63)
kaopen	-0.331	-0.304	-0.078	-0.077	-0.775	-0.758		-0.259	-0.250	-0.056	-0.048	-0.847	-0.839
	(-1.14)	(-1.12)	(-1.15)	(-0.89)	(-0.99)	(-0.99)		(-1.11)	(-1.09)	(-1.07)	(-0.90)	(-1.01)	(-1.01)
Constant	0.571***	0.625***	0.332***	0.304***	1.095**	1.165**		0.416***	0.422***	0.310***	0.292***	0.877***	0.937***
	(3.69)	(3.16)	(8.67)	(7.01)	(2.20)	(2.20)		(7.75)	(7.55)	(6.16)	(5.80)	(2.89)	(2.88)
R-Sq.	0.04	0.04	0.08	0.10	0.08	0.08		0.05	0.05	0.10	0.10	0.13	0.14
Obs./ Countries	2300/71	1773/55	1580/49	1119/35	720/22	654/20		2300/71	2168/67	1580/49	1481/46	720/22	687/21

Notes: The bar indicates the reference regime. Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table B.16 — Currency misalignments and exchange rate regimes (*consensus classification*)

Dependent variable: $|Mis_{i,t}|$

	Misalignments from the BEER approach						*Misalignments from the APEER approach*					
	Whole sample		LDCs		EMEs		Whole sample		LDCs		EMEs	
Panel	A	B	A	B	A	B	A	B	A	B	A	B
Basic specification												
Fixed	-0.004	-0.003	-0.028	-0.027	0.039	-0.052	-0.026	-0.018	-0.038	-0.029	0.014	2E-04
	(-0.08)	(-0.05)	(-0.46)	(-0.46)	(0.29)	(-0.41)	(-0.75)	(-0.56)	(-0.99)	(-0.79)	(0.36)	(0.01)
Crisis	0.042*	0.039	0.030	0.031	0.083***	0.097**	0.022**	0.015	0.018	0.008	0.009	9E-05
	(1.88)	(1.50)	(1.05)	(0.91)	(4.44)	(2.80)	(2.12)	(1.54)	(1.36)	(0.72)	(0.61)	(0.00)
kaopen	-0.096*	-0.100*	-0.137**	-0.140**	-0.015	0.053	0.007	0.004	-0.028	-0.026	0.061***	0.067**
	(-1.79)	(-1.76)	(-2.43)	(-2.41)	(-0.11)	(0.31)	(0.37)	(0.23)	(-0.92)	(-0.82)	(2.87)	(2.09)
Constant	0.345***	0.360***	0.367***	0.383***	0.296*	0.331	0.095**	0.088**	0.127**	0.118**	-0.019	-0.037
	(4.69)	(4.71)	(4.55)	(4.65)	(1.92)	(1.58)	(2.33)	(2.21)	(2.58)	(2.43)	(-0.42)	(-1.49)
$R-sq.$	0.16	0.15	0.18	0.19	0.17	0.19	0.16	0.20	0.18	0.24	0.26	0.43
Obs./Countries	576/55	470/50	442/39	370/36	134/16	100/14	589/55	483/50	455/39	383/36	134/16	100/14
Controlling for inflation												
Fixed	-0.027	-0.028	-0.034	-0.035	-0.118	-0.181	-0.012	-0.005	-0.024	-0.016	-0.016	-0.038
	(-0.57)	(-0.59)	(-0.58)	(-0.63)	(-0.79)	(-1.33)	(-0.36)	(-0.15)	(-0.68)	(-0.47)	(-0.26)	(-0.76)
Crisis	0.045*	0.042	0.032	0.032	0.091***	0.097**	0.019*	0.013	0.015	0.005	0.010	4E-04
	(1.95)	(1.59)	(1.07)	(0.94)	(4.41)	(2.56)	(1.71)	(1.27)	(1.12)	(0.42)	(0.69)	(0.01)
kaopen	-0.106**	-0.111**	-0.138**	-0.141**	-0.057	-0.014	0.013	0.011	-0.026	-0.023	0.053**	0.047
	(-2.14)	(-2.16)	(-2.45)	(-2.43)	(-0.44)	(-0.08)	(0.62)	(0.53)	(-0.88)	(-0.75)	(2.32)	(1.31)
inflation	-0.112	-0.121	-0.048	-0.066	-0.346	-0.340	0.065*	0.066*	0.128**	0.124**	-0.067	-0.102
	(-1.26)	(-1.29)	(-0.47)	(-0.60)	(-1.52)	(-1.43)	(1.71)	(1.79)	(2.42)	(2.27)	(-0.97)	(-1.55)
Constant	0.387***	0.405***	0.379***	0.398***	0.527**	0.548**	0.071*	0.065*	0.097**	0.090**	0.025	0.027
	(6.11)	(6.08)	(5.25)	(5.32)	(2.74)	(2.12)	(1.79)	(1.67)	(2.24)	(2.13)	(0.47)	(0.62)
$R-sq.$	0.16	0.16	0.18	0.18	0.21	0.22	0.17	0.21	0.20	0.25	0.26	0.44
Obs./Countries	576/55	470/50	442/39	370/36	134/16	100/14	589/55	483/50	455/39	383/36	134/16	100/14

Notes: Robust t-statistics in parentheses. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

C. Figures

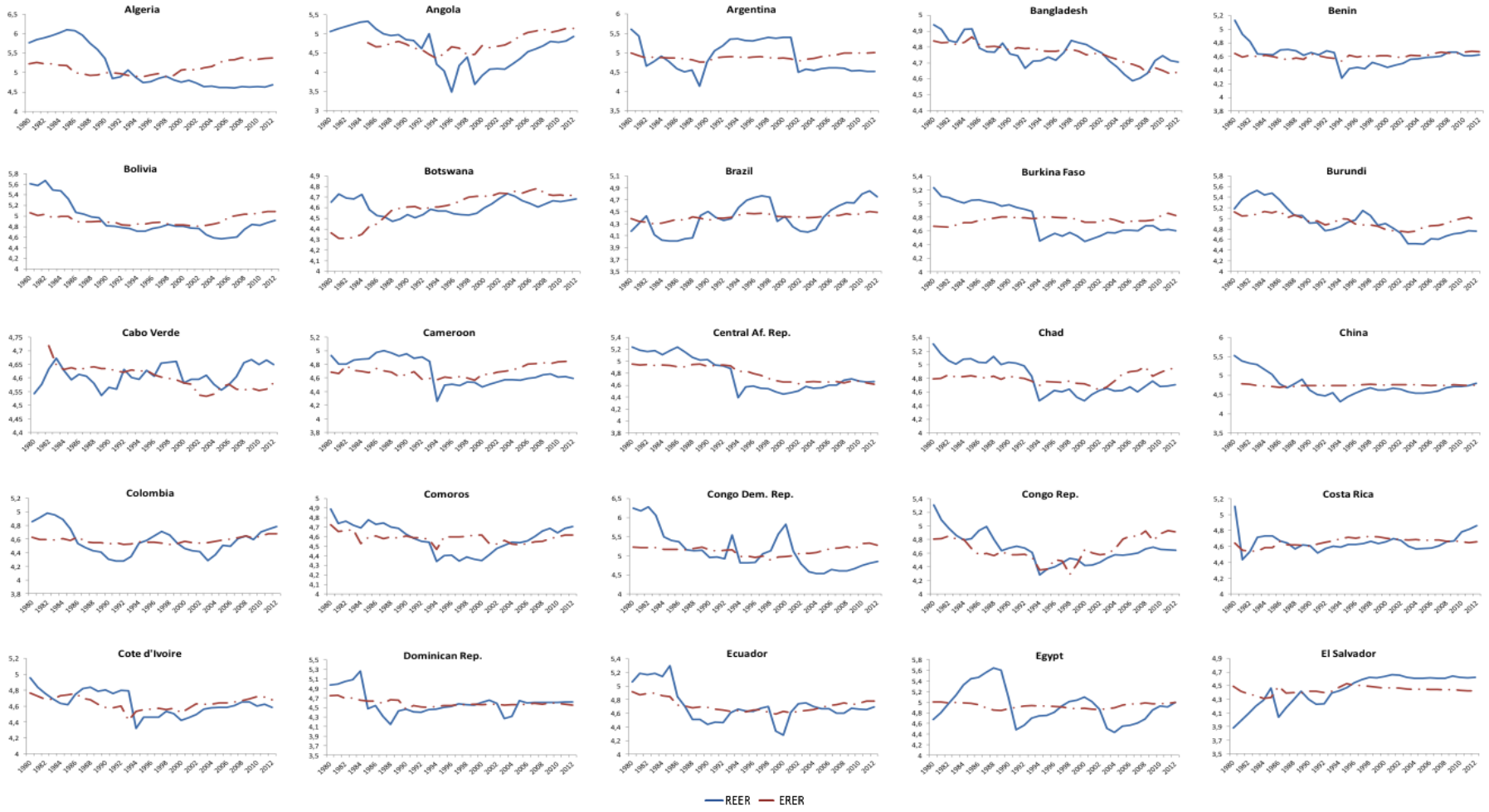

Figure C.1 — Real and Equilibrium Effective Exchange Rate (REER and ERER)
Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

