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Profitability, efficiency and risk in banking and microfinance

Rentabilité, efficacité et risque en milieu bancaire et microfinance

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Par

Votsoma DJEKNA

pour obtenir le grade de Docteur de l'Université du Littoral Côte d'Opale

***Profitability, efficiency and risk in banking and
microfinance***

Soutenue le 12 décembre 2022, après avis des rapporteurs, devant le jury d'examen :

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The view expressed in this dissertation are those of the author and do not necessary represent those of the University of Littoral Opal Coast.

In memory of my father,
VOTSOMA François,
The strength of your memory is a motivation

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Long abstract

L'objectif principal de notre thèse est d'analyser les facteurs explicatifs de la rentabilité, de l'efficacité et des crédits à problèmes dans le portefeuille des institutions financières.

La thèse est constituée de quatre chapitres. Le premier chapitre propose d'étudier l'importance de la segmentation de la clientèle sur le niveau de risque de l'institution financière. Le deuxième chapitre analyse l'impact de l'origine des actionnaires sur le niveau de risque dans les banques commerciales. Le troisième chapitre analyse les déterminants de l'inefficacité des institutions de microfinance dans les pays de la Communauté Economique et Monétaire d'Afrique Centrale et de l'Union Economique et Monétaire Ouest-Africaine. Enfin, dans le quatrième chapitre, nous soulevons l'importance de l'origine des actionnaires et du pouvoir de marché sur la rentabilité financière des institutions financières dans un contexte plus réduit à l'instar du le Cameroun.

Ces vingt dernières années ont été marquées par une expansion considérable du secteur de la microfinance. Depuis ses débuts sous forme de programmes expérimentaux dans les pays d'Asie et d'Amérique latine dans les années 1970, la microfinance a amélioré les revenus des plus pauvres et réduit les inégalités (Clark et Spraggon, 2022 ; Bangoura et al., 2016 ; Hudon, 2010). La microfinance a alors touché les ménages les plus défavorisés, parmi lesquels les femmes (D'Espallier et al., 2011 ; Diaz-Serrano et Sackey, 2022), les ménages considérés comme très risqués, les ménages les plus pauvres ou très pauvres (Hudon, 2010, Hudon et Traca, 2011) et a participé à amélioration du bien-être des exclus du secteur bancaire. La microfinance a donc été une réponse aux problèmes économiques majeurs que sont la pauvreté et les inégalités (Ledgerwood, Earne et Nelson, 2013 ; Liñares-Zegarra et Wilson, 2018).

Les institutions de microfinance (IMF) développent des stratégies pour améliorer leurs performances financières et sociales (Hermes et Hudon, 2018) afin de produire et d'offrir davantage de services financiers aux ménages à faibles revenus. La viabilité et la durabilité nécessitent un style de management, une gestion optimale des coûts, le

respect des contraintes et des objectifs spécifiques. Aujourd'hui, les institutions de microfinance (IMFs) continuent de se développer en intégrant les aspects socio-économiques dans leurs politiques visant particulièrement les femmes (Diaz-Serrano et Sackey, 2022). Les IMFs cherchent donc à combiner les aspects économiques, sociaux et même environnementaux afin de rester durables et de répondre aux objectifs sociaux, initiaux, de réduction de la pauvreté. Dans un contexte de recherche de rentabilité par les entreprises, les IMFs sont tiraillées entre des décisions stratégiques et des combinaisons optimales de facteurs pour rester rentables et pérennes.

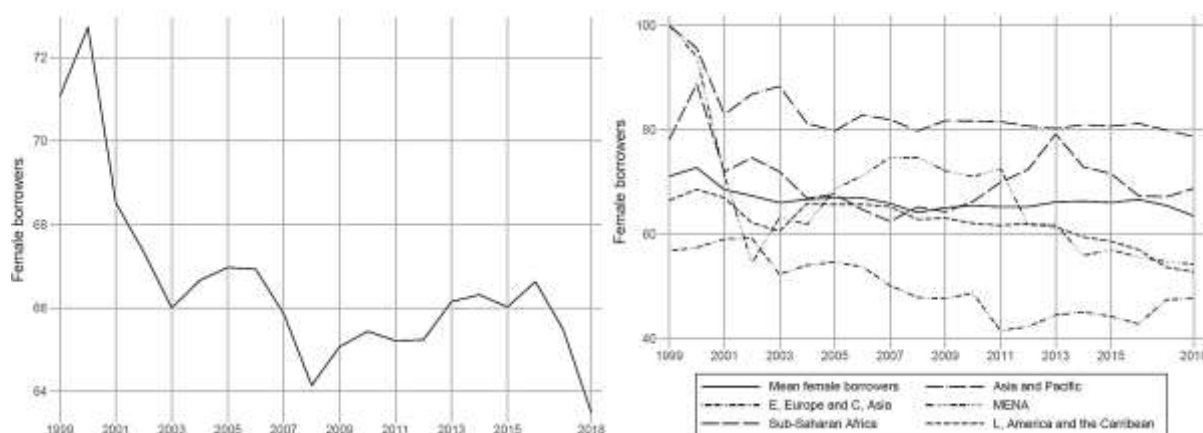
En plus des autres institutions présentes dans le secteur financier, la prolifération des IMFs a entraîné une compétition, une recherche tout azimuts du pouvoir de marché, de la rentabilité et de la pérennité. Les choix stratégiques des IMFs peuvent alors être biaisés et conduire celles-ci à s'exposer davantage à des risques financiers divers.

Une littérature importante sur la microfinance s'est intéressée, d'une part, aux facteurs susceptibles d'influencer la rentabilité des IMFs ainsi que leur efficacité, aux techniques de gestion des risques et aux déterminants des risques financiers. Et d'autre part, elle va mettre un accent sur la capacité qu'ont les IMFs à atteindre les femmes et à améliorer leur bien-être (D'Espallier et al., 2011). Plusieurs auteurs d'ailleurs ont mobilisé cette littérature pour justifier l'implication et le ciblage des femmes par les IMFs. C'est le cas, par exemple, de Abdullah and Quayes (2016) ; Armendariz et Morduch (2005) ; D'Espallier et al. (2011) qui avancent l'idée selon laquelle les femmes ont un taux de remboursement très élevé par rapport aux hommes. Les réseaux de défense et les sponsors de la microfinance, tels que la Banque Mondiale et le FMI, ainsi que les agences d'aide au développement bilatérales et multilatérales, affirment régulièrement que les femmes sont de bons risques de crédit (D'Espallier et al., 2011 ; Banque mondiale, 2007).

Mais qu'en est-il aujourd'hui ? Les femmes restent-elles toujours de meilleurs risques de crédit par rapport aux hommes ? Le fait est que notre graphique ci-dessous représente le pourcentage moyen de femmes emprunteuses dans le portefeuille des IMFs dans le

monde et dans les différentes régions¹. Il en ressort que le pourcentage moyen de femmes emprunteuses décroît au fur et à mesure dans le temps, surtout après la crise financière. En 1999, par exemple, le pourcentage moyen de femmes emprunteuses était largement au-dessus de 70% et s'est considérablement dégradé en 2003, puis en 2008, pour atteindre un niveau bas en 2018 en dessous des 64%. La situation par région confirme ce constat car on peut observer dans le graphique de droite une décroissance globale du pourcentage moyen de femmes emprunteuses. Toutes les dispersions dans la région Europe de l'est et Asie centrale et celles dans la région Amérique latine et Caraïbes sont en dessous du pourcentage moyen par contre celles dans la région Afrique sub-saharienne et dans la région Asie et pacifique sont au-dessus du pourcentage moyen. Seule la région MENA se situe au-dessus du pourcentage moyen de 1999 à 2012 et ensuite en dessous du pourcentage moyen après 2012.