Figure C.1 — *Continued.*

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

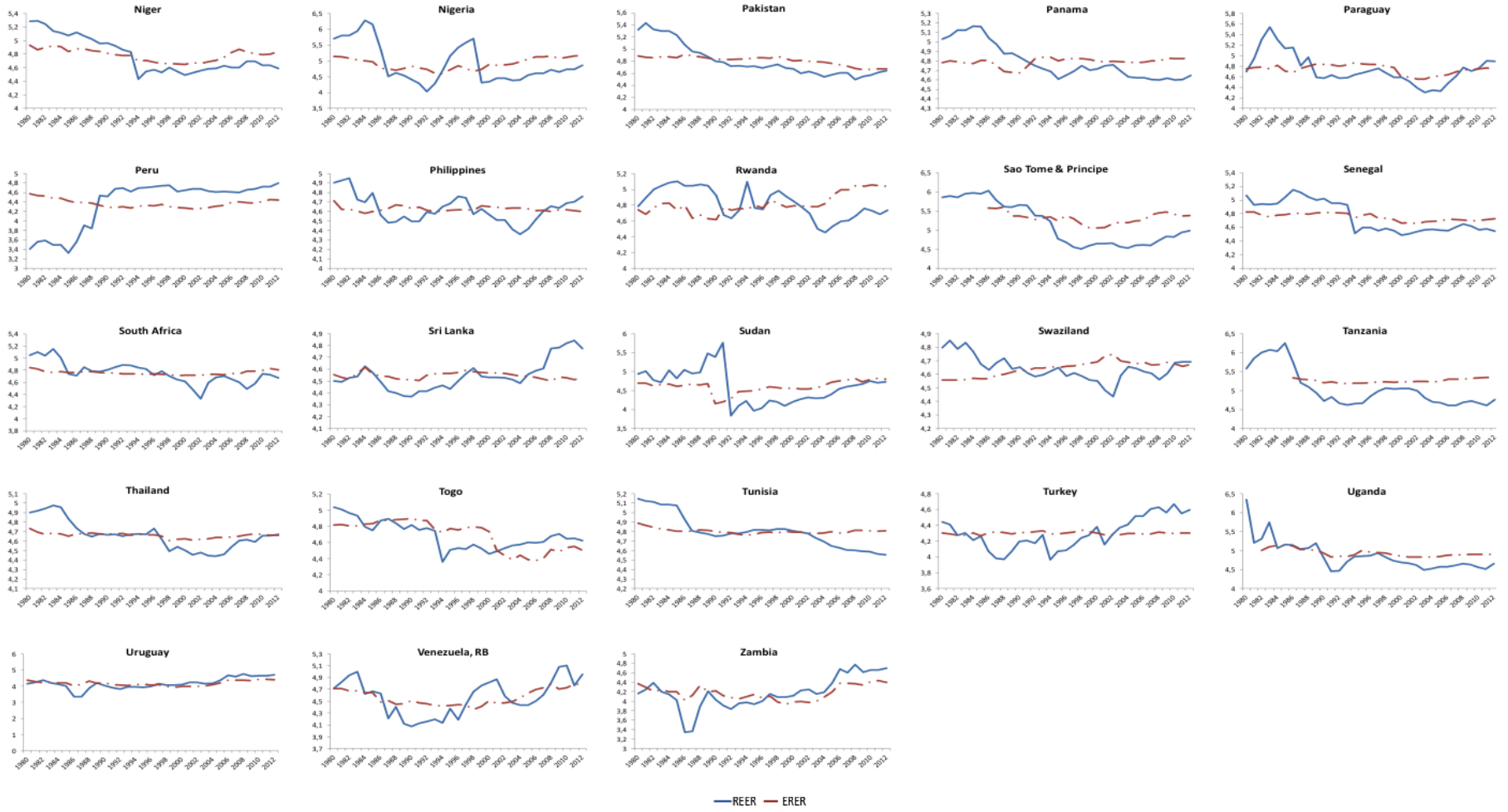

Figure C.1 — *Continued.*

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

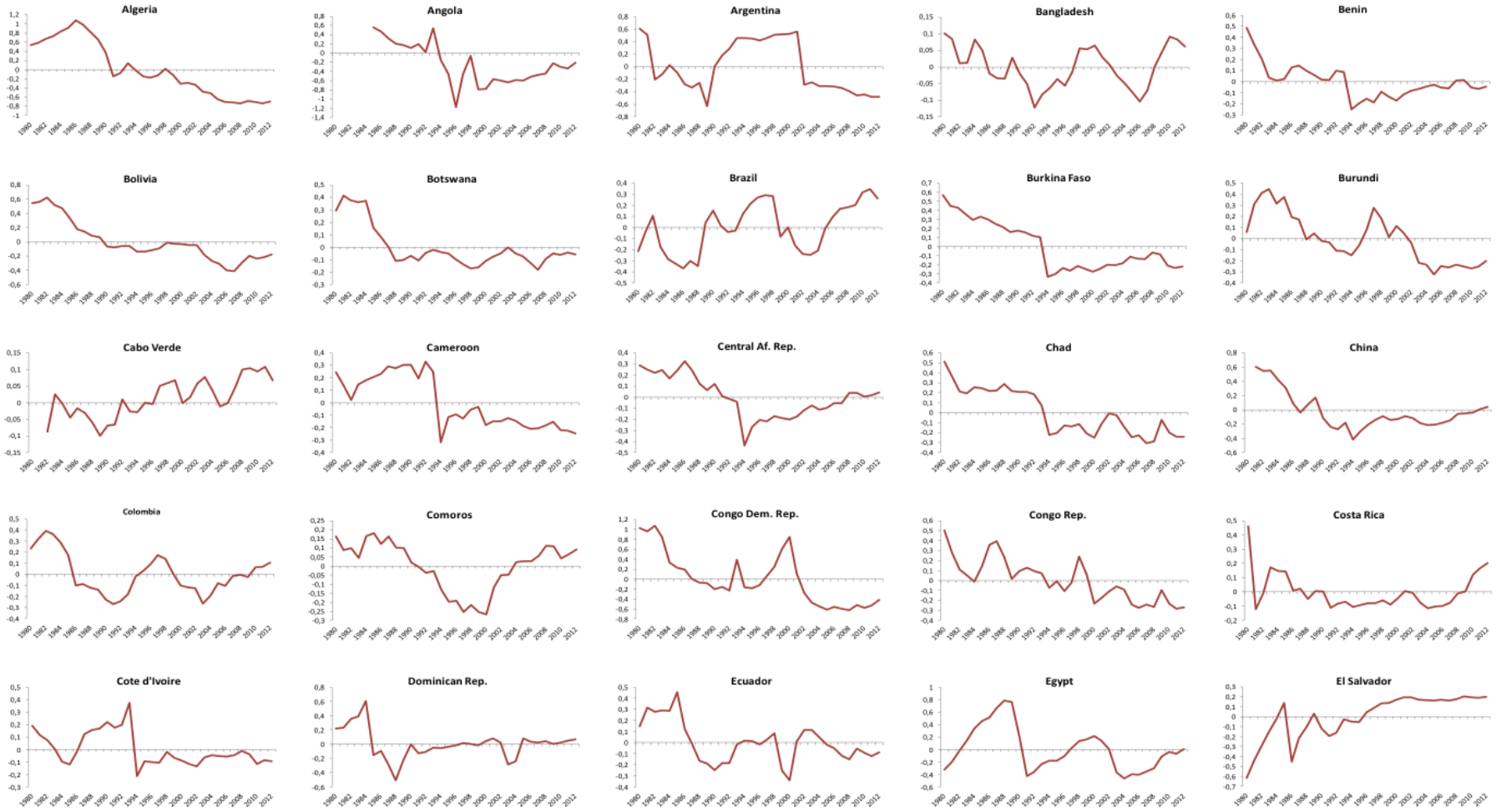

Figure C.2 — Currency misalignments

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

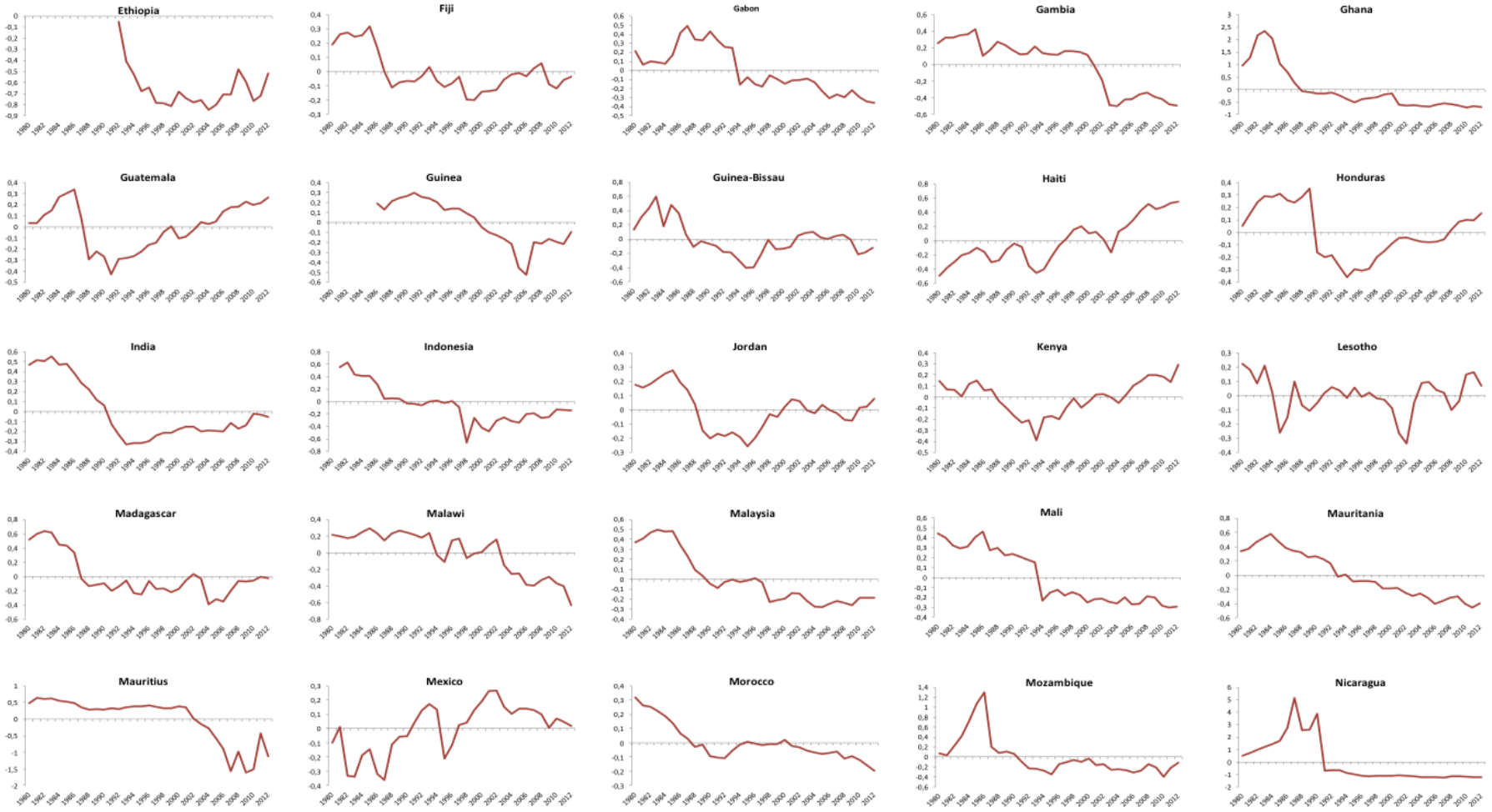

Figure C.2 — *Continued.*

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

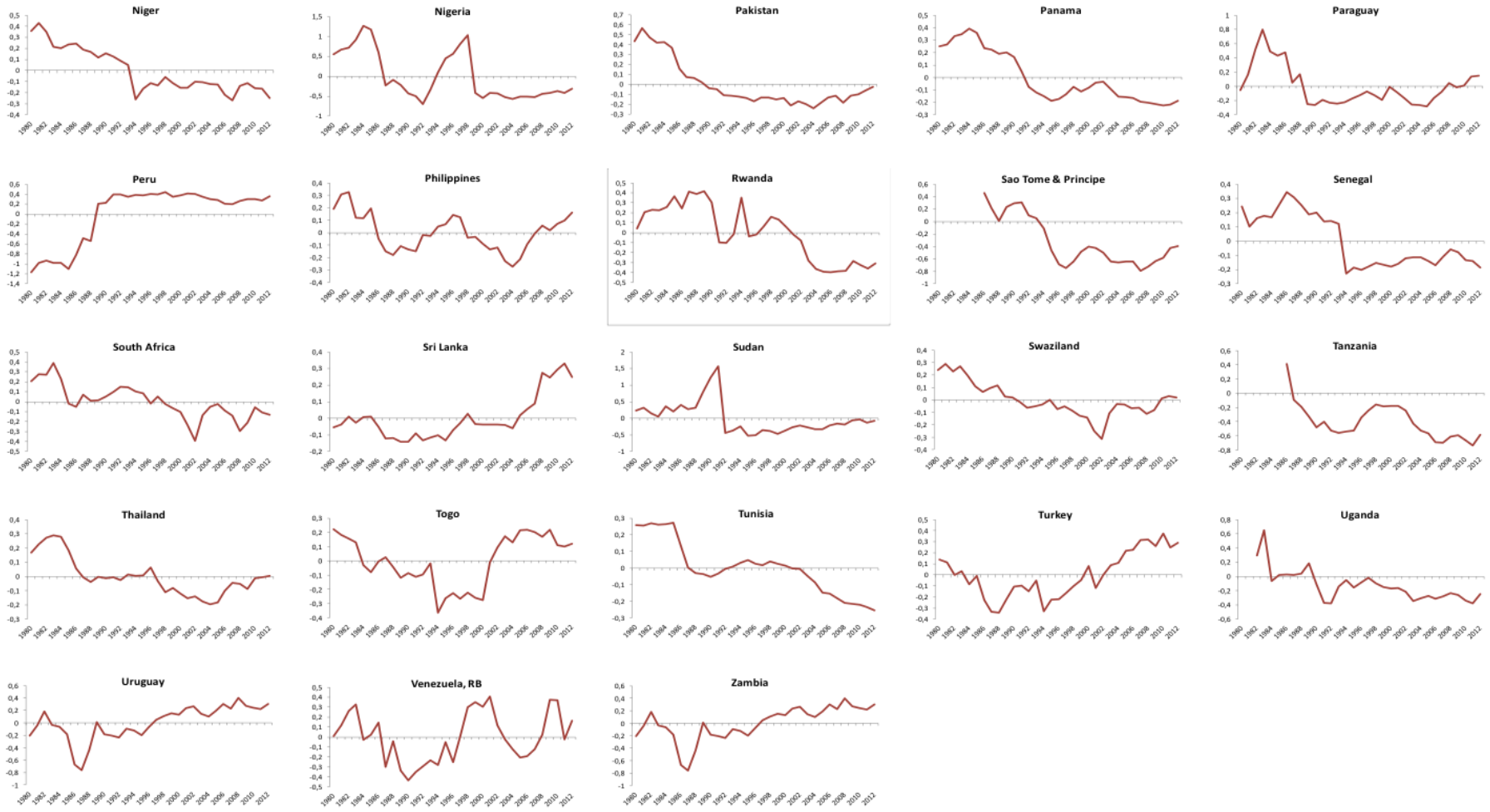

Figure C.2 — *Continued.*

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

Chapter 4

On the effectiveness of nominal exchange rate adjustment in emerging economies and developing countries*

Abstract

In this article, we assess the factors that enable a downward adjustment of the nominal exchange rate to lead to a real depreciation. To this end, we rely on panel data techniques in order to estimate the contribution over time of the key factors influencing the effectiveness of the nominal adjustment —as well as their mutual interactions, for a sample of 57 devaluation/depreciation episodes. Our results suggest that several prerequisites —namely in terms of exchange rate misalignments and accompanying macroeconomic policies— must be met to ensure that the downward adjustment of the nominal exchange rate will have the expected effect in terms of real depreciations. Furthermore, due to its inflationary impact, this nominal adjustment exerts a nonlinear effect on the dynamics of the real exchange rate, thus emphasizing the importance played by the size of the nominal adjustment.

Keywords: Currency misalignments; Emerging and Developing Countries; Macroeconomic policies; Nominal exchange rate adjustment.

JEL Classifications: C1, E6, F3, F41

*Note: A version of this chapter has been published as "Grekou, C., 2014. "On the effectiveness of nominal exchange rate adjustment in emerging and developing countries. EconomiX Working Papers 2014-61, University Paris Ouest - Nanterre La Défense, EconomiX."

4.1 Introduction

Emerging economies and developing countries facing economic hardship have often undertaken a number of macroeconomic adjustment programs, including nominal devaluations, to restore "equilibrium". In addition, several of those countries faced currency crisis that were reflected in a substantial depreciation of their nominal exchange rate.

Devaluations have been usually part of a wider policy package with the objective of lessening, through their effects on relative prices, the real costs of disequilibrium corrections (Collier and Joshi, 1989). One other positive effect expected from nominal exchange rate adjustments, whether intended or not, was the improvement of competitiveness, through a real depreciation, in order to reduce macroeconomic imbalances.[1]

Studies on this latter issue, though few, have in common to emphasize that some prerequisites must be fulfilled to ensure that a downward adjustment of the nominal exchange rate will be effective, i.e. will achieve a real depreciation. These prerequisites include, among others, those relating to the institutional environment, the exchange rate system, the wage indexation policies and stabilization policies (Edwards, 1989; Edwards and Santaella, 1992; Morrisson, Lafay and Dessus, 1993; Guillaumont and Guillaumont, 1995; inter alios). However, while the theoretical literature is well aware of the role of these prerequisites, the empirical literature offers very little, if any, quantitative estimates. In particular, most of these empirical studies, except Guillaumont and Guillaumont (1995), neglect the potential role exerted by the rate of the nominal adjustment itself and by the initial imbalances in which the nominal adjustment is implemented. At the same time, these studies are unable to distinguish the effects of the nominal adjustment from other characteristics potentially correlated with it. Finally, based on descriptive statistics, comparative analyses and cross-country regression analyses, most of these studies by omitting the temporal dimension cannot credibly provide evidence about likely impacts over time of nominal adjustments.

[1]For our discussion in the rest of the paper, we will generally use the term devaluation even if the exchange rate adjustment rather refers to a depreciation.

Taking account of all these issues, our paper presents an original approach which allows us to identify and to derive the contribution over time of the key factors influencing the effectiveness of a downward adjustment of the nominal exchange rate —as well as their mutual interactions. Our empirical analysis is carried out in two stages. First, we develop a sample of downward adjustment of the nominal exchange rate (including devaluation episodes) for a set of developing and emerging countries and assess real exchange rate misalignments prior to these episodes. Second, relying on this sample, we assess the effectiveness of nominal adjustment, i.e. the degree to which movements in the nominal exchange rate are transmitted to those of the real exchange rate; and investigate the key factors influencing their effectiveness. Specifically, we place special emphasis on three factors omitted, or at least, misspecified by the literature, i.e. the importance of: *(i)* the economic environment, *(ii)* the size of the nominal adjustment, and *(iii)* the initial disequilibrium situation —proxied here by the distortion of the real exchange rate.

The paper contributes to the literature in two respects. First, from a methodological point of view, we add a time series dimension by relying on panel data techniques —comparatively to previous studies based on cross-section regressions. In doing so, we are able to assess the contribution over time of the different factors that may contribute to the effectiveness of nominal adjustment. In addition, we consider a wider sample of episodes compared to previous studies. Second, we extend the existing literature by assessing in the same unified framework the impact of the economic/socio-political environment, of the size of the nominal adjustment and of the initial currency misalignment. In particular, we analyze the magnitude of the two latter effects over time, and control for their possible interrelations through their impact on inflation.

While our results confirm the importance of appropriate accompanying macroeconomic policies., they also highlight the initial real exchange rate misalignment and the size of the nominal adjustment as relevant *ex ante* effectiveness' factors. Furthermore, we show that, due to their inflationary impact, a downward adjustment of the nominal exchange rate exerts a nonlinear effect on the dynamics of the real exchange rate, thus highlighting the importance played by the size of the nominal adjustment.

The rest of the paper is organized as follows. Section 2 sets the background for our analysis by including the main contributions of the existing literature in a unified framework. In Section 3, we present our methodological approaches as well as the data. The results and related comments are displayed in Section 4. Section 5 is devoted to robustness analysis. Finally, Section 6 concludes.

4.2 On the effectiveness of nominal adjustment

4.2.1 Theoretical and empirical background

A number of studies, among them the noticeable contributions of Edwards (1988, 1989, 1992, 1994), have addressed the issue of the effectiveness of nominal exchange rate adjustment, i.e. the extent to which it may generate a real depreciation.

Edwards (1988) derived from a model of a small open economy with three goods (exportables, importables and nontradables) the following equation describing the dynamics of the real exchange rate in the short/medium run:

$$\Delta q_t = \beta \underbrace{(q_t^* - q_{t-1})}_{A} - \gamma \underbrace{(Z_t - Z_t^*)}_{B} + \Phi \underbrace{(e_t - e_{t-1})}_{C} - \omega \underbrace{(PMPR_t - PMPR_{t-1})}_{D} \tag{4.1}$$

where q_t and e_t are respectively the real and nominal exchange rates (expressed in log). An increase in e_t (resp. q_t) indicates a nominal (resp. real) depreciation of the domestic currency. q_t^* is the equilibrium real exchange rate, i.e. that prevailing when the economy reaches both internal and external balances[2] and is explained by a set of real variables, called *fundamentals*. Z_t is an index of macroeconomic policies, and Z_t^* is the sustainable level of macroeconomic policies. $PMPR_t$ stands for the parallel —black— market premium.[3]

According to equation (4.1), the dynamics of the real exchange rates is driven by changes in the nominal exchange rate (term C), measured by the coefficient Φ, and

[2]The internal balance is reached when the nontradables goods market clears, while the external balance is defined by the steady-state value of the net external position.

[3]The inclusion of a parallel market premium is justified by the existence of dual exchange rate systems in developing countries: a fixed nominal exchange rate for commercial transactions and a freely floating nominal exchange rate for financial transactions.

other control variables that may also influence the behavior of the real exchange rates. These latter variables include three elements. First, the convergence process of the real exchange rate towards its equilibrium level —term A. Second, the consistency and/or sustainability of macroeconomic policies (term B). Finally, the last element (term D) refers to the effect exerted by changes in the parallel market premium —which can be seen as an indicator of the market distortions/pressures and/or of the confidence in the economic authorities.

If equation (4.1) has the advantage of considering the effectiveness of devaluations a nominal adjustment —through the coefficientΦ— by controlling with the main factors that can also influence the dynamics of real exchange rates in the short/medium run, it however suffers from ignoring other key elements that may influence devaluations' the effectiveness of a nominal adjustment.

4.2.2 Interaction between nominal adjustment and inflation dynamics

One of these key elements refers to the size of the nominal adjustment and its interaction with inflation. Indeed, a downward adjustment of the nominal exchange rate may exert a direct inflationary effect. The magnitude and timing of this effect are uncertain and dependent on the exchange rate pass-through as well as the size of the nominal adjustment. On the one hand, a too weak adjustment could fail in improving the economic situation and could thus lead to other nominal adjustments, triggering in turn an increasingly inflation (Kiguel, 1994; Guillaumont and Guillaumont, 1995). This idea has been investigated by Guillaumont and Guillaumont (1995). In their analysis based on devaluation episodes, they highlight the importance of spurring surprise devaluations in order to avoid rising inflationary expectations: the more devaluation is frequent, the more inflation expectations will be widespread. Thus, with inflation expectations closer to real inflation, the devaluation is likely to be less effective. This consideration is in line with the results evidenced by Edwards (1989) who finds for stepwise devaluations a very low success rate. On the other hand, a too large nominal adjustment could trigger unnecessary inflationary pressures that would annihilate its expected effects. Guillaumont and

Guillaumont (1995) discuss this issue and note an ambivalent relationship between the size of a devaluation and its effectiveness due to an effect which they describe as a *saturation effect*. Their argumentation is built around the idea that a devaluation, by decreasing the relative price of nontradable goods (the main one being labor), implies a reduction in the real wage and is then likely to face an increasing social resistance. Thus, fiscal and monetary policies aimed at containing the nominal increase in the labor price will be even more difficult to implement if the nominal devaluation —and thus the increase in the relative price of tradable goods— is too substantial. Hence, according to Guillaumont and Guillaumont (1995) the marginal effectiveness of devaluation could be decreasing; it could probably have no impact, or even be negative if the devaluation exacerbates social claims.[4] Then, the relationship between changes in nominal exchange rates and changes in real exchange rates is likely to be nonlinear, depending on the size of the nominal adjustment —because of its inflationary effect. Following Guillaumont and Guillaumont (1995), we take into account this potential nonlinear relationship by considering a quadratic function of the nominal exchange rate's variation.

Furthermore, to capture the effect of the socio-political environment, we also include a number of variables intended to reflect this context.[5] Usually, nominal adjustment in emerging and developing countries have coincided with episodes in which they were forced to abandon the peg. Due to its urgent nature, nominal adjustments often trigger unpopular measures (e.g. lower subsidies, increased or new taxes, reduction of the public wage bill). These unpopular measures in turn generate an extremely tense political and social climate that typically ends up with unrests (strikes or public protests), contributing thus significantly to inflation (Aisen and Veiga, 2005). In such context, some governments have been "forced" to ease or even cancel the stabilization programs undertook before or along with the switch of the exchange rate regime, thereby limiting the effectiveness of the nominal adjustment (e.g. Ecuador 1982, Zambia 84, Nigeria 1988, Côte d'Ivoire 1990).[6] These important social and political costs have therefore led policy makers and international

[4]Social claims can be seen as an increasing function of inflation; the more the inflation, the more the social claims.

[5]Further details will be given in the empirical section.

[6]For further examples, see Morrisson (1996).

organizations (namely, IMF) to precede devaluation by adjustment programs —in some cases— in order to enhance the effectiveness of the former. The importance of the socio-political context is therefore noticeable and should be taken into account.

The empirical framework of Edwards can then be extended by taking into account the additional abovementioned factors:

$$\Delta q_{i,t} = \ \beta \ Mis_{i,t-1} + \gamma \ Macro_{i,t} + \Phi_1 \ \Delta e_{i,t} + \Phi_2 \Delta e_{i,t}^2 + \lambda \ SP_{i,t} \qquad (4.2)$$

where $\Delta q_{i,t}$ (resp. $\Delta e_{i,t}$) denotes changes in the real (resp. nominal) effective exchange rate; $Mis_{i,t-1}$ stands for the difference between the equilibrium real exchange rate and the lagged value of the observed real effective exchange rate $(q^*_{i,t} - q_{i,t-1})$. $Macro_{i,t}$ is the vector including the macroeconomic policy variables; $SP_{i,t}$ is a vector containing socio-political variables; $\Delta e_{i,t}^2$ is the squared value of the nominal exchange rate's variation — which stands for the *saturation effect*.

4.2.3 The importance of the economic environment

A further specification issue raised by equation (4.1) is to what extend the effectiveness of nominal exchange rate adjustment can be affected by the economic environment. A number of studies have addressed this issue.

In particular, given that a downward adjustment of the nominal exchange rate aims at restoring macroeconomic equilibrium through a real depreciation, those studies stress that this kind of adjustment should be implemented in situations where the real exchange rate is overvalued (see among others Edwards, 1989; Guillaumont and Guillaumont, 1995). Indeed, in this context, a downward adjustment of the nominal exchange rate can be useful to restore macroeconomic balance since it helps avoiding the costly and lengthy process consisting in putting and keeping the domestic inflation below the international level in order to generate a real depreciation. A nominal adjustment is thus particularly useful when prices and wages movements are rigid downward. Also, the effectiveness of such adjustment is even greater in low inflation countries —where prices and wages adjust relatively slowly— because in that case, it is more likely to affect the real exchange rate (Abbritti and Fahr, 2011).

Political economy approaches, also dealing with initial conditions, focus on the importance of institutional determinants in the successfulness of adjustment programs (see among others, Cukierman et al., 1992; Edwards and Santaella, 1992; Morrisson et al., 1993; Edwards, 1994). Evidence from this literature suggest that political stability is a key factor in the success of any adjustment program and more particularly of devaluations. Some factors such as political cycles (proximity of the elections, government turnover rates) and the socio-political unrest appear to strongly influence the implementation of fiscal adjustments and anti-inflationary policies which are necessary for the success of devaluation.[7]

Regarding the macroeconomic policies accompanying a devaluation, it has been widely argued, with reasons, that they play a key role in the effectiveness of the exchange rate policy (Khan and Lizondo, 1987; Edwards, 1989). Indeed, nominal adjustments are often implemented —through a devaluation— or occur when the real exchange rate is considerably overvalued. These overvaluations are in most cases the result of inconsistent macroeconomic policies which cause a decline in international reserves. Expansive fiscal and/or monetary policies are often the roots of this problem, as they may cause an increase of the domestic inflation rate and a deterioration of current account, thus making almost inevitable the adjustment if the situation persists.[8] Similarly, speculative pressures on currencies have often been fuelled by inconsistent policies and/or the uncertainty over the future course of policies. Thus, an essential step in the adjustment program seems to be the re-establishment of consistent macroeconomic policies (i.e., fiscal balance and/or financial monetary discipline). In particular, aggregate demand restraint measures are usually recommended in order to limit inflationary pressures caused by the nominal adjustment. These inflationary pressures might have different sources. They can be the result of the shift of consumption from imported to cheaper domestic goods (demand-pull inflation). The increase in import prices can also lead to an increase in production costs. As a result, the increased costs are transmitted to consumer

[7]Note however that, despite the important lessons drawn from these studies, it is worth recalling the potentially endogenous nature of political unrest. Indeed, as pointed out by Guillaumont and Guillaumont (1995), devaluation may itself be a factor of social unrest because it reduces real wages. For Morrisson (1996), social unrest are the result of the inflation generated by the devaluation itself.

[8]Naturally, a real shock (e.g. a term-of-trade shock) can also be the cause of macroeconomic imbalances.

prices, thus raising the general price level (cost-push inflation).[9] Finally, along with demand restraint measures, any indexation scheme linking nominal wages to prices should be eliminated in order to contain inflation.

A number of studies (see among others; Edwards, 1999 and 2001; Stiglitz, 2002) also mention the potential role played by exchange control policies in stabilizing the economy, arguing that restricting capital mobility would reduce macroeconomic instability. For countries facing a currency crisis, the introduction of capital controls presents another interest by giving additional leeway to restructure their economies (Edwards, 1999). The more recent literature on capital flows provides complementary insights on this issue. As highlighted by some studies (Calvo, et al., 1993; Saborowski, 2009; Combes et al., 2011), the significant increase in capital inflows that has followed the financial openness of most developing and emerging countries has often resulted in an appreciation of their real exchange rates, which has turned in a real overvaluation. This situation, by undermining the competitiveness and widening current account and fiscal deficits, creates major problems for macroeconomic management. In case of sudden stops in capital flows, the fiscal position would be more problematic, therefore making the fiscal adjustment needed to achieve real depreciation more difficult.[10] Exchange rates and capital controls policies, through their stabilizing effects, might therefore play an important role in the successfulness of a downward nominal adjustment.

It is then key to examine how the marginal effect of changes in the nominal exchange rate on the dynamics of real exchange rates varies as a function of the economic environment. To deal with this issue, we extend equation (4.2) by considering an interaction model of the form:

$$\begin{aligned}\Delta q_{i,t} = \beta Mis_{i,t-1} + \Phi_1 \Delta e_{i,t} + \Phi_2 \Delta e_{i,t}^2 + \gamma_1\ Macro_{i,t} + \gamma_2\ Macro_{i,t} \times \Delta e_{i,t} \\ + \lambda_1 SP_{i,t} + \lambda_2 SP_{i,t} \times \Delta e_{i,t}\end{aligned} \tag{4.3}$$

[9] It is worthwhile noting that the degree of the exchange rate pass-through to the prices depends on the market structures. For instance, if the domestic market is close to imperfect competition, producers may maximize their profits by reflecting the changes in the exchange rate into sales prices ("producer currency pricing" behaviour; see Obstfeld and Rogoff, 1995). In case of more competitive markets, producers are forced to bear a part of the exchange rate changes by reducing their mark-ups ("pricing to market" behaviour; see Krugman, 1987).

[10] See Calvo (2003) for a review of literature on sudden stops.

Then equation (4.3) offers the advantage of isolating the direct effect of the nominal adjustment on the real exchange rate (including a saturation effect) apart from those attributable to the economic environment (interaction terms).

4.3 The empirical framework

4.3.1 Investigating the effectiveness over time of nominal adjustment

Since we are interested in assessing the effectiveness of downward adjustments of the nominal exchange rate over the short and medium terms, we consider a time window of four years, i.e. from the adjustment's year to the three following years. For each year, variables are taken in variation with respect to the year prior to the nominal adjustment.[11] Equation (4.3) can then be rewritten as follows:

$$\begin{aligned}\Delta q_{i,t} = \beta Mis_{i,t_k-1} + \Phi_1 \Delta e_{i,t_k} + \Phi_2 \Delta e^2_{i,t_k} + \gamma_1\ Macro_{i,t_k} + \gamma_2\ Macro_{i,t_k} \times \Delta e_{i,t_k} \\ + \lambda_1 SP_{i,t_k} + \lambda_2 SP_{i,t_k} \times \Delta e_{i,t_k}\end{aligned} \tag{4.4}$$

where $t_k = 0, \ldots, 3$ indicates the considered time horizon (t_0: the adjustment's year; $t_{1,2,3}$: 1, 2, 3 year(s) after the adjustment).

Before proceeding to the estimation, further corrections have to be made. Indeed, equation (4.4) cannot be estimated since the equilibrium levels of real exchange rates ($q^*_{i,t}$) are unknown. These latter need to be determined in order to make equation (4.4) operational. This will be done in the next subsection.

Moreover, in its current form, equation (4.4) does not yet reflect completely the different mechanisms described in the previous section. The first problem involves the appropriate definition of the initial distortion of the real exchange rate. The variable Mis_{i,t_k-1} does not adequately capture the importance of this initial distortion; rather it reflects the autonomous tendency for the real exchange rate to reach its equilibrium level. To fully capture the effects exerted by the initial distortion of the real exchange rate, we include an interaction term between Mis_{i,t_k-1} and a

[11] Edwards and Santaella (1992) adopt the same approach.

dummy variable for the devaluation's adjustment's year ($Dum_{k=0}$): $Init.Dist_{i,t_k-1}$ = $Dum_{k=0}$*Mis_{i,t_k-1}.

Another important element to be taken into consideration is the *saturation effect*. As stated earlier, this effect implies a potential nonlinear relationship between changes in the nominal and the real exchange rates, depending on the threshold reached by the nominal adjustment and the subsequent increase in inflation. However, the effect of nominal exchange rates' variations on inflation, as it can be seen in Figure 4.1, tends not to be persistent. Indeed, the inflation rate (CPI-based) reaches a peak during the adjustment's year (at most one year for high inflation countries), then returns to its pre-adjustment level no more than two years after the nominal adjustment.[12]

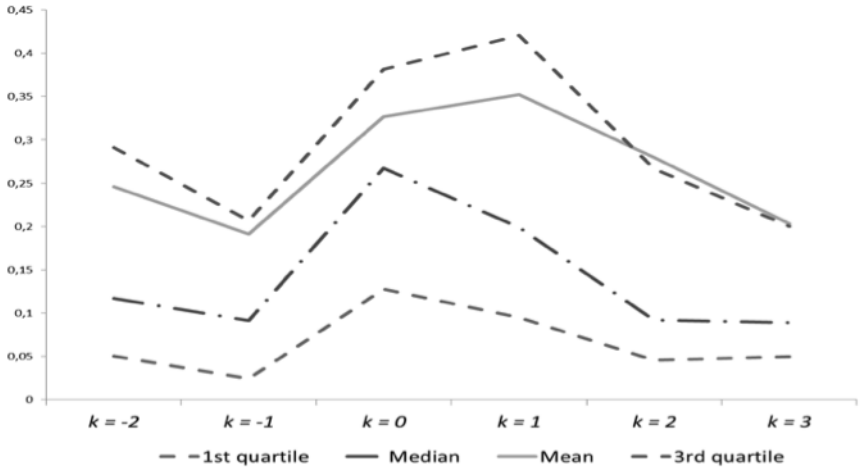

Figure 4.1 — Inflation rate

Note: We do not represent the extremums as they distort the graph, making thus unobservable/unclear the non-persistence of inflation.

Therefore it is quite unlikely that the *saturation effect* persists over time and, as a consequence, the coefficient of the squared value of the nominal effective exchange rates' variations —in equation (4.4)— might not adequately reflect this time-varying

[12]Borensztein and De Gregorio (1999) studied the effect of devaluation on inflation and made the same observations. They argued that the non-persistence of the effect of devaluation on inflation is not surprising since if fundamental determinants of inflation do not change after the devaluation, the economy should return to its initial level of inflation. Note however that for some Latin America countries, the inflation has followed a different path specifically during the debt crisis. Inflation has remained higher than its pre-devaluation level, and even in some cases countries have experienced periods of hyperinflation. A possible explanation may stem from the fact that these countries devalued with already high inflation rates. This is also in line with the findings of Cebotari (2013). See Figure C.1 in Appendix C for the evolution of inflation for each considered country.

property. To overcome this drawback, we introduce other time dummy variables for the three years following the nominal adjustment and include interaction terms between these dummy variables and the squared value of nominal exchange rates' variations.

All in all, the equation to be estimated is then:

$$\begin{aligned}\Delta q_{i,t} = \ \alpha_i + \ \beta_1 \ Mis_{i,t_k-1} + \ \Phi_1 \ \Delta e_{i,t_k} + \ \sum_{j=0}^{3} \ \Phi_{2,k} \ Dum_{k=j} * \Delta e^2_{i,t_k} + \ \lambda_1 \ SP_{i,t_k} \\ + \ \beta_2 \ Init.Dist_{i,t_k} * \Delta e_{i,t_k} + \ \gamma_1 \ Macro_{i,t_k} + \ \gamma_2 \ Macro_{i,t_k} * \Delta e_{i,t_k} \\ + \ \lambda_2 \ SP_{i,t_k} * \Delta e_{i,t_k} + \ \sum_{j=0}^{2} \omega_j \ Dum_{k=j} + \ \varepsilon_{i,t_k}\end{aligned} \tag{4.5}$$

where α_i stands for the country-fixed effects, and ε_{i,t_k} is an error term.

4.3.2 Assessing equilibrium exchange rates

Equilibrium exchange rates are, by definition, unobservable. To tackle this issue, we rely on the Behavioral Equilibrium Exchange Rate (BEER) introduced by Clark and MacDonald (1998).[13] The BEER approach consists in estimating a long-run relationship between the observed real effective exchange rate and a set of fundamentals. This estimated long-run relationship is assumed to give an assessment of the real equilibrium exchange rate.

To select our real effective exchange rate fundamentals, we resort to a —preliminary— Bayesian analysis to account for the multiplicity of potential models and fundamentals inherent to the BEER approach. Indeed, Bayesian approaches, by providing coherent methodologies to address the issue of model uncertainty, allows the identification of the most relevant fundamentals with regard to our sample of countries. More specifically, we here follow the Bayesian Averaging of Classical Estimates (BACE) approach proposed by Sala-i-Martin et al. (2004) and assume diffuse priors.[14] This latter assumption is made to reflect our ignorance about (or unwilling

[13]For extensive survey on the BEER approach and related concepts (e.g. PPP, FEER, NATREX) we refer to Driver and Westaway (2005).

[14]BACE combines the averaging of estimates across models, with classical ordinary least- squares (OLS) estimation which comes from the assumption of diffuse priors. I thank the authors for

to specify) prior beliefs. Our results show that, among an initial set of 8 potential determinants[15], 3 are found significantly related to the long-run behavior of real exchange rates: the terms of trade (*tot*), the relative productivity (*rprod*), and the net foreign asset position (*nfa*).[16] Moreover, a positive relationship between the real effective exchange rate and each of these 3 fundamentals is expected. Indeed, an increase in the relative productivity as well as an improvement in the terms of trade and the net foreign asset position tend to appreciate in the long run the real effective exchange rate. The equation to be estimated is therefore as follows:

$$q_{i,t} = \alpha_i + \beta_1 \, rprod_{i,t} + \beta_2 \, tot_{i,t} + \beta_3 \, nfa_{i,t} + \varepsilon_{i,t} \tag{4.6}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ respectively indicate the individual and temporal dimension of the panel. $q_{i,t}$ denotes the real effective exchange rate; α_i are the country-fixed effects and $\varepsilon_{i,t}$ is an error term.

The following usual procedure is used to estimate equation (4.6). The first step consists in determining the order of integration of the variables (real effective exchange rates and fundamentals) and then in testing the existence of a cointegration relationship between the real effective exchange rate and the fundamentals. If the cointegration hypothesis is not rejected, the coefficients of the long-run relationship will be estimated using an efficient panel estimation procedure.

4.3.3 Selecting nominal adjustment episodes

We define a downward nominal adjustment as an episode in which: *(i)* the depreciation of the nominal exchange rate must be greater or equals to 15%, and *(ii)* no devaluation/depreciation has occurred during the three years preceding the selected episode, nor during the three following years. The threshold chosen for the nominal adjustment (i.e. at least 15%), while arbitrary, is used by most empirical studies (Edwards 1989, 1992; Frankel and Rose 1996; Milesi-Ferretti and Razin 1998;

making their original GAUSS code available:
http://www.nhh.no/Default.aspx?ID=3075

[15] Terms of trade, government spending, foreign direct investment, net foreign asset position, official development aid, relative productivity, openness, and investment.

[16] To save space, the BACE results are displayed in Table C.1 in Appendix C. We follow the methodology proposed by Moral-Benito (2012) for the implementation of the BACE analysis in the panel data context.

Céspedes 2005). The first explanation is that during large devaluation/depreciation episodes all effects tend to be stronger and therefore easier to highlight. The second is that small devaluations/depreciations frequently happen without being sufficiently spaced in time to investigate their respective effects. Finally, the selected episodes correspond to both *de jure* official decision and *de facto* observed variations. *De facto* episodes are identified by assessing changes in the nominal effective exchange rate.[17] *De jure* episodes are selected from various issues of the *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* (AREAER, International Monetary fund) as well as other sources.[18]

These criteria allow to fulfill two main objectives. Firstly, by defining a devaluation/depreciation episode based on both *de jure* and *de facto* adjustments in exchange rates as well as on sizeable changes in the nominal effective exchange rate, we exclude from our sample unsuccessful speculative attacks that are usually taken into account by studies focusing on financial crises (see among others; Eichengreen et al., 1995; Kaminsky and Reinhart, 1999). Secondly, by imposing that none devaluation/depreciation has occurred during the three years prior and following the selected episode, we definitely focus our attention on the short-medium run. Our selection criteria are then a bit more restrictive than those of Edwards (1989, 1992) which only exclude devaluations/depreciations that have occurred two years before and after the downward adjustment of the nominal exchange rate. Guillaumont and Guillaumont (1995) do not impose such a constraint and select devaluation episodes relying on changes in the nominal effective exchange rate. Their analysis has then a major drawback: it does not clearly define the time horizon of devaluations' effects and therefore leads to select, for a country, several episodes that have occurred, but not sufficiently remote in time to investigate their effectiveness.

Overall, our selection criteria lead to a sample of 57 devaluation/depreciation episodes. Those episodes have occurred over the 1976-2009 period in 40 developing and emerging countries. They include most notable Latin American currency

[17]Note that since we are working with annual data, devaluations/depreciations that occurred at year-end are recorded as they had occurred the following year because the most important variation of the exchange rate will be that of the following year. This choice was dictated by the data analysis.

[18]Kaminsky's currency crises database (2006), and information from the Historical Exchange Rate Regime database (International Economics). This latter is available at: http://intl.econ.cuhk.edu.hk/exchange$_r ate_r egime/index.php?cid = 20$

crises (e.g. Argentina 2002; Brazil 1999; Mexico 1994 and 2001; Venezuela 2002), some Asian and European crises (e.g. Philippines 1997; Russia 1998; Turkey 1994 and 2001) and devaluations that have occurred in African countries (namely the CFA Franc devaluation in 1994). Table A.2 in Appendix A provides further details regarding the selected episodes.

4.3.4 Selected indicators

The real effective exchange rate is the dependent variable. It is calculated as the weighted average of real bilateral exchange rates against trade partners. The devaluation/depreciation episode is defined by assessing changes in the nominal effective exchange rate. Those multilateral measures give a more accurate picture of nominal adjustments as they reduce a considerable bias owing from the use of the bilateral exchange rates *vis-à-vis* the US dollar: indeed a country's currency could depreciate against the US dollar, while appreciating against trading partners' currencies. Both real and nominal effective exchange rates are from the Bruegel's database.

Our set of macroeconomic indicators includes variables intended to reflect the economic environment as well as the macroeconomic policies implemented along with the devaluation/depreciation.[19]

To capture the nature of the fiscal policy, we include the fiscal balance. Since an overvalued real exchange rate is usually the result of an inconsistent fiscal policy —that usually results in increasing fiscal deficits, the improvement in the fiscal balance by helping to limit the real exchange rate's appreciation, can attenuate the inflationary effects of a devaluation/depreciation. The effects of the devaluation/depreciation will then be more effective if it is accompanied by a fiscal adjustment.[20] In the same vein, we consider the effects of the monetary policy by including the money —and quasi-money— supply (M2) and two indexes of the domestic credit: *(i)* the domestic credit to public sector, and *(ii)* the ratio of domestic credit to public

[19]We include few macroeconomic indicators to limit endogeneity and simultaneity problems.

[20]We do not discuss the issue of the means by which the fiscal deficits are reduced (e.g. increase in taxes, government expenditures reduction). Even if these ways of reducing the fiscal deficits have different implications regarding the real exchange rate dynamics, they always go the same direction: the reduction of the fiscal deficit limits the appreciation of the real exchange rate or even reduce the overvaluation; the only difference lies in the degree of this effect. For a discussion on fiscal deficits reduction and real exchange rate dynamics, see Khan and Lizondo (1987).

sector to total domestic credit. As for fiscal policies, expansionary monetary policies are expected to seriously weaken the effectiveness of devaluations/depreciations. We also take into account effects that may be exerted by possible changes in the exchange rate regime. Indeed, devaluation/depreciation episodes are often followed by switch in exchange rate regimes that may impact the adjustment process of the real exchange rate or the implementation and the success of stabilization programs (Gosh et al., 2003). Following the distinction made in the selected devaluation/depreciation episodes, we consider the *de jure* and the *de facto* exchange rate regime classifications. We here rely on the Reinhart and Rogoff de facto classification (see Ilzetzki, Reinhart and Rogoff 2011). We also include the Chinn-Ito *kaopen* index (Chinn and Ito, 2008) in order to take into account the existence of exchange controls.[21]

Finally, in order to include the potential role that the socio-political context may play, we add some variables capturing the political climate as well as the electoral cycle since the proximity of election can impact the real exchange rate dynamics.[22] We use several available indicators: the *Political violence* index —from the *Center for Systemic Peace*— to proxy the socio-political context and the *Political Terror* index (from the *Political Terror Scale*) which can be seen as a global indicator encompassing both civil and political rights. Additionally, we create two dummy variables: *(i)* "*Conflict*" which scores 1 in case of conflict —armed or not— and 0 otherwise; and *(ii)* "*Election*" which scores 1 the year of elections, 0 otherwise, to account for the electoral cycle.