Figure 1. 1. Portefeuille moyen à risque et pourcentage d'emprunteurs féminins.



Source : Calcul à partir des données *Mix Market*.

Une double question nous interpelle. Premièrement est-ce que les femmes restent toujours de « meilleurs risques » ? et deuxièmement pourquoi le pourcentage moyen de femmes emprunteuses décroît dans le portefeuille des IMFs si celles-ci tendent à réduire l'exposition au risque des IMFs ?

¹ MENA, Afrique subsaharienne, Asie et pacifique, Europe de l'est et Asie centrale, Amérique latine et les caraïbes.

Afin de répondre à cette problématique, nous estimons la relation entre le pourcentage de femmes emprunteuses et le niveau de risque à partir d'un modèle linéaire multivarié sur un échantillon de 508 IMFs situées dans 80 pays du monde entre 1999 et 2018.

Nous mobilisons la théorie de la détection du signal (Spence, 1973), la théorie du compte de contrôle (Hodgman, 1963) et la théorie du portefeuille de Markowitz (Markowitz, 1952), qui permettraient à l'institution de microfinance (IMF) de différencier ses emprunteurs et de trouver des combinaisons de rentabilité optimale pour ses activités afin de choisir les « meilleurs risques ». Ces théories nous semblent appropriées étant donné les objectifs de rentabilité de l'IMF et la forte présence d'asymétrie d'information sur ce marché. Il est donc crucial que l'emprunteur soit un déposant et que les signaux envoyés par ce dernier à l'agent de crédit soient positifs pour une meilleure évaluation de la solvabilité et du niveau de risque de l'emprunteur.

Les résultats de nos estimations montrent que les IMFs ayant un pourcentage de femmes emprunteuses élevé, un rendement des actifs élevé et une grande taille gèrent mieux les risques que leurs homologues. Un autre résultat est que plus une IMF se dote de provisions pour la dépréciation des prêts, plus son portefeuille à risque augmente. De façon plus intuitive, le niveau de risque des IMFs augmente en période de crise. Enfin, les résultats révèlent également qu'en période d'inflation, le niveau de risque diminue alors qu'il augmente en période de croissance économique.

La deuxième section de cet article présente la littérature existante sur la relation entre le type de clientèle et le risque en microfinance, la troisième section l'approche méthodologique, la quatrième section les données, la cinquième section les résultats empiriques et les interprétations, la sixième section les tests de robustesse et la dernière section conclut.

Les banques traditionnelles et les institutions de microfinance peuvent être considérées comme deux types d'intermédiaires financiers d'essences différentes, mais elles ont souvent le même objectif : collecter l'épargne d'agents excédentaires pour le financement de projets jugés rentables (Fall, 2009, 2011). D'ailleurs, les faits stylisés sur

la période 1980-2019 dans les pays de l'UEMOA et de la CEMAC montrent clairement une augmentation de la microfinance bancaire complémentaire. De plus, comme le montre Kouakou (2020), cette combinaison des activités bancaires et de microfinance ne peut être que bénéfique pour la croissance. Alors que les banques formelles apprennent l'intermédiation de proximité, les IMF apprennent la connaissance bancaire. Cette conception de l'institution financière guide le choix des produits (outputs) et des facteurs de production (inputs) dans cette étude.

Néanmoins, les banques et la microfinance se distinguent par leur logique d'intermédiation, l'échelle de leurs opérations, la temporalité de leurs contrats et les mécanismes de sélection et de suivi des projets (Fall, 2011). Dans les pays de l'UEMOA et de la CEMAC, le statut juridique des banques et des IMF constitue une autre distinction. Les institutions bancaires sont supervisées par la banque centrale et régies par la loi bancaire, tandis que les structures de microfinance dépendent du ministère de l'Économie et des Finances et sont régies par une loi spécifique. Les banques sont des institutions financières monétaires car elles ont le pouvoir de créer de la monnaie, alors que les IMF n'ont pas cette licence. Les IMF sont des institutions non monétaires qui fonctionnent uniquement sur la base des ressources qu'elles collectent.

La littérature économique et financière modélise les intrants et les extrants de la banque et de la microfinance selon deux approches principales : la production et l'intermédiation. L'approche de la production considère que les banques produisent diverses catégories de dépôts, de prêts et d'autres services en utilisant des facteurs physiques, tels que le capital physique, le travail, les matériaux et la superficie (Benston, 1965 ; Bell et Murphy, 1968 ; Berger et Humphrey, 1991). Le modèle d'intermédiation considère les institutions financières comme des agents (ou intermédiaires) qui transfèrent des fonds entre les agents ayant des besoins de financement et ceux ayant des capacités de financement. Dans cette optique, les facteurs de production sont le travail, le capital physique et parfois les fonds propres pour convertir le capital financier tel que les dépôts et autres fonds en prêts, titres, investissements et autres actifs générateurs de revenus. L'institution produit alors des services d'intermédiation dans la

mesure où ses produits émanent des actifs de l'entreprise sous la forme de différents types de prêts et d'investissements, et où les coûts financiers des comptes sont enregistrés au passif (Sealey Jr et Lindley, 1977).

Plusieurs raisons justifient le choix de l'approche de l'intermédiation pour analyser l'efficacité des IMF dans cette étude. Tout d'abord, Berger et Mester (1997) notent que l'approche de l'intermédiation est plus appropriée, car les gestionnaires des institutions financières se concentrent sur la réduction des coûts totaux, et pas seulement sur les coûts hors taux d'intérêt. Ohene-Asare (2011) confirme que cette approche englobe les coûts totaux de la banque et n'exclut pas les charges d'intérêt, car ces charges constituent une part importante du coût total de la banque, et leur élimination pourrait biaiser les résultats empiriques. La deuxième raison, évoquée par Sealey Jr et Lindley (1977), tient à la nature des activités des institutions financières. Les institutions financières étant spécialisées dans la transformation des dépôts et des crédits, les dépôts collectés constituent une partie des fonds utilisés pour accorder des crédits et réaliser des investissements. Les dépôts sont donc considérés comme des intrants et non comme des extrants, comme dans l'approche de la production qui peut être plus appropriée, comme le souligne Ohene-Asare (2011), pour les études d'efficience au niveau des agences bancaires.

Pour Ferrier et Lovell (1990), l'approche par l'intermédiation est la meilleure lorsque l'objectif est la viabilité économique de l'institution financière, car elle incorpore tous les coûts bancaires généraux, contrairement à l'approche par la production qui se concentre principalement sur les coûts d'exploitation. Il n'y a pas de consensus sur l'utilisation de certains outputs et inputs dans l'analyse de l'efficacité des institutions financières, bien que l'approche de l'intermédiation soit dominante.