All data are annual. Sources, definitions and calculation details are provided in Appendix A.1.

4.4 Results

4.4.1 Estimating equilibrium exchange rates

The first step in the estimation of equilibrium exchange rates consists in applying unit root and cointegration tests. We begin by testing the presence of unit root in

[21] *kaopen* is a good proxy for restrictions on capital account transactions and current account transactions.

[22] See, among others, Rogoff and Sibert (1988).

our series (the real effective exchange rates and their fundamentals). To do so, we rely on the second-generation unit root tests (Choi 2002; Pesaran 2003) which relax the assumption of cross-sectional independence.[23] Both tests are based on the null hypothesis of unit root. Results are displayed in Table B.2 in Appendix B, and as it can be seen, all tests conclude that the variables —*reer*, *rprod*, *tot*, and *nfa*— are integrated of order one. We then test for the existence of a long-run relationship between the real effective exchange rate and the fundamentals. To this end, we perform the Westerlund (2007) cointegration test which, in addition to be robust to cross-sectional dependence, allows for various form of heterogeneity.[24] As displayed in Table B.3 in Appendix B, results indicate that there is a cointegration relationship between the real effective exchange rate and the three identified fundamentals. We can therefore estimate the cointegration relationship.

To do so, we rely on the Pooled Mean Group (PMG; see Pesaran, Shin and Smith 1999) procedure. The choice of the PMG estimator is mainly motivated by the fact that it allows a greater degree of heterogeneity among the countries —compared to other panel cointegration estimation procedures (FMOLS, DOLS)— which is particularly suitable since we are dealing with quite heterogeneous countries. Estimation results of the long-run relationship are reported in Table 4.1. They are in accordance with theory and existing empirical results: an increase in the relative productivity as well as an improvement in the terms of trade and the net foreign asset position lead to an appreciation of the equilibrium real exchange rate in the long-run. Furthermore, only the terms of trade impact the real exchange rate in the short-run.[25]

The initial distortion of the real exchange rate, Mis_{i,t_k-1}, is then derived from the difference between the observed real effective exchange rate at $t-1$ ($q_{i,t-1}$) and its equilibrium level at t ($q^*_{i,t}$) which corresponds to the fitted value of $q_{i,t}$ obtained

[23]The use of these second-generation tests is validated by the cross-sectional dependence test, the CD test (Pesaran, 2004). See Table B.1 in Appendix B.

[24]Among the four tests that constitutes the Westerlund (2007)'s test, two are designed to test the alternative hypothesis that the panel is cointegrated as a whole while the other two test the alternative that at least one unit is cointegrated. The null of the test is that there is no cointegration.

[25]The coefficient of the error-correction term (*ec.*) — -0.212 — corresponds to half-life of approximatively 3.60 years.

Table 4.1 — PMG estimation results

	Coef.	*z*
Long-run dynamic		
rprod	0.132**	2.28
tot	0.358***	8.96
nfa	0.108***	2.64
Short-run dynamic		
ec.	-0.212***	-8.39
rprod	0.017	0.04
tot	-0.087**	-1.99
nfa	-0.080	-1.38
const.	0.260***	8.90

Note: ***, **, and * denote respectively significance at 1%, 5% and 10% level. Estimates over the 1975-2011 period.

from the estimation of equation (4.6):[26]

$$Mis_{i,t_k-1} = q^*_{i,t} - q_{i,t-1} \tag{4.7}$$

4.4.2 Factors influencing the effectiveness of nominal adjustments

In order to investigate the potential factors that allow devaluations/depreciations to be effective, we first estimate an equation that includes usual determinants of the dynamics of the real exchange rates and their interactions with the change in the nominal exchange rate (as described by equation (4.1)). The effect of the magnitude of the devaluation/depreciation, the importance of the initial distortion of the real exchange rates, the effect of changes in the exchange rate regime, the importance of the socio-political context and the economic environment are progressively considered till we obtain the complete model, described by equation (4.5). Results are displayed in Table 4.2.[27]

As it can be seen, in all the regressions, a nominal devaluation/depreciation generates —*ceteris paribus*— a real depreciation but the pass-through proves to be rather weak. Indeed, the associated coefficient varies between 0.19 and 0.58, meaning that the response of the real effective exchange rate following an infinitesimal variation of the nominal effective exchange rate is, in average, around two fifths

[26]Figure C.2.2 in Appendix C displays the obtained exchange rate misalignments.

[27]For brevity, our comments focus only on the direct effects of a devaluation on the real exchange rate and those attributable to the economic environment (interaction terms). Also note that in "Section C.3" in Appendix C, we present a preliminary analysis of the data —i.e. stylized facts.

(a little bit less than two third at best). This result may be explained by the impact that exchange rate movements exert on prices and could then reveal a strong exchange rate pass-through on domestic prices. From a policy viewpoint, this result might justify an overshooting of the initially required devaluation/depreciation rate to obtain a significant depreciation of the real exchange rate. However, this overshooting could also be inadequate due to a potential nonlinear effect of the devaluation/depreciation on the real exchange rate.

Indeed, results —reported in columns 2.2 to 2.7— confirm this nonlinear effect as the coefficient of the squared value of the devaluation/depreciation rate —i.e. the change in the nominal exchange rate in the first year— has a significant and negative sign in all regressions. However, in all cases, the coefficient becomes positive and significant from the second year following the devaluation/depreciation episode. This transitory negative effect could be explained by the immediate inflationary effect —as observed in Figure 4.1— coupled with the delay in policy responses —after the devaluation/depreciation— which may significantly erode positive effects expected at least during the first year. This result therefore confirms the findings of Guillaumont and Guillaumont (1995) about the existence of a *saturation effect*. However, in contrast with their results, our findings show that this effect decreases over time as it is significant only during the devaluation/depreciation year.

It also appears that the effectiveness is directly and strongly linked to the existence of an overvalued real exchange rate before the devaluation/depreciation episode. Indeed, the coefficients associated with the initial misalignment of the real exchange rate as well as the interaction term between the initial misalignment of the real exchange rate and the change in the nominal exchange rate is negative and significant in all specifications, thus suggesting that the more the real exchange rate is overvalued prior to the devaluation/depreciation, the easier it will depreciate following the devaluation/depreciation.

Table 4.2 — Investigating the effectiveness factors

Dependent variable	$\Delta REER_k$						
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)
Effectiveness of devaluations							
$\Delta NEER_k$	0.187***	0.273***	0.348***	0.543***	0.579***	0.526***	0.547***
	(4.01)	(4.12)	(3.03)	(4.98)	(4.89)	(4.46)	(4.71)
$\Delta NEER^2 * D_{k=0}$		-0.260***	-0.150***	-0.216***	-0.300***	-0.205***	-0.291***
		(-2.93)	(-2.83)	(-3.09)	(-4.42)	(-3.92)	(-4.38)
$\Delta NEER^2 * D_{k=1}$		0.111	0.113	0.154	0.139	0.144	0.120
		(0.92)	(0.95)	(1.37)	(1.14)	(1.16)	(0.98)
$\Delta NEER^2 * D_{k=2}$		0.170***	0.177***	0.247***	0.241***	0.260***	0.229**
		(2.83)	(2.88)	(2.87)	(2.62)	(2.75)	(2.50)
$\Delta NEER^2 * D_{k=3}$		0.172***	0.177***	0.271***	0.243***	0.249***	0.237***
		(3.17)	(3.19)	(3.53)	(2.85)	(2.89)	(2.78)
$Init.dist.*\Delta NEER_k$			-0.428***	-0.517***	-0.646***	-0.503***	-0.567***
			(-3.53)	(-2.87)	(-3.27)	(-2.65)	(-3.00)
$ERR^a*\Delta NEER_k$				0.020**	0.016***	0.010**	0.012**
				(2.19)	(2.82)	(2.15)	(2.04)
$Fis.bal.*\Delta NEER_k$					-0.139**	-0.128**	-0.152**
					(-2.10)	(-2.32)	(-2.13)
$Credit^b*\Delta NEER_k$					0.174	0.298*	0.206*
					(1.61)	(1.77)	(1.92)
$M2/GDP*\Delta NEER_k$					0.393*	0.184	0.281*
					(1.69)	(1.27)	(1.95)
$kaopen*\Delta NEER_k$					0.121	0.198**	0.153
					(1.13)	(1.91)	(1.47)
$Pol.violence*\Delta NEER_k$					-0.123		
					(-1.07)		
$Pol.\ Terror*\Delta NEER_k$						0.255**	
						(2.06)	
$Conflict*\Delta NEER_k$					0.043	0.045	0.071*
					(1.55)	(1.51)	(1.95)
$Election*\Delta NEER_k$					-0.016	-0.069	-0.029
					(-0.42)	(-1.61)	(-0.78)
Control variables							
Mis_{i,t_k-1}	-0.009	-0.076	-0.041	-0.087	-0.089	-0.072	-0.085
	(-0.33)	(-1.46)	(-1.09)	(-0.94)	(-0.86)	(-0.52)	(-0.77)
ERR^a				0.035***	0.029***	0.027***	0.029***
				(4.00)	(3.03)	(2.85)	(3.01)
$Fis.bal$	-0.148**	-0.190**	-0.179*	-0.142**	-0.122**	-0.148**	-0.118*
	(-2.14)	(-2.03)	(-1.78)	(-2.09)	(-2.06)	(-2.11)	(-1.68)
$Credit^b$	0.146**	0.098*	0.102*	0.040	0.042*	0.050	0.021
	(2.34)	(1.81)	(1.84)	(1.30)	(1.99)	(1.39)	(1.17)
$M2/GDP$	0.004**	0.004**	0.007**	0.003**	0.162	0.031	0.100*
	(2.12)	(2.24)	(2.14)	(1.98)	(1.26)	(1.24)	(1.92)
$kaopen$	0.027	0.032	0.025	0.073	0.066	0.073	0.069
	(1.14)	(1.08)	(1.17)	(1.26)	(1.28)	(1.45)	(1.34)

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust t-statistics in parentheses.

a: *de facto* classification

b: Domestic credit to public sector (%GDP)

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Table 4.2 — *Continued from previous page*

Dependent variable	$\Delta REER_k$						
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)
Political violence					0.001		
					(0.03)		
Political Terror						0.036	
						(0.72)	
Conflict					0.004*	0.023*	0.008*
					(1.66)	(1.90)	(1.76)
Election					-0.001	-0.014	-0.005
					(-0.05)	(-0.89)	(-0.33)
Others							
Constant	-0.076***	-0.009	-0.024	0.059*	0.015	0.029	0.022
	(-6.19)	(-0.75)	(-0.86)	(1.87)	(0.26)	(0.49)	(0.37)
$D_{k=0}$		-0.045***	-0.051***	-0.039***	-0.043**	-0.037**	-0.038**
		(-2.83)	(-3.05)	(-2.61)	(-2.59)	(-2.24)	(-2.38)
$D_{k=1}$		-0.016	-0.012	-0.008	-0.008	-0.007	-0.005
		(-1.23)	(-0.89)	(-0.60)	(-0.64)	(-0.55)	(-0.43)
$D_{k=2}$		-0.008	-0.005	-0.002	-0.005	-0.004	-0.002
		(-0.76)	(-0.82)	(-0.22)	(-0.45)	(-0.35)	(-0.21)
Observations	228	228	228	228	228	228	228
Devaluation episodes	57	57	57	57	57	57	57
R^2	0.26	0.47	0.52	0.58	0.60	0.62	0.60

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust t-statistics in parentheses.

Controlling for changes in the exchange rate regime, our results strongly evidence that the move towards a more flexible regime after a devaluation/depreciation episode reduces the effectiveness of the nominal adjustment.[28] The coefficients are positive and highly significant in all regressions. The causes can be found in the benefits usually attributed to fixed exchange rates. Indeed, it has been extensively argued that fixed exchange rate regime, by committing countries to both monetary and fiscal discipline —and thus credibility— contribute to the creation of a stable internal economic environment (e.g. low inflation, low uncertainty on the exchange rate; see Ghosh et al., 2003) which plays a key role in the effectiveness of a devaluation/depreciation.

Regarding macroeconomic policy variables, our results confirm the role played by prudent macroeconomic policies: fiscal deficit and/or expansionary monetary policy tend to erode the depreciating effect of the devaluation/depreciation on the real exchange rate. In other words, as long as the governments are able to control their fiscal and monetary policies, they will significantly enhance the effectiveness of the

[28]For brevity, we only report the results obtained using the *de facto* classification. Results are robust to change in the exchange rate regime classification and are available upon request.

devaluation/depreciation. Finally, regarding the *de jure* financial openness, results are less clear-cut. It appears, at first sight, that the implementation of exchange control policies enhances the effectiveness of devaluations/depreciations as the coefficient associated with the interaction term between *kaopen* and the change in the nominal exchange rate is positive and statistically significant. But, the fact that the coefficient is only significant in one of the three regressions where it is included calls for caution in interpreting the results.

As regards the socio-political environment, results are rather inconclusive. Indeed, among all the indicators used, only the interaction terms between the change in the nominal exchange rate and *(i)* "*Political Terror*", and *(ii)* "*Conflict*" appear "relatively" significant —in one of three cases for *Conflict*— with the expected positive sign. This result suggests that in periods of conflicts or marked by a tense political climate, the real effective exchange rate tends to appreciate. Devaluations/depreciations occurring in such context have therefore a lower probability to be effective. This could be explained by the cost of the conflict which may place a strain on the public finances hampering by the way the fiscal adjustment, or by the inflationary effect of a tense political and social climate —as shown by Aisen and Veiga (2005). Coefficients of the other variables —i.e. "*Political violence*" and "*Elections*"— have a negative sign and are not significant. It is therefore difficult to draw any robust conclusions on the link between devaluation/depreciation's effectiveness and the socio-political context.[29]

4.5 How robust are these results?

To test the robustness of our results, we conduct a number of additional regressions by addressing two issues. First, as our results may depend on our sample of devaluation/depreciation episodes, we rely on alternative selection criteria and investigate hereafter the sensitivity of our results to the sample of devaluation/depreciation episodes. Second, we test the robustness of our findings by performing a number

[29]This inconclusive result may also be due to the quality and the relevance of the indicators used which remain questionable. Also, it could be the result of our methodological choice. Indeed, if the dependent variable was the inflation rate or even the real bilateral exchange rate, the effects of the socio-political variables might have been more noticeable. One can therefore think that the use of the real effective exchange rate blurs our perception of the effects of those variables.

of cross-sectional regressions on the different time horizons of the analysis, i.e. the year of the nominal adjustment ($k = 0$) and the three following years ($k = 1, 2, 3$).

4.5.1 Sensitivity to the sample of devaluation/depreciation episodes

Different criteria have been used in the empirical literature to select devaluation/ depreciation episodes. In this section, we check the robustness of our results by considering alternative selection criteria. To do so, we adopt the definition proposed by Milesi-Ferretti and Razin (1998), which, compared to our definition, adds two additional criteria: *(i)* the rate of nominal adjustment would have to increase by more than 10 percent compared to the previous year, and *(ii)* must be below 10 percent during the previous year. These two additional conditions restrict our initial sample to episodes in which the exchange rate was relatively stable the year prior the devaluation/depreciation —and therefore is closer to the concept of currency crises as described in theoretical models. The application of these criteria reduces our sample from to 57 to 42 episodes (33 countries).[30]

Results —displayed in Table 4.3— confirm our previous findings which then appear robust to changes in the definition of devaluation/depreciation episodes. For all the variables, we identify the same effects than the ones highlighted in Table 4.2. Indeed, looking at our main variables of interest, results confirm *(i)* the importance of the existence of substantial exchange rate misalignments prior to the devaluation/depreciation episode, and *(ii)* a nonlinear relationship between the size of the nominal adjustment and its effectiveness. Furthermore, those new results confirm that expansive macroeconomic policies tend to reduce the effectiveness of devaluation/depreciation by inducing an appreciation of the real effective exchange rate. Changes in the exchange rate regime towards a more flexible one also seem to alter the effectiveness of devaluations/depreciations. Compared to our previous results, the negative influence of the financial openness appears stronger.[31]

[30] See Table A.2 for details.

[31] The difference in this finding could be the consequence of the definition of devaluation/depreciation episodes, which includes more nominal adjustment associated to currency crises. Tighter capital controls, by reducing sudden withdrawal of flows resulting from currency crisis, can help to develop a more stable macroeconomic environment and then contribute to the effectiveness of devaluations.

Table 4.3 — Robustness check: Investigating the effectiveness factors

Dependent variable	$\Delta REER_k$						
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)
Effectiveness of devaluations							
$\Delta NEER_k$	0.414***	0.389***	0.479***	0.615***	0.612***	0.608***	0.586***
	(7.63)	(6.65)	(6.13)	(5.96)	(5.45)	(5.07)	(5.48)
$\Delta NEER^2 * D_{k=0}$		-0.235***	-0.156***	-0.226***	-0.445**	-0.427**	-0.394**
		(-2.61)	(-2.83)	(-3.40)	(-2.43)	(-2.35)	(-2.24)
$\Delta NEER^2 * D_{k=1}$		0.185	0.194	0.139	0.226	0.193	0.204
		(1.26)	(1.19)	(0.69)	(0.95)	(0.77)	(1.33)
$\Delta NEER^2 * D_{k=2}$		0.182**	0.274**	0.297***	0.278**	0.279*	0.256**
		(2.25)	(2.19)	(3.38)	(2.32)	(1.85)	(1.99)
$\Delta NEER^2 * D_{k=3}$		0.244***	0.338***	0.309***	0.280**	0.247**	0.266***
		(3.72)	(3.51)	(3.53)	(2.32)	(2.13)	(2.73)
$Init.dist.*\Delta NEER_k$			-0.408***	-0.515***	-0.561***	-0.367**	-0.519***
			(-3.05)	(-2.97)	(-2.76)	(-2.17)	(-2.85)
$ERR^a*\Delta NEER_k$				0.017**	0.061***	0.059***	0.059***
				(2.11)	(2.91)	(2.84)	(2.91)
$Fis.bal.*\Delta NEER_k$					-0.214*	-1.047**	-1.152*
					(-1.68)	(-2.16)	(-1.74)
$Credit^b*\Delta NEER_k$					0.657**	0.571*	0.676**
					(2.01)	(1.69)	(2.08)
$M2/GDP*\Delta NEER_k$					0.249	0.263	0.259
					(1.29)	(1.44)	(1.21)
$kaopen*\Delta NEER_k$					0.639**	0.647***	0.661***
					(5.82)	(5.97)	(6.19)
$Pol.violence*\Delta NEER_k$					-0.133		
					(-0.97)		
$Pol.\ Terror*\Delta NEER_k$						0.133	
						(0.73)	
$Conflict*\Delta NEER_k$					0.076	0.041	0.039
					(0.73)	(0.42)	(1.41)
$Election*\Delta NEER_k$					0.001	0.004	0.001
					(0.02)	(0.09)	(0.03)
Control variables							
Mis_{i,t_k-1}	-0.091	-0.044	-0.026	-0.081	-0.073	-0.064	-0.071
	(-0.81)	(-0.92)	(-1.03)	(-1.07)	(-1.38)	(-1.48)	(-1.41)
ERR^a				0.032***	0.038***	0.039***	0.039***
				(3.77)	(4.38)	(4.41)	(4.44)
$Fis.bal$	-0.118**	-0.128**	-0.155**	-0.185**	-0.344**	-0.311*	-0.317*
	(-2.09)	(-2.21)	(-2.16)	(-2.06)	(-2.05)	(-1.89)	(-1.88)
$Credit^b$	0.015	0.032	0.037	0.096	0.127	0.124	0.148
	(0.33)	(0.81)	(0.91)	(1.28)	(0.98)	(0.96)	(1.16)
$M2/GDP$	0.024*	0.019*	0.017*	0.020*	0.072	0.067	0.049
	(1.97)	(1.80)	(1.79)	(1.75)	(1.45)	(1.43)	(1.44)
$kaopen$	0.163	0.291	0.124	0.236	0.198*	0.211*	0.209*
	(1.29)	(1.23)	(1.29)	(1.52)	(1.94)	(1.92)	(1.89)

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust t-statistics in parentheses.

a: *de facto* classification

b: Domestic credit to public sector (%GDP)

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Table 4.3 — *Continued from previous page*

Dependent variable	$\Delta REER_k$						
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)
Political violence					-0.043		
					(-0.98)		
Political Terror						0.010	
						(0.18)	
Conflict					0.029	0.022	0.019*
					(1.06)	(0.85)	(1.74)
Election					0.004	0.002	0.003
					(0.27)	(0.14)	(0.18)
Others							
Constant	0.041	0.145***	0.128**	0.136***	0.181**	0.178**	0.171**
	(0.89)	(3.00)	(2.52)	(2.83)	(2.21)	(2.11)	(2.25)
$D_{k=0}$		-0.050***	-0.046***	-0.050***	-0.058***	-0.058***	-0.060***
		(-3.64)	(-3.16)	(-3.33)	(-4.07)	(-3.90)	(-6.05)
$D_{k=1}$		-0.012	-0.013	-0.008	-0.054	-0.013	-0.014
		(-1.01)	(-1.04)	(-0.60)	(-1.07)	(-1.14)	(-1.24)
$D_{k=2}$		-0.011	-0.010	-0.009	-0.004	-0.006	-0.005
		(-1.03)	(-0.29)	(-0.90)	(-0.38)	(-0.63)	(-0.55)
Observations	168	168	168	168	168	168	168
Devaluation episodes	42	42	42	42	42	42	42
R^2	0.35	0.43	0.55	0.58	0.60	0.60	0.60

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust t-statistics in parentheses.

Finally, as previously, the socio-political context does not impact the effectiveness of a devaluation/depreciation. Indeed, all the interaction terms between the change in the nominal exchange rate and the socio-political variables are not significant in any of the specifications.

4.5.2 Sensitivity to time windows

We also test the robustness of our results by performing a number of cross-sectional regressions over different time windows between the year of the devaluation/depreciation and the following years. This kind of time-varying parameter regressions allows to investigate the evolution of the coefficients associated with the variables over the 4 years time horizon. Indeed, due to changes in the economic environment, we may expect that the parameters are time-varying. This is specially the case of the coefficients associated with the initial distortion of the real exchange rate and the rate of the nominal adjustment as these two latter variables may have considerable effects only during the first year of the nominal adjustment ($k = 0$). This analysis will therefore justify, *ex post*, our methodological approach based on

the use of dummy variables to highlight the time-varying property of the saturation effect and of the initial distortion of the real exchange rate. Results are presented in Table 4.4.

Again, the results are in line with those so far obtained. In addition, they justify our methodological approach regarding the use of dummy variables. Indeed, during the devaluation/depreciation year, we observe a negative and significant impact of the squared value of the devaluation/depreciation rate, confirming by the way the existence of a *saturation effect*. Our findings also confirm the importance of the initial misalignment of the real effective exchange rate and the increasing importance of accompanying macroeconomic policies over time. Moreover, those new results confirm the negative impact exerted by changes in the exchange rate regime towards a more flexible one. Finally, we do not observe any significant time-varying effect of the socio-political context.

Table 4.4 — Robustness check: Cross-sectional analysis on different time windows

Dependent variable	$\Delta REER_k$											
	k=0			***k=1***			***k=2***			***k=3***		
	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)	(4.9)	(4.10)	(4.11)	(4.12)
Effectiveness of devaluations												
$\Delta NEER_k$	0.623***	0.658***	0.717***	0.433***	0.523***	0.639**	0.358**	0.478**	0.650*	0.321**	0.609***	0.628***
	(6.30)	(6.80)	(6.58)	(3.17)	(3.57)	(2.40)	(2.61)	(2.52)	(1.70)	(2.09)	(2.93)	(3.55)
$\Delta NEER_k^2$		-0.367**	-0.453***		-0.121	-0.192		0.485*	0.354		0.487***	0.591**
		(-2.46)	(-3.98)		(-0.23)	(-0.35)		(1.75)	(1.11)		(2.74)	(2.58)
Mis_{i,t_k-1}*$\Delta NEER_k$		-0.238**	-0.352***									
		(-2.27)	(-3.20)									
ERR^a*$\Delta NEER_k$		0.061**	0.023**		0.020**	0.032**		0.051	0.046		0.061	0.060
		(2.05)	(2.04)		(2.09)	(2.39)		(1.63)	(1.51)		(0.80)	(0.71)
Fis.Bal$*\Delta NEER_k$	-0.391**	-0.357**	-0.352**	-0.387**	-0.364*	-0.398**	-0.483*	-0.447**	-0.346**	-0.270*	-0.642**	-0.265**
	(-2.40)	(-2.24)	(-2.20)	(-2.18)	(-1.70)	(-2.41)	(-1.68)	(-2.48)	(-2.33)	(-1.83)	(-2.37)	(-2.54)
$Credit^b$*$\Delta NEER_k$	0.145	0.294*	0.276*	0.183	0.153*	0.167	0.137	0.603	0.629	0.417*	0.551*	0.607
	(1.27)	(1.73)	(1.86)	(0.41)	(1.69)	(1.37)	(1.32)	(1.10)	(1.34)	(1.69)	(1.69)	(0.93)
$M2/GDP$*$\Delta NEER_k$	0.573*	0.389*	0.407	0.239	0.296**	0.241*	0.300	0.113	0.251*	0.257	0.215*	0.262
	(1.68)	(1.71)	(1.62)	(1.52)	(2.08)	(1.76)	(1.44)	(1.00)	(1.86)	(1.34)	(1.83)	(1.39)
kaopen$*\Delta NEER_k$		-0.149	0.348		0.148	0.567		0.421**	0.488**		0.198	0.776*
		(-0.41)	(0.40)		(1.32)	(0.87)		(2.14)	(2.27)		(0.48)	(1.98)
Pol.violence$*\Delta NEER_k$			-0.226			-0.186			0.483			0.678
			(-0.62)			(-0.24)			(1.03)			(1.09)
Conflict$*\Delta NEER_k$			-0.199			-0.415			-0.179			-0.327
			(-0.64)			(-0.68)			(-0.51)			(-0.82)
Election$*\Delta NEER_k$			0.135			0.010			0.278			0.232
			(0.57)			(0.03)			(0.55)			(0.57)
Control variables												
$\Delta Mis_{i,t_k-1}$	-0.144***	-0.094**	-0.106***	-0.113	-0.106	-0.128	-0.092	-0.119	-0.127	-0.123	-0.151	-0.120
	(-2.98)	(-2.06)	(-2.73)	(-1.47)	(-1.05)	(-1.34)	(-0.83)	(-0.83)	(-0.64)	(-0.66)	(-0.17)	(-0.55)
ERR^a		0.082**	0.055**		0.015	0.027**		0.032	0.048		0.049	0.042
		(2.42)	(2.13)		(1.39)	(2.10)		(1.08)	(1.01)		(1.15)	(1.07)
Fis.Bal	-0.194*	-0.177**	-0.139**	-0.528*	-0.565**	-0.580**	-0.633	-0.368**	-0.316**	-0.456*	-0.720**	-0.481**
	(-1.72)	(-2.09)	(-2.07)	(-1.93)	(-2.11)	(-2.13)	(-1.38)	(-2.06)	(-2.17)	(-1.79)	(-2.04)	(-2.18)
$Credit^b$	0.163	0.295*	0.294**	0.097	0.205*	0.376	0.042	0.299*	0.403	0.126	0.179**	0.231
	(1.52)	(1.98)	(2.17)	(1.44)	(1.72)	(1.03)	(1.16)	(1.84)	(1.19)	(1.40)	(1.98)	(1.18)
$M2/GDP$	0.045*	0.164	0.239	0.083*	0.088**	0.335*	0.063	0.410	0.489*	0.089*	0.149*	0.426*
	(1.82)	(1.26)	(1.61)	(1.83)	(2.13)	(1.72)	(1.38)	(0.71)	(1.73)	(1.86)	(1.76)	(1.73)
kaopen		-0.096	0.051		0.139	0.278		0.183**	0.209**		0.172	0.349*
		(-1.42)	(1.19)		(1.25)	(0.90)		(2.17)	(2.37)		(0.76)	(1.71)
Political violence			-0.042			-0.135			0.029			0.219
			(-0.45)			(-0.54)			(0.18)			(0.92)
Conflict			-0.048			0.069			-0.008			-0.169
			(-0.59)			(0.29)			(-0.05)			(-1.20)
Election			-0.021			-0.033			0.135			0.176
			(-0.37)			(-0.30)			(0.83)			(1.08)
Constant	0.007	-0.024	0.013	-0.044	-0.051	-0.061	-0.059	0.089	0.049	-0.075	0.141	0.215**
	(0.26)	(-0.59)	(0.26)	(-1.09)	(-0.60)	(-0.64)	(-1.37)	(1.01)	(0.50)	(-1.45)	(1.53)	(2.48)
Observations	57	57	57	57	57	57	57	57	57	57	57	57
Adj. R-squared	0.57	0.61	0.62	0.33	0.41	0.42	0.26	0.38	0.39	0.28	0.31	0.38

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust t statistics in parentheses. a: *de facto* classification.b: Domestic credit to public sector (%GDP)

4.6 Conclusion

In this paper, we have assessed the factors that enable a downward adjustment of the nominal exchange rate to lead to a real depreciation by paying a particular attention to the role played by the size of the nominal adjustment and the initial distortion of the real exchange rate. To do this, we have studied the evolution of the real effective exchange rate from the year in which the devaluation/depreciation occurs to the three following years, using a large sample of devaluation/depreciation episodes in developing and emerging countries.

Our results indicate that the effectiveness of a nominal adjustment depends not only on the implementation of appropriate accompanying macroeconomic policies, but also on the economic context in which the nominal adjustment occurs and the size of the nominal adjustment. In particular, the existence of an overvaluation prior to the devaluation/depreciation and the size of the nominal adjustment appear as important *ex ante* effectiveness factors. On the contrary, we find no strong support that the effectiveness of a devaluation/depreciation is related to the socio-political context.

Several lessons regarding economic policy might be drawn from those results. First, devaluations that are not justified by considerable exchange rate misalignments and are implemented without appropriate accompanying macroeconomic policies, are likely to fail in improving competitiveness, and thus the economic situation. Second, the existence of a weak pass-through between the nominal and the real exchange rates may require an overshooting of the rate of devaluation which is initially needed. At the same time, a too high nominal adjustment can also trigger an immediate inflationary spiral. In this respect, the first two years after the nominal adjustment episode appear to be pivotal years in which the competitiveness effect of the nominal adjustment may be compromised. This reinforces the necessity of accompanying economic policies in order to overcome immediate inflationary pressures. If these different prerequisites are not met, large nominal exchange rate adjustments, whether intended or not, are likely to bring to countries more disadvantages than benefits.

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Appendices

A. Data appendix

A.1. Data

Table A.1 — Data sources and definitions

Variables & Definitions	Sources
Exchange rate	
Nominal Effective Exchange Rate (NEER): Weighted average of bilateral exchange rates against 67 trading partners.	Bruegel's database
Real Effective Exchange Rate (REER): Weighted average of real bilateral exchange rates against 67 trading partners.	Bruegel's database
Exchange rate regime	
***de jure* classification**	IMF
***de facto* classification**	Ilzetzki, Reinhart & Rogoff
Exchange rate fundamentals	
Terms of trades (*tot*): expressed in logarithms	WDI
Government consumption (*gov*): in percentage of GDP	WDI
Foreign direct investment (*fdi*): in percentage of GDP	WDI
Net Foreign Assets[a] **(*nfa*)**: in percentage of GDP	Lane & Milesi-Ferretti
Official Development Aid (*oda*): in percentage of GDP	WDI
Relative productivity (*rprod*): Measured by the ratio of GDP PPP per capita in the country and the weighted average GDP per capita PPP of partner countries. The weights and partners are the same than those used for the calculation of the real effective exchange rate.	
Openness (*open*)	WDI
Investment (*invest*): in percentage of GDP	WEO
Macroeconomic indicators	
Fiscal balance (*fis.bal*): in percentage of GDP	WEO
Domestic credit (*dom.cred*): in percentage of GDP Domestic credit provided to public and private sector.	IFS
Domestic credit to public sector (*cred.PS*): in percentage of GDP	IFS
Money and quasi-money (*M2*): in percentage of GDP	WDI
kaopen[b]: Financial openness measured on a zero-to-one scale, 1 being the highest financial openness degree.	Chinn & Ito
Consumer Price Index (*CPI*): expressed in logarithm	WEO
Socio-political indicators	
Political violence[b]: measured on a scale from 0 to 1, 1 being the highest degree of political violence.	Center for Systematic Peace
Political Terror[b]: bounded between 0 and 1, 0 being absence of political terror.	Political Terror Scale
Election: Scores 1 years of Presidential and/or Legislative elections, 0 otherwise. Computed using informations in *Constituency-Level Elections Archive and African Elections Database.*	
Conflict Scores 1 if the country is involved in a conflict.	Uppsala Conflict Data Program

Continued on next page

Table A.1 — *Continued from previous page*

Variables & Definitions	**Sources**
Other indicators	
GDP current US$: expressed in logarithms	WEO
GDP per capita: expressed in logarithms	WEO

Notes: a: Updated by adding current account balances in the last years where data on net foreign assets were not available. Data relative to current account balance are from WDI database.

b: We modified the original scale.

IFS: *International Financial Statistics* (International Monetary Fund)

WDI: *World Development Indicators* (World Bank)

WEO: *World Economic Outlook* (International Monetary Fund)

A.2. Devaluation episodes sample

Table A.2 — Selected countries and devaluation episodes

Country	Date	Country	Date
Asia & Pacific			
Fiji	1987, 1998*, 2009	Philippines	1997*
Europe & Central Asia			
Russian Federation	1998*	Turkey	1980, 1994, 2001
Latin America & Caribbean			
Argentina	2002*	Mexico	1976*, 1982*,
Brazil	1983, 1999*		1985, 1994*, 2001*
Costa Rica	1981*, 1991*	Peru	1982
Dominican Republic	1985*, 1990*, 2003*	Trinidad & Tobago	1985*, 1993*
Ecuador	1999	Uruguay	1982*, 2002*
El Salvador	1986*, 1990*	Venezuela	1995, 2002*
Jamaica	1983*		
Africa			
Benin	1994*	Kenya	1993
Burkina Faso	1994*	Madagascar	1993*
Cameroon	1994*	Mali	1994*
Central African Republic	1994*	Mauritius	1979*
Chad	1994*	Mauritania	1992*
Congo Republic	1994*	Niger	1994*
Côte d'Ivoire	1994*	Nigeria	1998*
Egypt	1994*	Senegal	1994*
Equatorial Guinea	1994*	Sierra Leone	1985
Ethiopia	1992*, 2010	Tanzania	1986*
Gabon	1994*	Togo	1994*
Ghana	2009	Zambia	1992

Note: Successful devaluations correspond to underlined episodes. " * " indicates the devaluation episodes retained for the robustness check.

B. Further results

B.1. Cross-sectional dependence tests

Table B.1 — Cross-sectional dependence test results

	reer	***gov***	***invest***	***fdi***	***nfa***	***oda***	***open***	***tot***	***rprod***
Pesaran (CD)'s	45.32	4.14	13.01	56,07	99.65	34.83	34.80	9.96	56.83
test	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: The test is based on the null of no cross-sectional dependence and is standard Normal under this null. *p.values* are given in parentheses.

B.2. Unit root tests

Table B.2 — Unit root test results

		reer	***gov***	***invest***	***fdi***	***nfa***	***oda***	***open***	***tot***	***rprod***
	level	-2.51	-2.49	-2.50	-2.85	-2.26	-2.61	-2.14	-2.39	-2.41
CIPS*		(0.13)	(0.17)	(0.13)	(0.01)	(0.60)	(0.04)	(0.03)	(0.34)	(0.28)
	1^{st}	-3.05	-4.01	4.49	-4.83	-3.24	-4.70	-4.15	-3.40	-2.92
	diff.	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
	level	-0.91	1.17	5.17	22.93	0.37	11.00	11.02	0.23	-3.96
Choi		(0.81)	(0.12)	(0.00)	(0.00)	(0.35)	(0.01)	(0.00)	(0.40)	(1.00)
Pm	1^{st}	42.01	42.91	53.15	51.97	44.33	52.66	53.85	35.51	34.93
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	level	3.92	-1.41	-4.78	-12.88	-0.64	-7.66	-6.70	2.81	8.95
Choi		(1.00)	(0.08)	(0.00)	(0.00)	(0.26)	(0.00)	(0.00)	(0.99)	(1.00)
Z	1^{st}	-19.38	-20.11	-24.32	-23.85	-20.46	-23.85	-24.68	-16.61	-17.04
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	level	4.13	-1.19	-4.68	-15.62	-0.48	-8.51	-7.63	3.61	11.19
Choi		(1.00)	(0.11)	(0.00)	(0.00)	(0.31)	(0.00)	(0.00)	(0.99)	(1.00)
L*	1^{st}	-25.68	-26.77	-32.97	-32.26	-27.08	-32.49	-33.45	-22.29	-22.09
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: We allow for individual deterministic trends and constants for all variables except *open* (only individual intercepts). The tests are built on the null of a unit root; *p*.value in parentheses. Appropriate lag orders are determined by running auxiliary ADF test regressions for each of the cross-sectional units. We also refer to the lag order that minimizes the Schwarz criterion. Conclusions are robust to change in model's specification.