Comme mentionné ci-dessus, l'objectif de cette étude est d'analyser les déterminants de l'inefficience des IMF dans les pays de l'UEMOA et de la CEMAC. Etant donné que les IMF varient d'une zone à l'autre, en fonction des spécificités de chaque système financier, des niveaux de pauvreté, de l'importance des subventions et de l'implication des

pouvoirs publics (Fall et Servet, 2010), nous utilisons la méthodologie développée par Wang et Ho (2010). Un des premiers apports de cette étude est l'utilisation du modèle de Wang et Ho (2010), qui n'a pas encore été utilisé à notre connaissance dans le secteur de la microfinance. Cette méthode d'estimation permet de distinguer, pour chaque institution, l'hétérogénéité invariante dans le temps de l'inefficience variable dans le temps. L'hétérogénéité de chaque institution est nécessaire pour au moins deux raisons. La première est d'estimer la technologie de production en considérant l'hétérogénéité sous forme d'effets fixes. Cette hétérogénéité se reflète dans l'estimation de la technologie de production par une constante différente pour chaque institution, et se traduit donc par une partie différente du coût de production (dans le cas de l'estimation d'une fonction de coût). La deuxième raison est d'estimer correctement l'inefficacité. Si l'hétérogénéité n'est pas prise en compte, une partie de celle-ci se reflète dans l'estimation de l'inefficacité. Cela conduit à une surestimation ou à une sous-estimation. Bien que nécessaire, la prise en compte de l'hétérogénéité par l'intégration d'effets fixes dans l'estimation de la technologie peut poser des problèmes d'estimation. En effet, cette dernière est potentiellement sujette à un problème de paramètres incidents, car il y a autant d'effets à estimer qu'il y a d'institutions dans l'échantillon. L'estimation de ces effets fixes est problématique dans les cas où chaque institution est observée pendant un nombre limité d'années.

Pour éviter ce problème potentiel de paramètres accessoires tout en distinguant l'hétérogénéité de l'inefficacité, Wang et Ho (2010) proposent une transformation en différence première ou en intra. Ces méthodes estiment la technologie de production sans être sujettes à ce problème de paramètres incidents, car les effets fixes seront supprimés de l'estimation, mais la technologie de production sera toujours correctement estimée.

Nous utilisons la méthode de Wang et Ho (2010) pour estimer une fonction de coût translog afin de caractériser la technologie de production des IMF et d'analyser les déterminants de l'inefficience. A notre connaissance, une autre contribution de cette

étude est qu'elle est la première à décomposer les dépenses opérationnelles en dépenses administratives, financières et d'amortissement pour estimer la technologie de production des prêts. Les estimations sont réalisées sur un échantillon de 102 IMF de huit pays de l'Afrique de l'Ouest et du Centre pour une période de 16 ans allant de 2003 à 2018.

Cette étude met en évidence que dans les économies de l'UEMOA et de la CEMAC, trois déterminants sont importants : le pourcentage de femmes emprunteuses, la concentration des parts de marché et l'âge de l'entreprise. Les IMF spécialisées dans les prêts aux femmes sont moins efficaces, et les IMF les plus jeunes sont les plus efficaces. Nous constatons également que moins il y a de concurrence dans le secteur de la microfinance au niveau local, plus il est efficace.

Le reste de ce document est organisé comme suit. La section 2 présente la littérature connexe. La section 3 présente les méthodes utilisées pour examiner les déterminants de l'inefficience et, en particulier, les méthodes utilisées pour décomposer l'inefficience de l'hétérogénéité. En particulier, cette section présente l'approche de Wang et Ho (2010) qui est appliquée dans le reste de l'étude. Cette section présente également la stratégie d'estimation qui décompose les dépenses opérationnelles en dépenses administratives, financières et d'amortissement pour estimer la technologie de production des prêts, en s'assurant que l'homogénéité est imposée, et présente la spécification des déterminants de l'inefficience. La section 4 présente l'échantillon des institutions de microfinance des pays de l'UEMOA et de la CEMAC ainsi que les données utilisées. Enfin, la section 5 présente les résultats empiriques et leurs interprétations.

L'une des principales préoccupations des régulateurs et superviseurs bancaires dans de nombreux pays est le niveau élevé et persistant des prêts non productifs enregistrés dans leurs systèmes bancaires, un processus qui a débuté avec la crise financière mondiale. Des problèmes ont été signalés tant dans les banques des pays développés (Beck et al., 2015 ; Nkusu, 2011 ; Ozili, 2019 ; Tinta et Sanou, 2021) que dans celles des pays en développement et des marchés émergents (Belaid et al., 2017 ; Ozili, 2019).

Les prêts non productifs (PNP) sont la mesure traditionnelle la plus directe du risque bancaire et représentent la principale source d'insolvabilité des banques dans les pays en développement et émergents (Honohan, 1997 ; Lanine et Vander Vennet, 2006). Leurs déterminants sont multiples et comprennent des facteurs propres aux banques tels que de mauvaises pratiques de gestion ou des prêts excessifs (Podpiera et Weill, 2008), mais des facteurs macroéconomiques et institutionnels jouent également un rôle, notamment les retombées du risque souverain, l'explosion des prix des actifs ou des matières premières, l'opacité financière et le laxisme de la réglementation (Noel et al., 2021).

Dans cet article, nous étudions les déterminants des risques bancaires dans la Communauté économique et monétaire de l'Afrique centrale (CEMAC) en nous concentrant sur l'impact de l'origine et de la structure de l'actionnariat. Nous considérons quatre types de banques : les banques locales, les banques publiques, les banques étrangères africaines et les banques étrangères non africaines. En particulier, nous nous intéressons à la question de savoir si les banques locales ont mieux (ou non) géré leurs portefeuilles de prêts par rapport aux autres banques, dans la mesure où elles pourraient bénéficier d'un avantage comparatif lié à la proximité culturelle et sociale de leur marché. En principe, cet avantage informationnel devrait améliorer l'efficacité du suivi des emprunteurs et le contrôle des risques de crédit. Comme le suggèrent les théories financières (Diamond, 1984), des niveaux plus faibles d'asymétrie d'information devraient profiter aux emprunteurs, car ils réduisent l'exposition des prêteurs au risque de crédit et aux coûts de surveillance, ce qui se traduit par des conditions de prêt plus favorables et de meilleures performances des emprunteurs. D'un autre côté, il se pourrait que les banques locales soient plus risquées si elles servent une clientèle plus pauvre et plus risquée que, par exemple, une clientèle composée de grandes entreprises exportatrices.

Dans cette étude, la principale mesure des risques bancaires est le ratio de prêts non performants, comme cela a été utilisé dans de nombreuses études (Beck et al., 2015 ; Belaid et al., 2017 ; Bofondi et Ropele, 2011 ; Mazreku et al., 2018 ; Nkusu, 2011 ; Ozili,

2019). Cependant, nous vérifions la robustesse de nos résultats en utilisant d'autres mesures, notamment le Z-Score et le ratio de provisionnement des prêts. Une contribution majeure de cette étude est la collecte détaillée d'informations sur les actionnaires au niveau des banques, qui nous permet non seulement d'identifier l'actionnaire majoritaire, mais aussi les deuxième et troisième actionnaires principaux. Comme nous le montrerons, le deuxième actionnaire peut avoir un impact sur ce processus et, par conséquent, des structures d'actionnariat plus diversifiées peuvent aboutir à des résultats plus favorables du point de vue de la surveillance.