B.3. Westerlund cointegration test

Table B.3 — Westerlund cointegration test results

Specification				***reer*** ***rprod,*** ***tot,*** ***nfa***		
	With constant			*With trend and constant*		
Statistic	Value	$Z-$value	$p-$value	Value	$Z-$value	$p-$value
G_t	-2.783	-3.453	0.000	-3.056	-2.391	0.008
G_a	-9.121	1.552	0.940	-9.381	4.524	1.000
P_t	-15.084	-3.522	0.000	-17.478	-3.087	0.001
P_a	-8.738	-1.153	0.125	-11.467	0.544	0.707

Note: Optimal lag and lead length determined by Akaike Information Criterion. Width of Bartlett-Kernel set to 2. Null hypothesis of no cointegration.

C. Supplementary materials

C.1. BACE results

Table C.1 — BACE results

	PIP	Post Mean	Post SD	Sign Cert. Prob.
tot	1.0000	0.1791	0.0266	1.0000
invest	0.4608	0.0356	0.0127	1.0000
rprod	0.9896	0.0873	0.0220	1.0000
open	0.1950	0.0034	0.0125	1.0000
gov	0.0445	-0.0041	0.0254	0.0000
nfa	0.6806	0.0802	0.0071	1.0000
fdi	0.2635	0.0069	0.0140	1.0000
oda	0.0265	-0.0002	0.0092	0.0000

Note: The dependent variable is the real effective exchange rate. The relevance of each fundamental —in explaining the real effective exchange rate's dynamics— is given by the *posterior inclusion probability* (PIP). We retain variables with PIP higher than 0.5. The columns "Post Mean" and "Post SD" respectively indicate the estimated coefficients and standard deviations, both correspond to the averages over all models. The column "Sign Cert. Prob." — Sign Certainty Probability— indicates the probability that the coefficient sign is positive. Results are based on 10,000 burn-ins and 20,000 draws. Simulations made using prior diffuse and birth-death MCMC sampler.

C.2. Figures

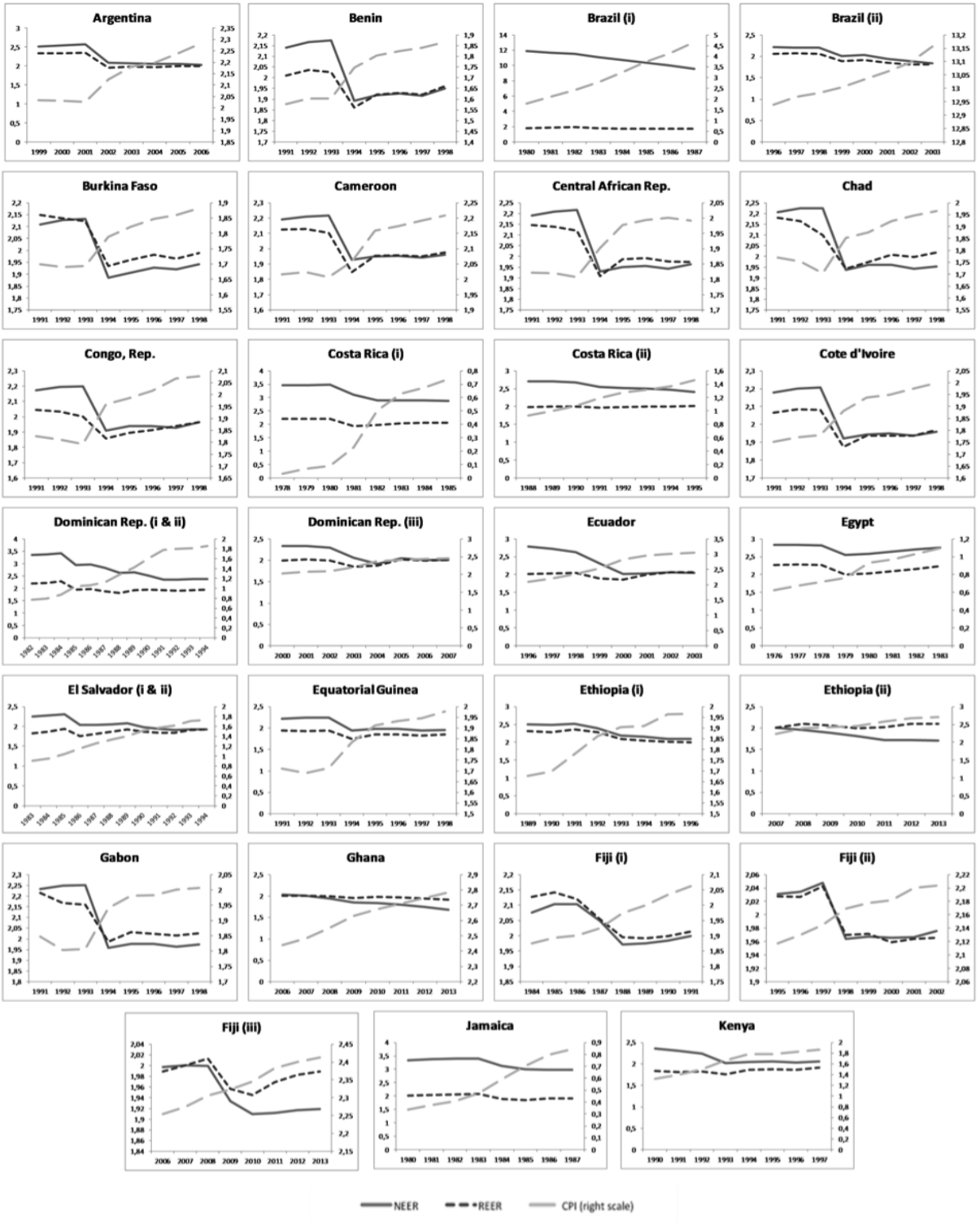

Figure C.2.1 — Nominal and real effective exchange rates, inflation (CPI)

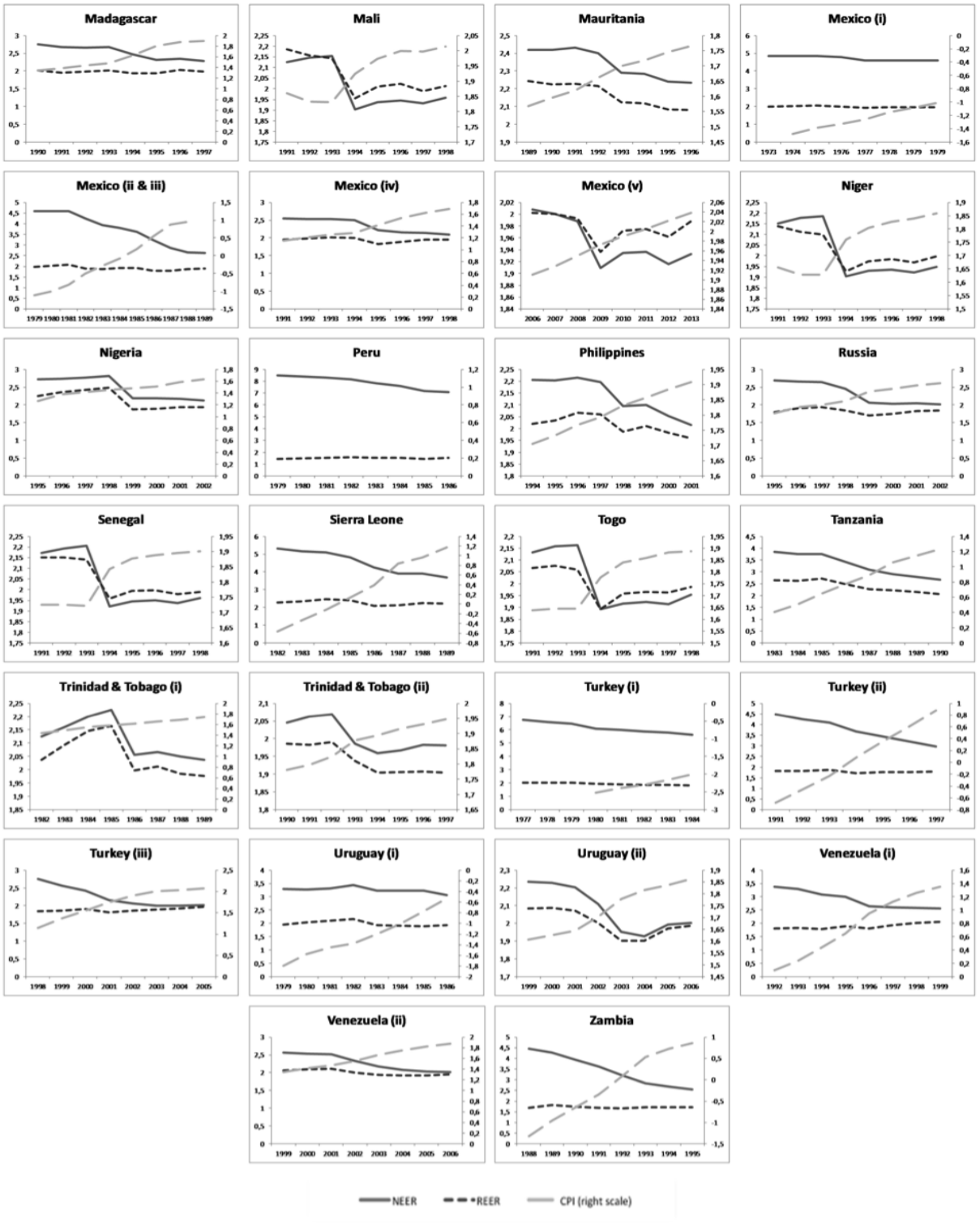

Figure C.2.1 — *Continued.*

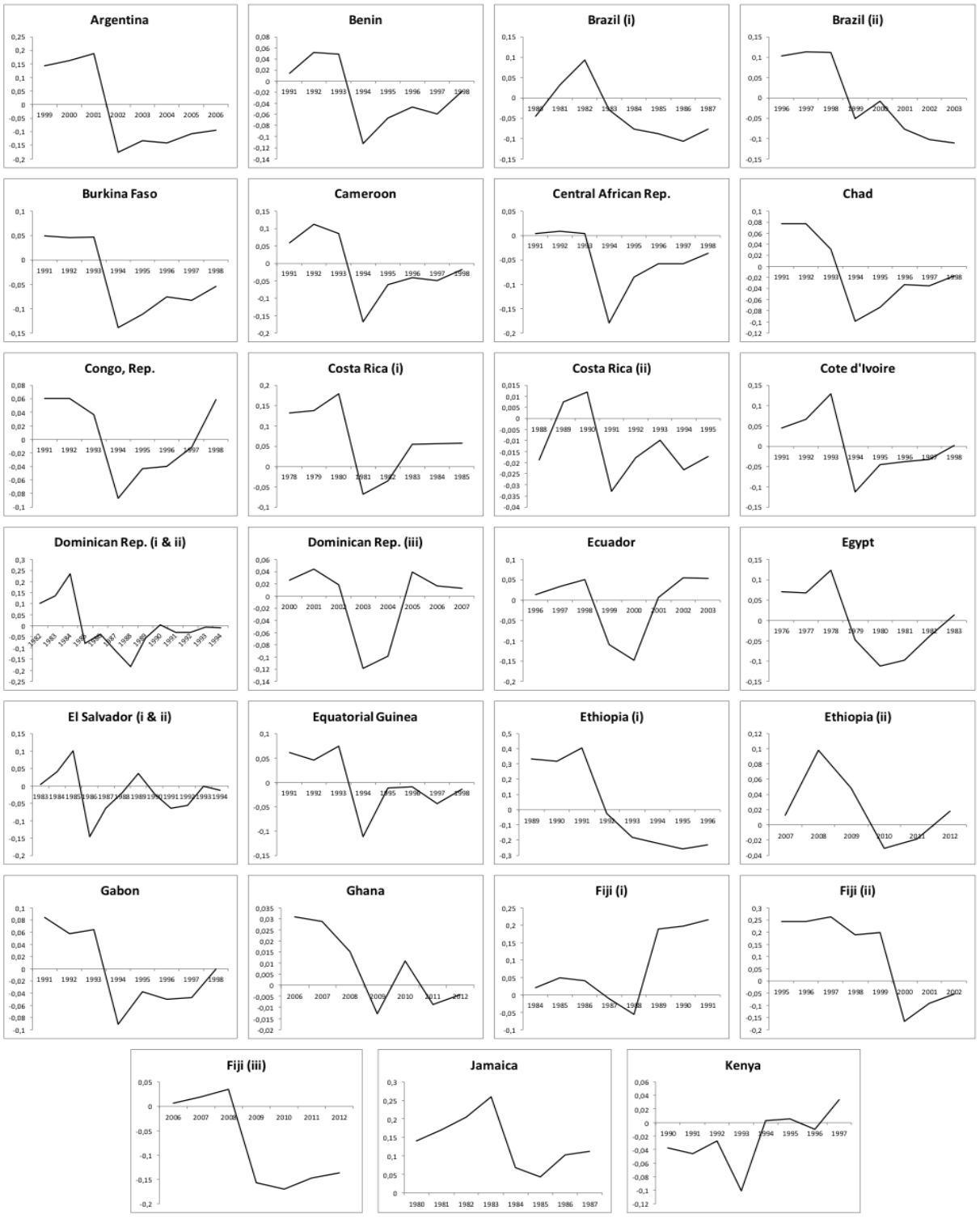

Figure C.2.2 — Exchange rate misalignments

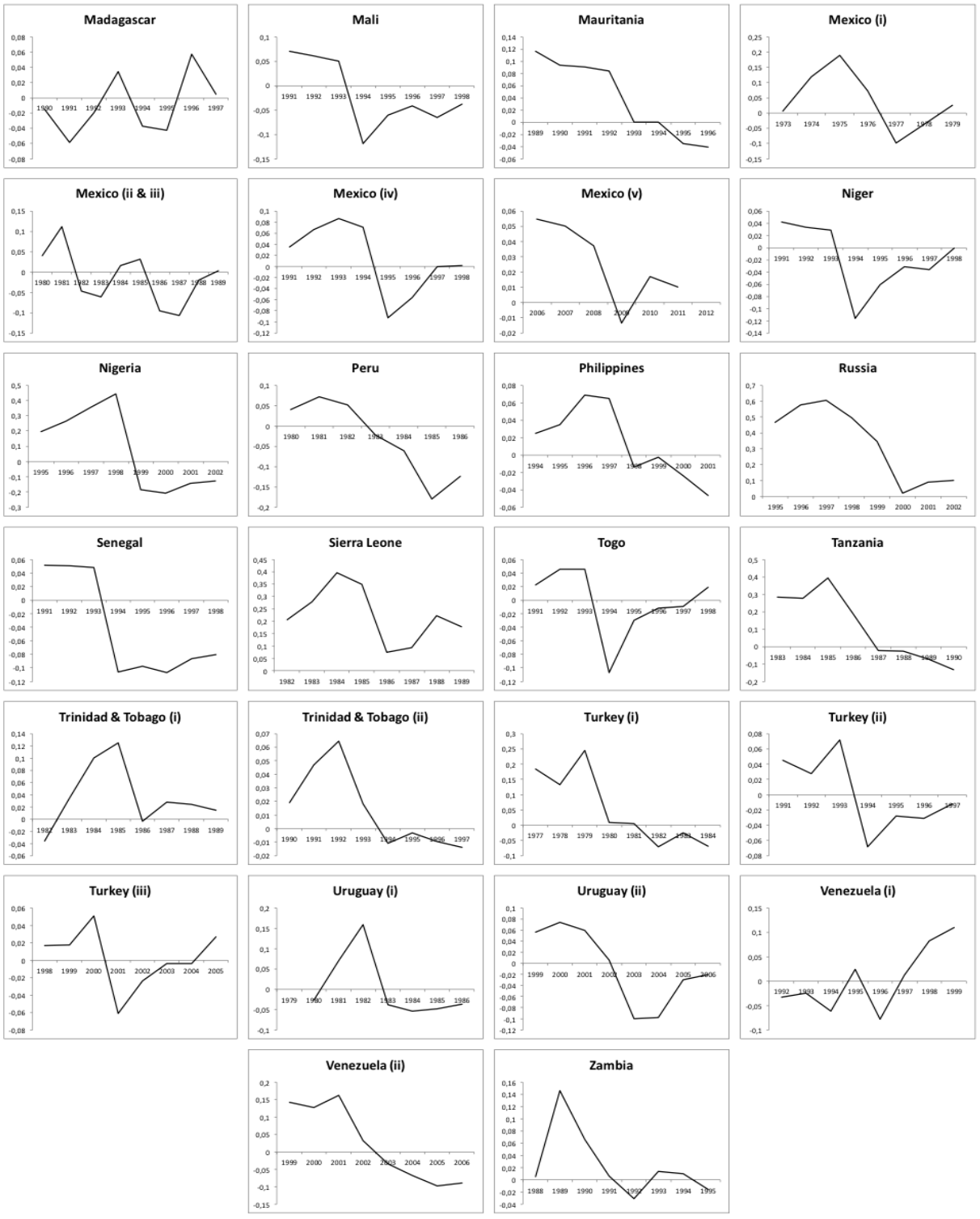

Figure C.2.2 — *Continued.*

C.3. Factors influencing the effectiveness of nominal adjustments: data analysis

As a first step, we investigate which variables matter for devaluations' effectiveness by comparing the behavior of these variables during the considered time scale in countries in which devaluations have been successful (hereafter, "panel S") and in other countries characterized by unsuccessful devaluations (hereafter, "panel U"). To determine whether a devaluation has been successful, we assess an effectiveness index which is defined as the ratio of the cumulative ex-post elasticity of the real exchange rate with respect to the nominal exchange rate for the year of the devaluation, one, two and three years after the devaluation:[32]

$$Effectiveness_{t_k} = \Delta REER_{t_k} / \Delta NEER_{t_k} \tag{C.3.1}$$

where $\Delta REER_{t_k}$ (resp. $\Delta NEER_{t_k}$) is the accumulated percentage change in the real (resp. nominal) effective exchange rate between the year prior to the devaluation and k year(s) after the devaluation ($k = 0, 1, 2, 3$).

We follow Edwards (1989) and consider as a successful episode any devaluation with an effectiveness index greater or equal to 0.3 for $k = 3$. This threshold value led to a selection of 37 successful devaluations among the 57 considered episodes (see Table A.2 in the Appendix). Table C.3.1 reports, for the two subsamples of episodes, the evolution of this index for the devaluation year (k = 0) and the three following years ($k = 1, 2$ and 3) as well as the devaluation rate in $k = 0$. In addition, in Figure C.3.1, we represent the behavior, over a five-year period (from the year prior to the devaluation to three years after, i.e. from $k = -1, 0, 1, 2$, and 3), of several factors that may influence the devaluation's effectiveness: the level of real exchange rate misalignments, the consumer price index (CPI; set equal to 100 the year prior to the devaluation), the fiscal balance (in % of GDP); M2, the money supply (in % of GDP); the domestic credit to public sector (in % of GDP); and the financial openness index (*kaopen*).[33]

[32] This elasticity provides an index of the degree of erosion experienced by the real exchange rate during the three years after the devaluation. A value of one indicates a complete (perfect) pass-through between the nominal and the real exchange rates while a negative value indicates that more than 100% of the nominal devaluation has been eroded.

[33] The detailed statistics are reported in Table C.3.2.

Table C.3.1 — Adjustment rates and effectiveness indexes

	Devaluation rate	**Effectiveness index**			
	Year of devaluation ***"k=0"***	Year of devaluation ***"k=0"***	1 year after devaluation ***"k=1"***	2 years after devaluation ***"k=2"***	3 years after devaluation ***"k=3"***
Panel S					
1^{st} quartile	-37.58	0.67	0.56	0.52	0.46
Median	-24.90	0.74	0.65	0.58	0.57
Mean	-28.78	0.75	0.69	0.66	0.62
[St. Dev.]	[18.24]	[0.15]	[0.20]	[0.21]	[0.20]
3^{rd} quartile	-13.81	0.78	0.82	0.81	0.77
Panel U					
1^{st} quartile	-47.99	0.29	0.10	-0.08	-0.06
Median	-36.15	0.43	0.27	0.09	0.03
Mean	-36.63	0.40	0.21	0.07	-0.02
[St. Dev.]	[20.43]	[0.27]	[0.30]	[0.28]	[0.25]
3^{rd} quartile	-19.38	0.59	0.44	0.27	0.13
Comparison of means	1.44 (0.16)	5.37 (0.00)	6.43 (0.00)	8.25 (0.00)	9.87 (0.00)

Note: In the line "Comparison of means", we reported the results of the tests of comparison of means between panels S and U. See Table C.3.2 for details regarding these tests.

The evidence suggests that unsuccessful devaluations are, on average, associated with higher rates of devaluation. The average size of devaluations in panel U is about 36,6%; in contrast, in panel S, the nominal adjustment reaches 28.8%.

Moreover devaluations episodes in panel U do not appear consistent with the level of real exchange rate misalignment prevailing prior to the devaluation. Indeed, prior to the devaluation, currencies exhibit an average real overvaluation around 16.1% in panel S while currencies in panel U tend to be undervalued of about 4.33%. Furthermore, the distribution of misalignments —through the quartiles— indicates that currency misalignments prior to the devaluation ranges from low to important overvaluations in panel S while it varies between moderate undervaluations to low overvaluations in panel U.[34] Then, changes in the nominal exchange rate appear disproportionate to the initial distortion of the real exchange rate in panel U while they appear more consistent in panel S. As a matter of fact, real exchange rates in panel S do not deviate over time substantially from their equilibrium level (in average the RER is close to its equilibrium). Real exchange rates in panel U, on the contrary, converge towards their pre-devaluation misalignment level only two

[34]See Table C.3.2 for further details.

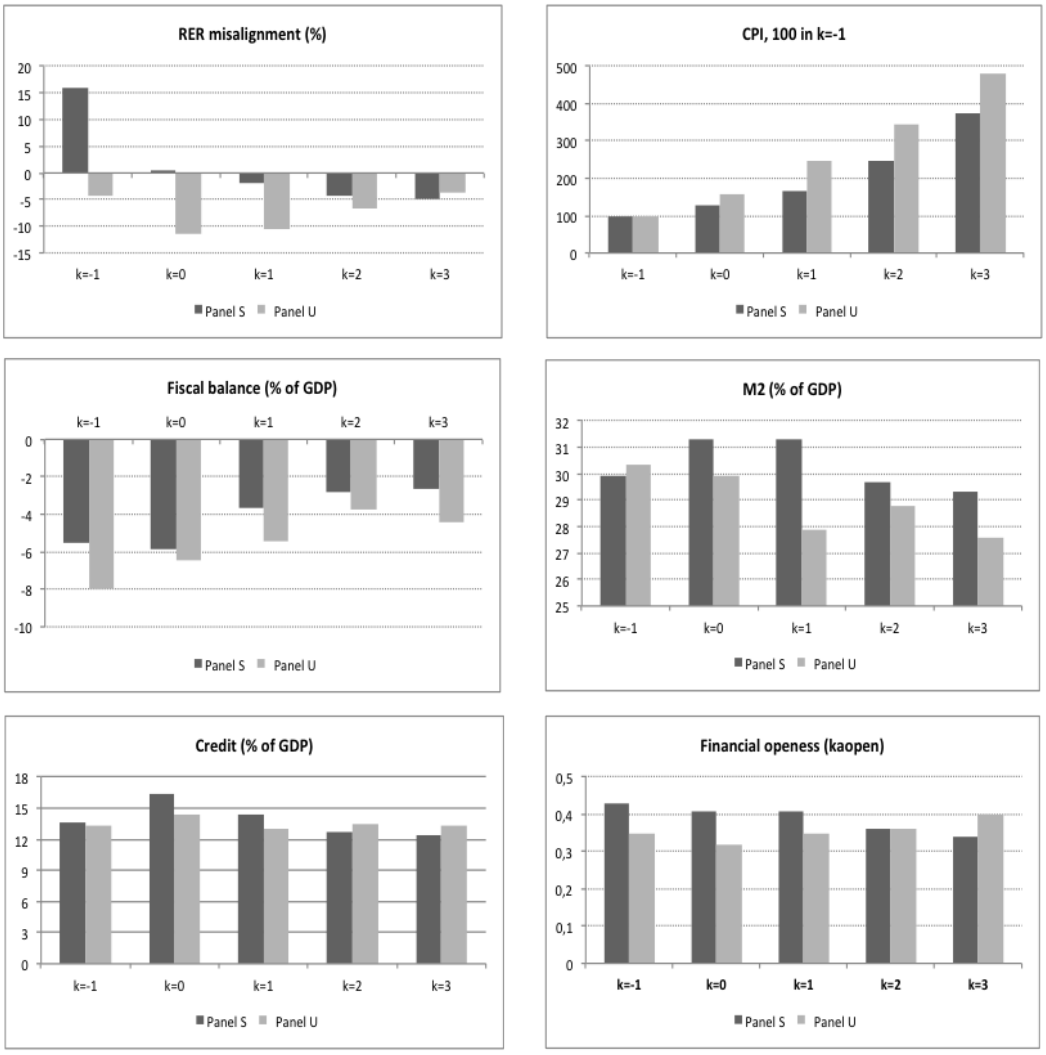

Figure C.3.1 — Behavior of variables affecting the effectiveness of nominal adjustments

years after the devaluation due to the overshooting of the rate of the devaluation. It is then not surprising that devaluation episodes in panel U perform worse than other episodes in terms of devaluation's effectiveness index —and this as of the devaluation's year. Indeed, the index is, during the first year ("$k = 0$"), almost twice in panel S compared to panel U. In successful devaluation episodes (i.e. panel S), the pass-through from the nominal to the real exchange rate is around 75% (so 25% of loss) during the devaluation year, while 60% of the effect of the devaluation has been eroded in panel U. Moreover the devaluation's effectiveness tends to decrease slowly over time in panel S. In contrast, in panel U, two years after the devaluation, 93% —in average— of the devaluation has been eroded.

Table C.3.2 — Variables affecting devaluations' effectiveness: summary statistics

	Year prior the devaluation ***"k=-1"***		*Year of the devaluation* ***"k=0"***		*1 year after the devaluation* ***"k=1"***		*2 years after the devaluation* ***"k=2"***		*3 years after the devaluation* ***"k=3"***	
	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U
RER Misalignments (%)										
1^{st} quartile	4.83	-8.68	-11.61	-15.21	-9.62	-13.72	-9.66	-9.17	-10.77	-7.48
Median	9.16	-2.95	-3.84	-10.51	-4.08	-9.95	-5.44	-4.83	-6.54	-1.97
Mean	16.09	-4.33	0.51	-11.45	-1.96	-10.51	-4.22	-6.77	-4.94	-3.63
[St. Dev.]	[20.53]	[12.48]	[21.27]	[11.19]	[16.18]	[11.30]	[8.57]	[12.65]	[10.84]	[13.88]
Diff. in means	4.66***		2.78***		2.33**		0.81		-0.37	
3^{rd} quartile	20.49	3.72	3.14	-4.84	0.50	-4.12	-1.04	0.88	-3.20	2.38
CPI index(100 in "k=-1")										
1^{st} quartile	100	100	109.77	130.33	118.98	160.75	133.13	183.91	145.84	204.03
Median	100	100	124.63	146.40	146.09	193.04	149.69	218.83	156.67	242.84
Mean	100	100	127.24	158.04	167.45	245.44	246.88	344.98	372.26	480.87
[St. Dev.]	[0]	[0]	[24.29]	[46.96]	[99.71]	[142.72]	[367.34]	[264.51]	[906.62]	[463.17]
Diff. in means	—		-2.74***		-2.17**		-1.16		-0.60	
3^{rd}quartile	100	100	135.33	157.98	159.05	296.34	177.94	445.33	212.15	557.03
Fiscal balance (% GDP)										
1^{st} quartile	-6.70	-10.68	-7.51	-10.12	-4.48	-8.26	-4.20	-6.34	-3.78	-6.41
Median	-5.00	-6.24	-4.81	-5.41	-3.37	-5.29	-2.60	-4.57	-2.97	-4.24
Mean	-5.48	-7.97	-5.83	-6.47	-3.63	-5.40	-2.79	-3.73	-2.61	-4.42
[St. Dev.]	[4.55]	[8.09]	[5.52]	[4.31]	[3.51]	[5.39]	[3.69]	[5.59]	[4.54]	[4.02]
Diff. in means	1.27		0.48		1.32		0.68		1.55	
3^{rd} quartile	-3.07	-4.09	-2.57	-3.67	-2.16	-2.79	-0.52	-0.57	-0.40	-2.13

Continued on next page

Table C.3.2 — *Continued from previous page*

	Year prior the devaluation ***"k=-1"***		*Year of the devaluation* ***"k=0"***		*1 year after the devaluation* ***"k=1"***		*2 years after the devaluation* ***"k=2"***		*3 years after the devaluation* ***"k=3"***	
	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U	Panel S	Panel U
M2 (% GDP)										
1^{st} quartile	19.44	23.36	20.38	25.04	20.94	20.56	19.95	21.43	20.61	19.90
Median	26.85	30.05	27.01	28.85	26.92	29.62	24.97	30.55	23.90	28.47
Mean	29.93	30.34	31.31	29.93	31.32	27.88	29.66	28.80	29.30	27.58
[St. Dev.]	[14.07]	[8.85]	[16.03]	[9.76]	[15.22]	[8.33]	[14.72]	[8.58]	[15.00]	[9.25]
Diff. in means	-0.13		0.40		1.10		0.28		0.53	
3^{rd} quartile	39.48	35.12	41.38	33.69	42.34	32.80	37.75	35.28	38.76	35.19
Credit (% GDP)										
1^{st} quartile	3.80	3.71	5.50	6.28	5.43	4.56	5.13	3.66	4.83	3.29
Median	9.93	10.79	9.74	8.10	8.72	8.39	8.73	10.26	7.72	9.63
Mean	13.61	13.34	16.45	14.45	14.37	13.05	12.69	13.42	12.37	13.34
[St. Dev.]	[13.83]	[16.24]	[16.30]	[13.73]	[13.83]	[11.90]	[12.11]	[12.98]	[12.31]	[13.74]
Diff. in means	0.06		0.49		0.38		-0.21		-0.26	
3^{rd} quartile	16.44	16.57	23.70	20.07	19.73	22.95	18.28	19.64	16.09	20.16
Financial openness (kaopen)										
1^{st} quartile	0.27	0.17	0.27	0.13	0.27	0.13	0.27	0.25	0.27	0.27
Median	0.48	0.27	0.45	0.27	0.48	0.27	0.27	0.27	0.27	0.29
Mean	0.43	0.35	0.41	0.32	0.41	0.35	0.36	0.36	0.37	0.40
[St. Dev.]	[0.24]	[0.24]	[0.22]	[0.20]	[0.23]	[0.21]	[0.22]	[0.23]	[0.23]	[0.25]
Diff. in means	1.20		1.56		1.00		0		-0.89	
3^{rd} quartile	0.48	0.49	0.48	0.49	0.48	0.49	0.41	0.41	0.48	0.48

Notes: "*Credit*"correspond to the domestic credit to public sector. "*kaopen*" is bounded between 0 and 1; 1 being the highest financial openness degree. "Diff in means" indicate the tests of comparison of means between the two panels. Each test is based on a t test: $t = (\bar{X_S} - \bar{X_U})/\sqrt{(S_S^2/n_S) + (S_U^2/\mathrm{n}_U)} \sim \mathrm{t}(n_S + \mathrm{n}_U - 2)$; $H_0 : \bar{X_S} - \bar{X_U} = 0$ vs. $H_1 : \bar{X_S} - \bar{X_U} \neq 0$. $\bar{X}_i$ (resp. S_i^2) corresponds to the mean (resp. empirical variance) of variable X in panel i. n_i indicates the size of panel i. *p.values* are reported in parentheses.

These performance differences also reflect instances of a better control of inflation following devaluation episodes in panel S than in panel U. During the two first years —i.e. "$k = 0$" and "$k = 1$", the annual inflation rate reaches around 60% in panel U, twice the rate observed in panel S. Moreover, there is some evidence that lower inflation in countries, in which devaluations have been successful, has been associated with a better control on the fiscal deficit. In contrast, inflation differential between the two subsamples of countries shows no relationship with a better control of money growth, neither with a tightening of capital controls.

Taken together, the lesson appears to be that countries characterized by an important real overvaluation of their currencies that register a nominal adjustment consistent with this disequilibrium and that are able to contain subsequent inflationary pressures will be likely to derive benefits in terms of competitiveness —i.e. real depreciation— from this nominal adjustment.

D. A theoretical model for the real exchange rate dynamics (Edwards, 1988)

The model presented in this section is a dynamic model of real exchange rate (RER) behavior in developing countries, developed by Edwards (1988). This model serves as theoretical background for our analysis. The model attempts to analyze the forces behind real exchange rate behavior in the developing countries and particularly addresses the issue of the importance of monetary and real variables in the process of real exchange rate determination in both the short and long runs. The model allows for both real and nominal factors to play a role in the short run. However, in the long run, only the real factors —the "fundamentals"— influence the equilibrium real exchange rate.

The model considers a small open economy with three goods: exportables, importables, and nontradables. It is assumed that there is a government sector and a dual nominal exchange rate system. The country produces exportable (X) and nontradable (N) goods and consumes the importable (M) and the nontradable. Nationals of the country hold a stock of domestic money (M) and foreign money (F). In addition, it is assumed that the private sector has inherited a stock of foreign money ($\tilde{F}$). The government consumes importables and nontradables, and uses non-distortionary taxes and domestic credit creation to finance its expenditures.

The dual exchange rate system is characterized by a fixed nominal exchange rate for commercial transactions (E) and a freely floating nominal exchange rate (δ) for financial transactions. This level takes whatever level is required to achieve asset market equilibrium. This assumption of a dual exchange rate system is made as a way of capturing the fact that in most developing countries there is a parallel market for financial transactions. It is assumed that there is a tariff on imports (r) and that, in the tradition of international trade theory, its proceeds are handed back to the public in a non-distortionary way. It is assumed that the price of exportables in terms of foreign currency is fixed and equal to unity (P_x^*). Finally, it is assumed that there is perfect foresight.

The model is given by equations (D.1) through (D.16).

Portofolio decisions

$$A = M + \delta F \tag{D.1}$$

$$a = m + \rho F \quad where \quad a = A/E;\ m = M/E;\ \rho = \delta/E \tag{D.2}$$

$$m = \sigma(\dot{\delta}/\delta)\ \rho F;\ \ \sigma^{'} < 0 \tag{D.3}$$

$$\dot{F} = 0 \tag{D.4}$$

Demand side

$$P_M = EP_M^* + r\ ;\ \ e_X = E/P_N\ ;\ \ e_M = P_M/P_N\ ;\ \ e_M^* = (P_M^* E)/P_N \tag{D.5}$$

$$C_M = C_M(e_M, a)\ ;\ \frac{\partial C_M}{\partial e_M} < 0\ \ \frac{\partial C_M}{\partial a} > 0 \tag{D.6}$$

$$C_N = C_N(e_M, a)\ ;\ \frac{\partial C_N}{\partial e_M} > 0\ \ \frac{\partial C_N}{\partial a} > 0 \tag{D.7}$$

Supply side

$$Q_X = Q_X(e_X)\ ;\ \ \frac{\partial Q_X}{\partial e_X} > 0 \tag{D.8}$$

$$Q_N = Q_N(e_X)\ ;\ \ \frac{\partial Q_N}{\partial e_N} < 0 \tag{D.9}$$

Government sector

$$G = P_N G_N + EP_M^* G_M \tag{D.10}$$

$$\frac{EP_M^* G_M}{G} = \lambda \tag{D.11}$$

$$G = t + \dot{D} \tag{D.12}$$

External sector

$$CA = Q_X(e_X) - P_M^* C_M(e_M, a) - P_M^* G_M \tag{D.13}$$

$$\dot{R} = CA \tag{D.14}$$

$$\dot{M} = \dot{D} + E\ \dot{R} \tag{D.15}$$

$$G = t + \dot{D} \tag{D.16}$$

Equation (D.1) defines total assets (A) in domestic currency as the sum of domestic money (M) plus foreign money (F) times the free market nominal exchange rate. Equation (D.2) defines the real assets in terms of exportable good, where E is the (fixed) commercial rate, $\rho = \delta/E$ is the spread between the free (δ) and commercial (E) nominal exchange rates. Equation (D.3) is the portofolio composition equation and establishes that the desired ratio of real domestic money to foreign money is a negative function of the expected rate of depreciation of the free rate δ. Since perfect foresight is assumed, in (D.3) expected depreciation has been replaced by the actual rate of depreciation. Equation (D.4) establishes that there is no capital mobility and that no commercial transactions are subject to the financial rate δ.[35] It is assumed, however, that this economy has inherited a positive stock of foreign money, so that $F_0 > 0$.