En utilisant des données de panel et la méthodologie du filtre à effets fixes (FEF) de Pesaran et Zhou (2018), nous étudions si les risques bancaires dépendent de l'origine et de la structure de l'actionnariat. Nous utilisons des informations sur la période 2000-14 sur un échantillon de 55 banques commerciales situées dans quatre des six pays de la CEMAC : Cameroun (17 banques), Tchad (12), Congo (15) et Gabon (11). Nos résultats suggèrent que les banques locales opèrent avec des ratios de prêts non performants plus élevés que les autres types de banques, notamment après avoir contrôlé les conditions spécifiques aux banques et les conditions macroéconomiques. Plus précisément, nous constatons que leur ratio de prêts non productifs est supérieur de 8,6 points de pourcentage (p.p.) par rapport à une moyenne de 10,7 p.p.. Il est intéressant de noter que l'origine et le type du deuxième actionnaire le plus important ont un impact sur les risques bancaires. Plus précisément, si le deuxième actionnaire d'une banque locale est le gouvernement, les risques bancaires sont plus élevés de 0,038 point de pourcentage pour chaque point de pourcentage supplémentaire. Si le deuxième actionnaire le plus important est une entité étrangère, les risques bancaires sont inférieurs de -0,248 p.p. pour chaque pourcentage de propriété si l'entité provient d'autres pays africains et de -0,034 p.p. pour chaque pourcentage de propriété si elle provient de pays en dehors de l'Afrique. Évalués à la part moyenne de propriété, par exemple des deuxièmes plus grands actionnaires africains de 29,27 pour cent, les ratios de NPL des banques locales ne sont que de 3,01 p.p. plus élevés que ceux des autres banques. Cela met en évidence le rôle positif joué par les actionnaires étrangers dans

les banques qui sont majoritairement détenues par des actionnaires locaux. Nos résultats suggèrent donc que la structure spécifique de l'actionnariat des banques justifie une attention accrue de la part des autorités de surveillance. Enfin, nous démontrons que les banques de plus grande taille et mieux capitalisées affichent des ratios de NPL plus élevés, tandis que les banques plus rentables affichent des ratios de NPL plus faibles.

Le reste du document est structuré comme suit. La section suivante présente la littérature connexe. Les troisième et quatrième section présentent les données et la méthodologie. La cinquième section présente les résultats empiriques et la dernière section conclut.

Le secteur bancaire des pays de l'Union économique et monétaire des États de l'Afrique centrale (CEMAC) a longtemps été caractérisé par une forte présence de banques étrangères qui ont été progressivement reprises par l'État dans les années 1970. Alors dominé par des capitaux publics, une politique monétaire essentiellement interventionniste et un manque de respect de la réglementation, le système bancaire de la CEMAC a traversé une période de crise importante et de profondes restructurations et réorganisations (Avom et Eyeffa, 2007).

Aujourd'hui, malgré le niveau de risque, et surtout après une profonde restructuration dans les années 1980, l'une des évolutions remarquables a été le désengagement quasi-total, voire total, de l'État de la propriété des banques. Depuis lors, les banques de la sous-région semblent relativement stables. La déréglementation du secteur et la globalisation de l'industrie ont conduit à une prolifération des institutions financières en Afrique centrale.

On observe donc une augmentation du nombre de banques et une diversification de l'actionnariat, initialement dominé par quelques groupes (ou pays). Par exemple, l'actionnariat africain est passé de 4,57% dans les années 2000 à 25,04% en 2014, tandis que l'actionnariat non africain a diminué de plus de 55,48% à 33,32%. Quant à la structure de l'actionnariat local, on observe une fluctuation dans une fourchette de 20

% et 40 % d'actionnaires d'origine camerounaise, entre 2000 et 2014. On observe également un changement dans la structure du marché avec une augmentation du nombre de banques au Cameroun qui passe de 8 banques en 2000 à 13 banques en 2014. L'origine des principaux actionnaires des banques camerounaises entre 2000 et 2014 est dominée par le Cameroun (35,58%), les États-Unis (15,85%), la France (15,66%), le Nigéria (12,20%) et légèrement le Togo (6,31%).

Situé en Afrique centrale sur le golfe de Guinée, le Cameroun est l'un des pays les plus importants de la sous-région CEMAC, représentant plus de 65 % de l'ensemble de l'activité économique de la zone. Depuis les années 2000, le Cameroun a connu une forte libéralisation financière qui a augmenté la prolifération des institutions financières et le degré de compétitivité. Malgré l'augmentation du nombre d'agences sur l'ensemble du territoire, le marché bancaire camerounais semble toujours caractérisé par une forte concentration des activités bancaires et un accès limité aux services financiers.

Le problème de la consolidation des banques françaises et européennes attire particulièrement l'attention. Dans un contexte de faible rentabilité persistante, un nouveau mouvement de concentration dans le secteur bancaire européen avec plusieurs annonces d'opérations de fusion est d'actualité (Silvia et al., 2021 ; Couppey-Soubeyran et Nicolas, 2021).

Selon Couppey-Soubeyran et Nicolas (2021), ce mouvement va accroître la concentration du secteur bancaire européen et, plus largement, le pouvoir de marché afin de générer des rentes en fixant des prix supérieurs à ce qu'ils seraient si la pression concurrentielle était plus forte. Le marché bancaire camerounais, quasi oligopolistique, n'aurait-il donc pas intérêt à rester concentré ?

Bien que Boyd et De Nicolo (2005) montrent que les banques dans un système plus concentré ont tendance à augmenter leur prise de risque, les systèmes bancaires concentrés augmentent le pouvoir de marché et les profits. Il est donc particulièrement intéressant d'évaluer les effets des changements structurels dans le système bancaire camerounais sur ses indicateurs de performance et sa rentabilité. Quel serait l'impact

d'un marché moins concentré, d'une structure de propriété diversifiée et d'un grand nombre de banques sur la rentabilité des banques au Cameroun ?

Un certain nombre d'études ont analysé les effets du pouvoir de marché ou de la concurrence sur la rentabilité des banques en se basant sur différents indicateurs. Les indicateurs couramment utilisés sont l'indice de Herfindahl-Hirshman (Azar et al, 2022 ; Lapteacru, 2017 ; Pelletier, 2018 ; Wang et al, 2020 ; Weill, 1998), la statistique H de Panzar et Rosse (Lapteacru, 2017 ; Lapteacru et Nys, 2011), la concentration des actions détenues par les p plus grandes banques (Léon et Zins, 2020 ; Weill, 1998), l'indice de Lerner (Alexakis et Samantas, 2020 ; Klein et Weill, 2022 ; Lapteacru, 2017 ; Wang et al, 2020) ou encore l'indicateur de Boone (Boone, 2001, 2008 ; Chen et Hsu, 2022).

L'objectif de cet article est d'analyser la relation entre l'origine géographique de l'actionnaire, le pouvoir de marché et la rentabilité des banques au Cameroun. En utilisant un modèle linéaire multivarié, je régresse la rentabilité des banques sur les variables de la structure de propriété et du pouvoir de marché. Je dispose d'un panel non équilibré de 14 banques commerciales situées au Cameroun, observées successivement sur 15 ans, de 2000 à 2014. J'effectue des tests supplémentaires pour corroborer nos résultats en utilisant des sous-échantillons, des variables alternatives et des méthodes d'estimation.

Les résultats montrent que la structure de propriété et la concurrence sont des déterminants importants de la rentabilité des banques au Cameroun. Ils montrent, d'une part, que les banques avec des actionnaires camerounais et les banques avec des actionnaires africains sont plus rentables que les autres banques (avec des actionnaires étrangers en dehors de l'Afrique). D'autre part, les résultats montrent que la concurrence dégrade la rentabilité des banques et qu'un marché bancaire concentré est plus rentable.

La deuxième section du document passe en revue les études théoriques et empiriques sur la relation entre la structure de la propriété, la structure du marché et la rentabilité des banques. La troisième section traite de la méthodologie et de la spécification du modèle. La quatrième section présente les données de mon étude. La cinquième section

présente les résultats de l'analyse empirique, la sixième section présente les tests de robustesse et enfin la dernière section conclut et développe les implications politiques.

Résumé

L'objectif principal de notre thèse est d'analyser les facteurs explicatifs de la rentabilité, de l'efficacité et des crédits à problèmes dans le portefeuille des institutions financières. La thèse est constituée de quatre chapitres. Le premier chapitre propose d'étudier l'importance de la segmentation de la clientèle sur le niveau de risque de l'institution financière. Pour cela, nous examinons la relation entre le pourcentage de femmes emprunteuses et le niveau de risque des institutions de microfinance. Nous trouvons une relation négative entre le pourcentage de femmes emprunteuses et le portefeuille à risque, bien que la part des femmes dans la clientèle des institutions de microfinance tend à diminuer. L'analyse montre que ce paradoxe apparent s'explique par l'augmentation de la taille des institutions de microfinance : les femmes réduisant l'exposition au risque, les institutions dans lesquelles elles sont plus présentes grossissent plus vite, et sont obligées de réduire la part des femmes, au risque d'augmenter leur exposition au risque. Le deuxième chapitre analyse l'impact de l'origine des actionnaires sur le niveau de risque dans les banques commerciales. Pour cela nous examinons la relation entre l'origine des actionnaires et le risque dans la Communauté Economique et Monétaire d'Afrique Centrale. Nous trouvons que les banques détenues localement ont opéré avec des ratios de prêts non performants significativement plus élevés que leurs homologues détenus par l'État ou par des étrangers. Il est également intéressant de noter que l'origine et le type du deuxième plus grand actionnaire ont un impact sur les risques de crédit observés dans les banques locales. Alors que l'Etat en tant que second actionnaire majoritaire contribue à des risques plus élevés dans les banques locales, les actionnaires étrangers contribuent à des niveaux de risques plus faibles en particulier lorsqu'ils proviennent des régions africaines. Nos résultats suggèrent donc que la structure spécifique de l'actionnariat des banques justifie une attention supplémentaire en matière de supervision. Le troisième chapitre analyse les déterminants de l'inefficacité des institutions de microfinance dans les pays de la Communauté Economique et

Monétaire d'Afrique Centrale et de l'Union Economique et Monétaire Ouest-Africaine. Les résultats mettent en évidence le fait que les institutions de microfinance moins spécialisées dans les prêts aux femmes et les institutions de microfinance plus jeunes sont plus efficaces et que la concurrence détériore l'efficacité des institutions de microfinance dans ces pays. Enfin, le quatrième chapitre examine la relation entre l'origine de l'actionnaire, le pouvoir de marché et la rentabilité des banques. Nous trouvons que les banques détenues localement et les banques détenues par des africains sont plus rentables que les autres banques et que la concurrence (pouvoir de marché) détériore (améliore) leur rentabilité. Un autre résultat important est que les mécanismes d'intermédiation financière (la transformation des dépôts en crédits) réduisent la rentabilité des banques et que plus les provisions sont élevées, plus la banque est rentable. Enfin, en période de croissance économique ou d'inflation, la rentabilité des banques camerounaises diminue.

Mots clés : Rentabilité, Efficacité, Risque, Banque, Microfinance.

Abstract

The main objective of our thesis is to analyse the explanatory factors of profitability, efficiency and non-performing loans in the portfolio of financial institutions. The thesis consists of four chapters. The first chapter proposes to study the importance of customer segmentation on the risk level of the financial institution. To this end, we examine the relationship between the percentage of female borrowers and the risk level of microfinance institutions. We find a negative relationship between the percentage of female borrowers and the portfolio at risk, even though the share of women in the clientele of microfinance institutions tends to decrease. The analysis shows that this apparent paradox can be explained by the increase in the size of microfinance institutions: as women reduce risk exposure, the institutions in which they are more present grow faster, and are forced to reduce the share of women, at the risk of increasing their risk exposure. The second chapter analyses the impact of shareholder origin on the risk level of commercial banks. We examine the relationship between shareholder origin and risk in the Economic and Monetary Community of Central Africa. We find that locally owned banks operated with significantly higher non-performing loan ratios than their state-owned or foreign-owned counterparts. It is also interesting to note that the origin and type of the second largest shareholder has an impact on the credit risks observed in local banks. While the state as the second largest shareholder contributes to higher risks in local banks, foreign shareholders contribute to lower levels of risk especially when they come from African regions. Our results therefore suggest that the specific ownership structure of banks warrants additional supervisory attention. The third chapter analyses the determinants of inefficiency of microfinance institutions in the countries of the Central African Economic and Monetary Community and the West African Economic and Monetary Union. The results show that microfinance institutions less specialized in lending to women and younger microfinance institutions are more efficient and that competition worsens the efficiency of microfinance institutions in these countries. Finally, the fourth chapter examines the relationship between shareholder origin, market power and bank profitability. We find

that locally owned banks and African owned banks are more profitable than other banks and that competition (market power) worsens (improves) their profitability. Another important result is that financial intermediation mechanisms (the transformation of deposits into credits) reduce the profitability of banks and that the higher the provisions, the more profitable the bank. Finally, in periods of economic growth or inflation, the profitability of Cameroonian banks decreases.

Keywords: Profitability, Efficacy, Risk, Bank, Microfinance.

List of abbreviations

ADM:	Administrative Expense
ALB:	Average Loan Balance
ASB:	Average Savers Balance
CEMAC:	Communauté Economique et Monétaire d’Afrique Centrale Central African Economic and Monetary Community
CERBER:	Collecte, Exploitation et Restitution aux Banques et Etablissements Financiers des Etats Réglementaires
CFCFGH:	Caudill and Ford (1993), Caudill et al. (1995), and Hadri (1999)
COBAC:	Commission des Opérations Bancaires Central African Banking Commission
CPI:	Customer Price Index
DEA:	Data Envelopment Analysis
FEF:	Fixed-effects filter
FIN:	Financial Expense
GDP:	Gross Domestic Product
GLP:	Gross Loan Portfolio
GMM:	Generalized Method of Moments
HDI:	Human Development Index
HHI:	Herfindahl-Hirschman Index
IMF(s):	Institution(s) de Microfinance(s)
KGMHLBC:	Kumbhakar et al. (1991), Huang and Liu (1994), and Battese and Coelli (1995)
LLR:	Loan Loss Rate
MCO:	Moindres Carrés Ordinaires
MENA:	Middle East and North Africa
MFI(s):	Microfinance institution(s)
MIX:	Microfinance Information Exchange