Equations (D.5) through (D.9) summarize the demand and supply sides. e_X and e_M are the (domestic) relative prices of exportables and importables with respect to nontradables. Notice that e_M includes the tariff on imports. e_M^*, on the other hand, is defined as the relative price of importables to nontradables that excludes the tariff. Naturally, e_M is the relevant price for consumption and production decisions. Demand for nontradable and importable goods depend on the relative price of importables and on the level of real assets; supply functions, on the other hand, depend on the price of exportables relative to nontradables. Equations (D.10) and (D.11) summarize the government sector, where G_M and G_N are consumption of M and N respectively. It is convenient to express real government consumption in terms of exportables as:

$$g = g_M + g_N \tag{D.10b}$$

where $g = G/E$, and $g_n = G_N PN/E$. Equation (D.11) defines the ration of government consumption on importable goods as λ. Equation (D.12) is the government budget constraint and says that government consumption has to be financed via non-distortionary taxes (t) and domestic credit creation ($\dot{D}$). Notice, however, that under fixed nominal commercial rates a positive rate of credit growth ($\dot{D} > 0$) is not sustainable. Stationary equilibrium, then, is achieved when $G = t$ and $\dot{D} = 0$.

[35] Later, the assumption of no capital mobility is relaxed; it is assumed that the government is not subject to capital controls, and that there are some capital flows in and out of the country.

If, however, a crawling peg is assumed for the commercial rate (i.e. $(\dot{E}/E)$, it is possible to have a positive $\dot{D}$ consistent with the rate of crawl.

Equations (D.13) through (D.16) summarize the external sector. Equation (D.13) defines the current account in foreign currency as the difference between output of exportables Q_X and total (private plus public sector) consumption of importables. Equation (D.14) establishes that in this model, with no capital mobility and freely determined financial rate, the balance of payments $(\dot{R})$ is identical to the current account, where R is the stock of international reserves held by the central bank expressed in foreign currency. It is assumed that initially there is a positive stock of international reserves (R_0). Equation (D.15) provides the link between changes in international reserves, changes in domestic credit and changes in the domestic stock of money. Finally, the model is closed with equation (D.16) which is the definition of the real exchange rate as the relative price of tradables to nontradables. Notice that this definition of RER excludes the tariff on imports. This is done because most empirical measures of RER exclude import tariff or taxes.

Long run sustainable equilibrium is attained when the nontradable goods market and the external sector (current account and balance of payments) are simultaneously in equilibrium. Due to the assumption tight exchange controls, the external sector long run sustainable equilibrium implies that the current account is in equilibrium in every period. In the short and even medium run, however, there can be departures from this equilibrium. This, of course, will result in the accumulation or decumulation of international reserves. A steady state is attained when the following four conditions hold simultaneously: *(i)* the nontradables market clears; *(ii)* the external sector is in equilibrium $\dot{R} = 0 = CA = \dot{m}$; *(iii)* fiscal policy is sustainable $G = t$; and *(iv)* portofolio equilibrium holds. The real exchange rate prevailing under these steady state conditions is the long run equilibrium real exchange rate.

The nontradable goods market clears when:

$$C_N(e_M, a) + G_N = Q_N(e_X) \tag{D.17}$$

Notice that $G_N = e_X g_N$, where g_N is the real government consumption of N in

terms of exportable goods. From (D.17) it is possible to express the equilibrium price of nontradables as a function of a, g_N, P_M^* and r.

$$P_N = v(a, g_N, P_M^*, r) \quad where \quad \frac{\partial v}{\partial a} > 0;\ \frac{\partial v}{\partial g_N} > 0;\ \frac{\partial v}{\partial P_M *} > 0;\ \frac{\partial v}{\partial r} > 0 \qquad \text{(D.18)}$$

Notice that since the real value of total assets (a), is an endogenous variable we have to investigate how changes in g_N, P_M^* and r affect real wealth (a) before solving for P_N.

Since the nominal exchange rate for commercial transactions is fixed, $(\dot{\delta}/\delta)$ in the portofolio equilibrium condition —equation (D.3)— can be substituted by the rate of change of the spread $(\dot{\rho}/\rho)$. Thus, we can write $m/\rho F = \sigma(\dot{\rho}/\rho)$. Inverting this equation and solving for $\dot{\rho}$ we obtain:

$$\dot{\rho} = \rho L\big(\frac{m}{\rho F}\big); \qquad L^{'}(.) < 0 \qquad \text{(D.19)}$$

Equation (D.19) indicates that the higher the spread the lower the expectations of further increases of the free rate, and thus, the higher the amount of (real) domestic money the public is willing to hold.

From equations (D.10), (D.12), (D.13), (D.14), and (D.15), the following expression for $\dot{m}$ can be derived:

$$\dot{m} = Q_X(e) - C_M(e, a) + g_N - t/E \qquad \text{(D.20)}$$

Equilibrium of the external sector requires that $\dot{m}$.

After the steady state values of ρ and m are determined, equation (D.18) can be used to find, for the corresponding values of g_N, P_M^* and r, the long run equilibrium price of tradables. Equation (D.16) can then be used to find the long run equilibrium real exchange rate:

$$e_{LR} = v(m_0 + \ \rho_0 F_0,\ g_N,\ r_0,\ P_{M_0}^*) \qquad \text{(D.21)}$$

As can be seen from equation (D.21) the long run equilibrium real exchange rate is a function of real variables only —the so-called fundamentals. Whenever there are changes in these variables, there will be changes in the equilibrium RER. In the short run, however, changes in monetary variables, such as D, $\dot{D}$ and E will also affect the RER.

The model has four important implications. First, in the short run real exchange rate movements will respond to both real and monetary disturbances. Second, in the long run equilibrium real exchange rate movements will depend on real variables only. Third, inconsistently expansive macroeconomic policies will generate, in the short run, an overvaluation. Fourth, nominal devaluations will only have a lasting effect on the equilibrium RER if they are undertaken from a situation of overvaluation and if they are accompanied by "appropriate" macroeconomic policies.

The following equation for the dynamics of RER behavior captures the points made by the model:

$$\begin{aligned}\Delta loge_t = \ \theta(loge_t^* \ - \ loge_{t-1}) - \lambda(Z_t - Z_t^*) \ + \ \Phi(logE_t - logE_{t-1}) \\ -\psi(PMPR_t - PMPR_{t-1})\end{aligned} \tag{D.22}$$

where e_t is the actual RER; e_t^* is the equilibrium real exchange rate, in turn a function of the fundamentals; Z_t is an index of macroeconomic policies (i.e. the rate of growth of domestic credit); Z_t^* is the sustainable level of the macroeconomic policies (i.e. rate of increase of demand for domestic money); E_t is the nominal exchange rate; $PMPR_t$ is the spread in the parallel market for foreign exchange.

Conclusion générale

Tout au long de cette thèse, nous nous sommes attachés à apporter des éclairages nouveaux sur les implications économiques et financières des mésalignements de change auxquelles font face les pays en développement et les économies émergentes. Plus particulièrement, les travaux que nous avons menés se structurent autour de deux axes de recherche qui renvoient chacun à une préoccupation majeure pour la "bonne" conduite de la politique de change: la question des effets des mésalignements de change sur la croissance économique et celle de la capacité et des modalités d'ajuste- ment des économies. Ces deux axes de recherche s'appuient chacun sur deux études empiriques qui ont vocation à répondre à ces questions sous un angle particulier.

La première analyse que nous effectuons dans cette thèse concerne les effets des mésalignements de change sur la croissance économique des pays de la zone CFA. Cette problématique s'inscrit dans les récents débats portants sur la compétitivité des pays de la zone CFA. En effet, suite à la forte appréciation de l'euro enregistrée durant la décennie 2000, des inquiétudes ont commencé à émerger sur la compétitivité-prix et plus généralement la "rentabilité" des secteurs d'exportation des pays de la zone CFA. Bien que ce contexte ait donné naissance à des travaux consacrés aux effets des mésalignements de change sur la croissance dans la zone CFA, ces études se limitent juste aux seuls effets de compétitivité-prix induits par les mésalignements de change. Or, à bien des égards, le cas de la zone CFA apparait pourtant atypique en raison de l'ancrage du Franc CFA à l'euro. En effet, du fait de cet ancrage, d'autres effets peuvent également être à l'œuvre. Le premier chapitre de cette thèse entend donc combler ce "vide" dans la littérature en intégrant dans l'analyse entre les mésalignements de change et la croissance économique, le canal dit de "la dette libellée en devises" qui, via des effets de valorisation sur les stocks de

dette en devises (hors Franc français et euro), exercerait des effets opposés à ceux induits par le canal "traditionnel" de la compétitivité. L'existence d'importants stocks de cette dette libellée en devises en raison du "péché originel" expose, en effet, ces pays à des effets de valorisation d'une ampleur plus ou moins importante qu'il convient de prendre en compte. L'examen de l'existence de ce canal est effectué via une analyse économétrique mobilisant entre autre un modèle non-linéaire à transition lisse en panel (*PSTR, Panel Smooth Transition Regression*) afin de mettre en évidence d'éventuels effets non-linéaires exercés par les mésalignements. Nos résultats, robustes à la mesure du mésalignement de change, indiquent que si la croissance dans les pays de la zone CFA est principalement expliquée par le canal de la compétitivité-prix, cet effet est toutefois atténué par des effets de valorisation exercés par les mésalignements sur la dette libellée en devises.

Le second chapitre s'inscrit dans la continuité du précédent puisqu'il étend l'analyse de l'existence du même canal de la dette en devises à un échantillon plus large composé de 72 pays émergents et en développement. Par ailleurs, l'accent est également mis sur le rôle du régime de change dans la diffusion des effets de valorisation qui sous-tendent le canal de la dette extérieure. En ce qui concerne la méthodologie, nous recourons à (*i*) une analyse bayésienne de type *Bayesian Model Averaging* (BMA) pour tenir compte de l'incertitude liée au choix du modèle de croissance et (*ii*) à la méthode des moments généralisés en système pour assurer une robustesse des résultats en présence d'endogénéïté. Nos résultats confirment l'existence d'un canal de la dette extérieure. Toutefois, les effets de valorisation qui sous-tendent ce canal apparaissent plus significatifs dans le régime de sous-évaluation. Par ailleurs, il ressort également de notre analyse que le régime de change joue un rôle important dans la diffusion de ces effets de valorisation.

Deux apports principaux émanent de ce premier axe de recherche. En effet, outre la mise en lumière de l'existence de non-linéarité dans la relation entre les mésalignements de change et la croissance, ce premier axe de recherche a permis de mettre en exergue l'existence d'un canal financier de la "dette en devises" à travers lequel les mésalignements de change impactent la croissance. Ce faisant, cette thèse contribue de façon significative à la littérature sur les canaux de transmission des effets des mésalignements de change sur la croissance. Au delà de ce seul aspect, la

mise en lumière de ce canal de transmission permet de réconcilier les deux pans de la littérature sur les effets des mésalignements de change sur la croissance à savoir l'*export led growth theory* et le *Consensus de Washington*. La deuxième contribution de ce premier axe de recherche réside également dans la mise en lumière de l'importance de considérer le régime de change dans la relation mésalignements de change - croissance. Ces deux contributions ont bien évidemment une portée en ce qui concerne la conduite de la politique économique —et plus particulièrement de change— dans la mesure où elles soulignent très clairement la nécessité de minimiser les mésalignements de change et surtout le besoin, pour ces pays, d'avoir un régime de change ou de mener une politique de change cohérente avec la composition de leur dette libellée en monnaies étrangères.

Le second axe de recherche de cette thèse s'intéresse plus particulièrement aux questions soulevées par la politique de change.

Dans le troisième chapitre, nous analysons la question de la capacité d'ajustement des économies selon le régime de change sous l'angle des mésalignements de change. En effet, dans la mesure où les mésalignements de change reflètent l'ampleur des déséquilibres internes et externes des économies, ils constituent un indicateur de choix pour l'analyse de la capacité d'ajustement des économies. L'analyse empirique que nous menons est également motivée par les insuffisances de la littérature empirique menée sur ce sujet. L'idée sous-jacente à notre analyse est qu'un régime de change approprié devrait faciliter les ajustements macroéconomiques des économies et leur éviter de subir des mésalignements de change importants. Notre analyse, basée sur un échantillon de 73 pays émergents et en développement et mobilisant diverses classifications *de facto* de régimes de change, ne parvient cependant pas à établir de façon robuste l'existence d'un lien entre le régime de change et les mésalignements de change. Plus spécifiquement, nous trouvons que les performances des régimes de change en terme de mésalignements dépendent de la classification des régimes de change utilisée. Par ailleurs, nous montrons que pour discriminer les régimes de change sur la base des mésalignements de change, il est important de les différencier sur la base de leur cohérence avec les politiques macroéconomiques sous-jacentes. Les mésalignements de change n'apparaissent pas ainsi relever de

l'arbitrage entre régimes fixes et flexibles, ni de l'utilisation des réserves de change —qui ne capturent pas de façon adéquate les interventions sur le marché de change, mais sont principalement le résultat de régimes de change dysfonctionnants.

L'apport principal de ce troisième chapitre est donc de fournir des arguments statistiques robustes pour expliquer l'incapacité actuelle de la littérature à obtenir des résultats probants sur les performances des régimes de change. En effet, si aucun consensus ne semble émerger sur la supériorité d'un régime par rapport à un autre, nos résultats montrent que ce résultat est en partie lié aux classifications *de facto* existantes des régimes de change. De façon plus générale, nos résultats montrent que l'objet sur lequel portent les performances des régimes de change doit être nécessairement cohérent avec la/les classifications *de facto* utilisée(s).

Le quatrième et dernier chapitre de cette thèse s'inscrit dans la continuité du troisième puisqu'il s'intéresse aux modalités de transmission des variations du taux de change nominal à celles du taux de change réel. En effet, en raison d'institutions faibles, de marchés financiers peu développés, d'un manque de crédibilité et d'une exposition forte aux chocs externes, les pays en développement et certaines économies émergentes ont souvent opté pour des régimes de changes fixes, ce qui s'est traduit par la mise en place de programmes d'ajustement accompagnés de dévaluations nominales dans le but de résorber les mésalignements de change. Dans d'autres pays, les crises financières se sont souvent accompagnées par de fortes dépréciations nominales. Etant donnée la fréquence de ces ajustements nominaux, nous cherchons à savoir dans ce chapitre dans quelle mesure ils se sont traduits par une dépréciation réelle. L'originalité de notre travail réside dans l'accent que nous portons sur les rôles joués par l'ampleur de la dévaluation/dépréciation ainsi qu'à l'ampleur initiale du mésalignement du taux de change réel, deux éléments moins étudiés dans la littérature. En nous appuyant sur un cadre théorique formel, des faits stylisés, et diverses analyses économétriques (dont une analyse bayésienne de type *Bayesian Averaging of Classical Estimates* (BACE)), nous montrons qu'une surévaluation importante du taux de change réel est une condition nécessaire pour que la dévaluation/dépréciation du taux de change nominal se traduise effectivement par une dépréciation du taux de change réel. Nos résultats mettent également en évidence l'existence d'une relation non-linéaire entre l'ampleur de la dévaluation/dépréciation

et son effectivité, soulignant ainsi l'importance de l'ampleur de l'ajustement nominal: une forte dévaluation/dépréciation nominale ne se traduit pas nécessairement par une forte dépréciation —à court/moyen terme— du taux de change réel.

Au-delà de ses apports, cette thèse comporte —naturellement— des limites qui ouvrent toutefois plusieurs pistes prometteuses pour des travaux de recherche futurs. Ainsi, dans la continuité des travaux menés dans notre premier axe de recherche —et développés dans les chapitres I et II, un prolongement réside dans le développement d'un modèle théorique afin de formaliser les effets de valorisation induits par les mésalignements de change et donc l'existence d'un canal de la dette libellée en devises. Au niveau empirique, une contribution importante à la littérature pourrait être de remonter plus en amont dans la relation mésalignements de change - croissance et d'identifier les facteurs et/ou conditions à la source des effets positifs ou négatifs des mésalignements de change réels. Un autre prolongement de l'analyse pourrait être d'étudier le canal de la dette en devises et son importance pour la croissance par le biais d'exercices de simulation effectués dans le cadre d'un modèle d'équilibre général par exemple, avec la prise en compte des caractéristiques structurelles des différents pays. Le cadre d'un modèle d'équilibre général se prête également bien pour analyser de manière plus détaillée et approfondie les conditions d'effectivité de l'ajustement par le taux de change nominal, analysées dans le chapitre IV. Le chapitre III quant à lui ouvre des réflexions à mener sur les classifications *de facto* existantes des régimes de change. En effet, l'incapacité de la littérature à obtenir des résultats robustes provient en partie du fait que les classifications de change mesurent en réalité différents aspects des politiques économiques sous-jacentes à ces régimes de change. Une des limites mise en exergue dans le chapitre III est l'incapacité de ces classifications à rendre compte du réel degré de flexibilité du taux de change. Cette limite à son tour laisse planer le doute sur les résultats des études s'intéressant aux capacités d'ajustement des économies selon les régimes de change. A ce titre, il serait utile de développer un indice multilatéral —dans l'esprit de celui de Gosh et al. (2014)— pour rendre compte du réel degré de flexibilité du taux de change des économies en lieu et place des classifications existantes basées sur des relations bilatérales. Par ailleurs, le chapitre III

pose certaines bases qui pourraient servir à une analyse du régime de change *de facto* optimal. Ainsi, un développement envisageable pourrait être de chercher à identifier le régime de change *de facto* sous-jacent au taux de change d'équilibre via l'estimation d'un panier d'ancrage "optimal".

Les différentes extensions proposées font notamment écho aux débats académiques et politiques concernant les projets d'unions monétaires en Afrique. Elles pourraient permettre ainsi non seulement des analyses prospectives sur la faisabilité des unions monétaires, mais aussi sur les modalités et les conditions d'ajustement du taux de change. En effet, si les autorités monétaires prévoient à court/moyen terme la création de cinq unions monétaires[36] —dans le but de promouvoir les échanges inter-membres, de favoriser une certaine stabilité à l'intérieur des zones afin d'appuyer la croissance, mais aussi de conférer/conforter (de) la crédibilité aux pays membres—, certaines questions cruciales comme celle du type de régime de change ou encore celle de la/des monnaies d'ancrage méritent d'être étudiées d'avantage.[37]

[36]Parmi ces unions monétaires, trois seraient l'expansion d'unions monétaires déjà existantes. Il s'agit notamment des deux blocs économiques et monétaires de la zone franc CFA —i.e. l'*Union Economique et Monétaire Ouest Africaine* (UEMOA) et la *Communauté Economique et Monétaire de l'Afrique Centrale* (CEMAC)— et de l'Aire Monétaire Commune qui rassemble l'Afrique du Sud, le Lesotho, le Swaziland et la Namibie.

[37]L'argument des échanges inter-régionaux comme vecteur important de la croissance prend une dimension plus importante eu égard aux prévisions démographiques sur le continent africain. En effet, selon les experts des Nations Unies, la population de l'Afrique doublera d'ici 2050. La poussée démographique, l'urbanisation et la croissance économique, devraient s'accompagner de nouveaux besoins —en alimentation, en énergie, en biens d'équipement durables, en technologies de l'information et de la communication, etc— ce qui ouvre des perspectives commerciales prometteuses.