NGO:	Non-Governmental Organisation
NIM:	Net Interest Margin
NPL(s):	Non-performing loan(s)
OLS:	Ordinary Least Square
PERSO:	Personnel Expense
ROA:	Return on Assets
ROE:	Return on Equity
SCP:	Structure-Conduct-Performance
SF(s):	Stochastic(s) Frontier(s)
SFA:	Stochastic Frontier Approach
SME:	Small Medium Entreprises
SYSCO:	Système de Cotation
TC:	Total cost
WAEMU:	West African Economic and Monetary Union
WDI:	World Development Indicators

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General introduction

Les institutions financières sont un élément essentiel des systèmes financiers et de l'économie, à travers leur principale fonction d'intermédiation financière (Merton, 1974) et de répartition du capital (Beck et al., 2000). Elles cherchent également à nouer les emprunteurs des engagements à long terme, que le marché ne peut pas prendre en charge (Pollin et Vaubourg, 1998). La complexité de cette activité, les réactions des agents économiques dans un environnement incertain et instable, font de celle-ci une activité très risquée et source de dysfonctionnements (Belaid et al., 2017 ; Freixas et Rochet, 2008). C'est d'ailleurs pourquoi Chiappori et Yanelle (1996) décrivent les institutions financières comme des entités dont l'activité est très risquée, dans lesquelles les pires catastrophes sont possibles, avec les plus graves conséquences potentielles. Couppey-Soubeyran (2017) ira plus loin en comparant les banques à des réacteurs nucléaires.

Les institutions financières sont des institutions (publiques ou privées) qui assurent une mission économique ou financière et qui fournissent des services financiers ; ce sont principalement les banques traditionnelles et les institutions de microfinance (Fall, 2009, 2011). Les banques traditionnelles ont une logique d'intermédiation différente, une échelle des opérations plus importante, une meilleure temporalité des contrats et des meilleurs mécanismes de sélection et de suivi des projets (Fall, 2011), comparées aux institutions de microfinance. Dans certains pays, comme ceux d'Afrique centrale et de l'ouest, les banques sont supervisées par la banque centrale et régies par la loi bancaire ; tandis que les structures de microfinance dépendent du ministère de l'Économie et des Finances et sont régies par une loi spécifique. Les banques sont des institutions financières monétaires car elles ont le pouvoir de créer de la monnaie, alors que les institutions de microfinance ne disposent pas de cette possibilité. Les institutions de microfinance sont des institutions non monétaires qui fonctionnent uniquement sur la base des ressources qu'elles collectent.

La microfinance a vu le jour dans les années 1970, à la suite des programmes expérimentaux dans les pays d'Asie et d'Amérique latine. L'objectif principal de la microfinance était la résolution de problèmes économiques majeurs tels que la pauvreté et les inégalités (Diaz-Serrano et Sackey, 2022 ; Ledgerwood, Earne et Nelson, 2013 ; Liñares-Zegarra et Wilson, 2018). La microfinance a non seulement permis ainsi l'accès aux services financiers à des exclus des banques classiques, mais aussi a contribué à réduire les inégalités à atteindre les ménages les plus pauvres (Clark et Spraggon, 2022 ; Bangoura et al., 2016 ; Hudon, 2010 ; Hudon et Traca, 2011) tout en améliorant leur bien-être.

L'un des objectifs des dirigeants des banques et les institutions de microfinance est donc de combiner les facteurs de production de manière à optimiser la rentabilité économique et sociale de l'institution, à améliorer leur efficacité et à gérer les risques en la pérennisant (Farvaque et al., 2012). Confrontées à une montée des risques et à une incertitude croissante concernant la maîtrise de leur rentabilité, les institutions financières ont développé des stratégies de maîtrise de ces problèmes. Tout en accentuant fortement les contraintes sur leur rentabilité, les institutions financières augmentaient les besoins de provisionnement de leurs portefeuilles de crédit, rendaient liquides leurs actifs financiers et usaient d'une politique de rationnement de crédit. Pour ces établissements, l'apparition de pertes significatives a rendu nécessaire l'adoption de mesures exceptionnelles de restructuration et d'assainissement du secteur d'activité. La montée des risques va donc exercer une influence majeure sur la détérioration potentielle de la qualité des encours de prêts. Elle va faire apparaître la nécessité d'adapter des stratégies ou des politiques de crédit, des méthodes de sélection des engagements, et des procès de surveillance de l'évolution de la situation financière des emprunteurs. C'est d'ailleurs pour cette raison que Refait-Alexandre (2004) et Refait-Alexandre et al. (2000) insistaient sur la prévision des risques de défaut car elle permettrait de prendre à temps des décisions à même de préserver les intérêts des dirigeants ou des partenaires commerciaux et financiers, voire des pouvoirs publics.

Ces vingt dernières années ont montré l'importance et l'impact des conséquences nombreuses des dysfonctionnements des systèmes financiers, de la recherche non contrôlée de la rentabilité et ont suscité des débats autour des facteurs explicatifs de la faillite des banques, de la fragilité globale des systèmes financiers et de la rentabilité des institutions financières. Nous pouvons citer par exemple la crise des années 80 dans la plupart des pays africains, la débâcle des caisses d'épargne aux Etats-Unis entre 1980 et 1984 (Goldstein, 1998). La décennie quatre-vingt-dix a été marquée par une crise majeure liée aux pertes très importantes sur crédits bancaires, touchant pratiquement tous les pays et affectant durablement le Japon (Mezgani, 2015). Également, la grande crise financière liée au marché du crédit, de 1997 à 1998 dans le contexte d'un système financier international globalisé² et la crise financière globale de 2007 à 2010.

L'une des manifestations de ces dysfonctionnements a été la dégradation de la rentabilité, de la solvabilité et une augmentation des portefeuilles à risque des institutions financières (particulièrement les banques). Plusieurs pays ont connu de profondes transformations structurelles à travers les programmes de restructuration et de sauvetage qui ont été mis en place pour assainir le système financier afin d'augmenter la rentabilité et de réduire les risques.

Ces dysfonctionnements ont montré l'importance d'identifier les sources et de renforcer les différentes approches de la réglementation. Gammadigbé (2012) parle d'une quantification en permanence de l'endurance du système financier face à l'émergence des chocs. Notre thèse va s'aligner sur ce constat en formulant des propositions dont l'intention est d'aider à améliorer l'efficacité et la rentabilité des institutions financières mais surtout à les prémunir contre la dégradation des portefeuilles.

² La banque d'affaire de Hong Kong, Peregrine, a dû fermer ses portes suite à la dépréciation d'un financement relais d'un montant de 235 millions de dollars (créance qui représente un quart de son capital) avancé à la société indonésienne 'PT Steady Safe' (Mezgani, 2015).

Aujourd'hui encore, l'une des préoccupations majeures des autorités de contrôle et de supervision bancaire est d'avoir des institutions financières rentables et surtout de mieux gérer et maîtriser les risques. Comme le portefeuille de crédits est l'un des principaux canaux générateurs des revenus dans les institutions financières, atteindre les objectifs des autorités de supervision passe par une politique de stabilisation du système financier comme une nécessité macroéconomique absolue pour la plupart des économies. Cette politique prend appui sur les composantes solides et saines du système. Dans son rapport de 2011, la Banque Centrale du Kenya montre que la mise en place d'un programme de gestion des risques dans les institutions financières a permis une nette amélioration de la qualité des portefeuilles.

Les institutions financières se doivent alors de trouver la combinaison optimale entre la rentabilité, l'efficacité et la minimisation des risques. D'après Madji (2002), la probabilité pour une banque de rester rentable et solvable est subordonnée principalement à une capitalisation suffisante, bien que Lacoue-Labarthe (2008) montre que la recherche effrénée du gain par les institutions financières peut accroître les risques financiers.

Bien que la nécessité de maîtriser les risques et d'assurer l'efficacité des institutions financières fasse l'objet d'un large consensus dans la littérature économique et financière, il existe encore des controverses, surtout sur les moyens, les méthodes et les stratégies d'y parvenir. Dans une étude sur les faillites bancaires dans les économies en voie de développement, Caprio (1997) montre que la relation entre les actionnaires et les dirigeants, la présence des régulateurs, la qualité de la gouvernance et la discipline de marché sont les facteurs explicatifs de la qualité du portefeuille et de la rentabilité des institutions financières. Godlewski (2005) renforce l'idée et trouve que la mauvaise (ou faiblesse de la) gouvernance, le manque de discipline des marchés et une régulation inefficace sont les facteurs susceptibles d'expliquer l'excès de prise de risque par les institutions financières.

Au vu de tout ce qui précède, il paraît intéressant de poser la question suivante : **quels sont les facteurs explicatifs de la rentabilité des institutions financières et des crédits à problème dans leur portefeuille ?** Nous scindons cette question principale en deux sous-questions. La première étant de savoir **quels sont les facteurs explicatifs des crédits à problème dans le portefeuille des institutions financières ?** Et la deuxième, **quels sont les facteurs explicatifs de la rentabilité et de l'efficacité des institutions financières ?**

Parce qu'elles doivent être rentables pour être pérennes, les institutions financières cherchent à maximiser leur profit. Dans cette vision, les institutions financières peuvent prendre des risques démesurés qui peuvent avoir des graves conséquences sur l'institution et même sur le système financier (risque systémique). La sécurité financière passe donc par des banques capitalisées et des portefeuilles sains. L'objectif principal de notre thèse est donc l'analyse des facteurs explicatifs de la rentabilité, de l'efficacité et des crédits à problème dans le portefeuille des institutions financières. Pour cela, nous mettons l'accent sur le niveau stratégique des institutions financières à travers la structure actionnariale et au niveau opérationnel à travers le type d'emprunteurs et des facteurs macroéconomiques. Le but est le même : améliorer la rentabilité et l'efficacité et réduire les risques.

Cette étude pourrait permettre aux autorités de contrôle et de supervision des institutions financières et surtout aux dirigeants de ces institutions d'avoir des meilleures stratégies leur permettant de disposer des institutions financières efficaces, rentables et sans risques (saines).

De plus, cette thèse constitue une contribution au débat sur l'importance de la prise en considération des déterminants microéconomiques et macroéconomiques dans la définition de la rentabilité, de l'efficacité et des risques financiers.

La littérature portant sur la rentabilité, l'efficacité et les risques financiers constitue un centre d'intérêt de grande importance dans les travaux menés sur le secteur financier. Elle classe les facteurs explicatifs des crédits à problème, de l'efficacité et de la

rentabilité en deux groupes, selon que les travaux soient de nature microéconomique ou macroéconomique. Au niveau stratégique, on peut identifier le conseil d'administration et les actionnaires et au niveau opérationnel, les dirigeants et les clients (Couppey-Soubeyran et Madiès, 1997), mais également les facteurs spécifiques à l'institution financière d'une part et, d'autre part, les facteurs macroéconomiques. Lahet et Vaubourg (2015, 2017) montrent d'ailleurs que les banques jouent souvent à la fois un rôle d'actionnaires et de clients. C'est le cas des systèmes multilatéraux de négociation où cette position a un effet crucial sur la forme de leur fonction objective et qui agit comme un dispositif concurrentiel qui réduit le prix et la rentabilité de l'échange historique et leur permet d'avoir un revenu positif.

Zamil (2010) quant à lui va penser que l'instabilité du secteur financier ne peut être combattue efficacement que par une bonne manière de gérer les risques par les institutions. Bien avant, Caprio (1997) s'inscrivait dans cette optique selon laquelle la standardisation de la réglementation bancaire réduit les risques financiers en améliorant la qualité du portefeuille et améliore la rentabilité en améliorant la capitalisation et la solidité de ces institutions financières.

Au vu de ce qui précède nous pouvons émettre quatre hypothèses principales :

Hypothèse 1. Le type de clientèle est associé au niveau de risque de l'institution.

Hypothèse 2. L'origine géographique et la nature des actionnaires sont associées au niveau de risque et de rentabilité de l'institution.

Hypothèse 3. Plus le marché est concentré, plus l'institution est efficace et rentable.

Hypothèse 4. Plus une institution est jeune, plus elle est efficace.

Concernant la gestion des risques et la rentabilité des institutions financières, Hayden et al. (2007) mettent en exergue deux théories contradictoires : la théorie traditionnelle de la banque et la théorie de la finance d'entreprise.

Alors que la théorie traditionnelle de la banque (incluant la théorie de préférence sur les états et la théorie du choix du portefeuille) se fonde sur la banque comme contrôleur délégué qui doit se diversifier pour atteindre son organisation optimale (Diamond, 1984), la théorie de la finance d'entreprise considère la banque comme une entreprise qui doit se concentrer sur une cible qui lui permet d'obtenir le plus grand avantage possible. Les dirigeants des institutions doivent ainsi concilier les divergences entre les actionnaires qui ont le goût pour le risque et les déposants qui préfèrent une gestion prudente de leurs épargnes (Couppey-Soubeyran et Madiès, 1997).

La figure ci-dessous présente le cadre conceptuel de notre étude. Les hypothèses, la méthodologie et le choix des variables utilisées émanent des modèles théoriques et empiriques connus dans la littérature, sachant que la disponibilité des données reste indispensable pour mener à bien notre analyse. Les données utilisées dans cette thèse sont des données de la base Mix Market pour les institutions de microfinance. Pour ce qui est des banques commerciales, les données proviennent du système de collecte, des rapports et états financiers des banques et du système d'exploitation et de restitution aux banques et établissements financiers des états réglementaires.

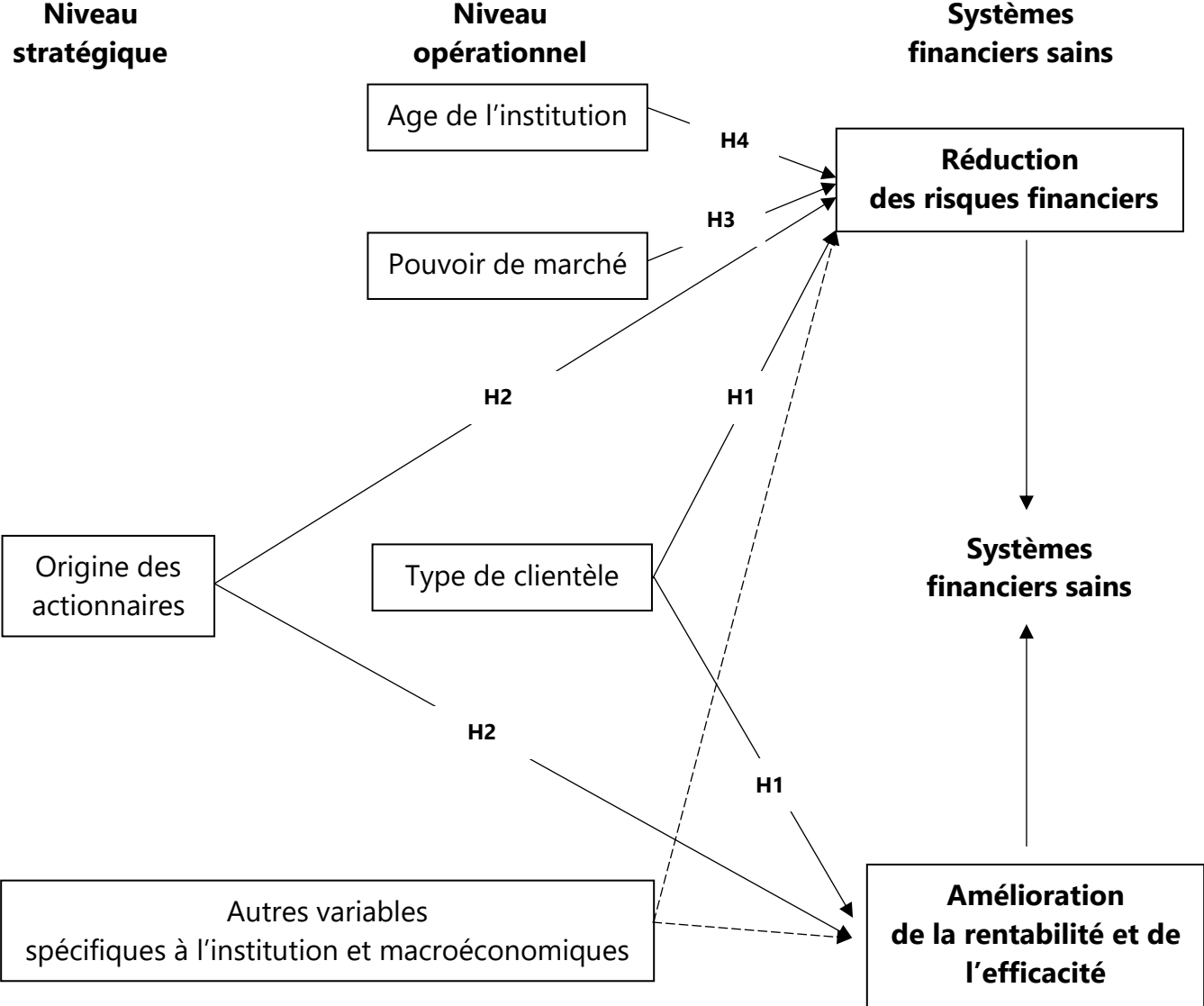
Le MIX est une plateforme de microfinance en ligne qui divulgue des informations sur plus de 2 500 IMFs clés dans le monde. Il assure la transparence financière des IMFs, contribuant ainsi à résoudre le principal problème lié au manque d'informations fiables, comparables et accessibles au public.

Le système de collecte, des rapports et états financiers des banques et du système d'exploitation et de restitution aux banques et établissements financiers des états réglementaires (CERBER) a été créé en 2000 pour assurer un échange de données entre établissements de crédit et une partie importante du *reporting* en Afrique centrale. Il permet aux établissements de crédit de transmettre des fichiers et états réglementaires de façon mensuelle, trimestrielle, semestrielle ou annuelle.

Les données macro financières et macroéconomiques proviennent de la base de la banque mondiale.

Afin de réduire le niveau de risque, les institutions de microfinance devraient maintenir les objectifs sociaux et développer davantage, avec l'appui des autorités compétentes, des programmes de valorisation des emprunteuses féminines, renforcer les politiques sur la détention de la liquidité afin de permettre à l'institution de faire face aux éventuels chocs externes et renforcer les politiques d'octroi de crédit. Afin d'améliorer leur efficacité, un contrôle et un renforcement de la réglementation restent indispensables dans le secteur et ces institutions doivent diversifier leurs portefeuilles sans se spécialiser dans des segments de clientèle particuliers.

Figure 0. 1. Cadre conceptuel de notre étude



Source : Par nos soins.

Concernant les banques, afin de réduire le niveau du risque, elles doivent libéraliser et diversifier davantage la structure actionnariale. Pour améliorer leur rentabilité, les autorités de régulation bancaire et monétaire doivent encourager, stimuler et inciter l'investissement local ou africain dans le capital social des banques dans certains pays et contrôler l'entrée de nouvelles banques sur ce marché.

Pour répondre à notre problématique, notre travail se subdivise en deux grandes parties.

La première partie de cette thèse analyse les facteurs explicatifs des risques dans les institutions financières et tente de répondre à la première question de recherche grâce à une analyse à partir de plusieurs échantillons.

Dans le premier chapitre, nous mettons en lumière l'importance de la segmentation de la clientèle sur le niveau de risque de l'institution financière. Nous examinons la relation entre le type de clientèle et le niveau de risque des institutions de microfinance. Dans ce chapitre, nous utilisons l'approche des MCO sur un échantillon de données avec 508 institutions de microfinance qui opèrent dans 80 pays dans le monde sur la période 1999-2018.

Dans le deuxième chapitre, nous analysons l'importance de l'origine des actionnaires sur le niveau de risque des institutions financières en utilisant les données de panel et la méthodologie des effets fixes filtrés développée par Pesaran et Zhou (2018). Nous utilisons un échantillon de 55 banques commerciales opérant dans quatre des six pays de la Communauté Economique et Monétaire d'Afrique Centrale sur une période allant de 2000 à 2014.

La deuxième partie de cette thèse se penche sur les facteurs explicatifs de la rentabilité financière de ces institutions et tente de répondre à la deuxième question de recherche à partir d'une analyse sur plusieurs échantillons.

Ainsi, dans un troisième chapitre, nous analysons les facteurs explicatifs de l'efficacité des institutions de microfinance dans les pays d'Afrique centrale et de l'ouest. A partir de la méthodologie développée par Wang et Ho (2010), nous utilisons une approche par les frontières stochastiques pour estimer une fonction de coût *translog* sur un échantillon de 102 institutions de microfinance sur la période allant de 2003 à 2018.

Enfin, dans le quatrième chapitre, nous soulevons l'importance de l'origine des actionnaires et du pouvoir de marché sur la rentabilité financière des institutions financières dans un contexte plus réduit : à l'instar du le Cameroun. Ici, nous appliquons un modèle multivarié sur un échantillon de données de panel constitué de 14 banques opérant au Cameroun sur la période allant de 2000 à 2014.

1. Pourquoi les institutions de microfinance réduisent-elles la part des femmes dans leur clientèle ?

1.1. Introduction

Ces vingt dernières années ont été marquées par une expansion considérable du secteur de la microfinance. Depuis ses débuts sous forme de programmes expérimentaux dans les pays d'Asie et d'Amérique latine dans les années 1970, la microfinance a amélioré les revenus des plus pauvres et réduit les inégalités (Clark et Spraggon, 2022 ; Bangoura et al., 2016 ; Hudon, 2010). La microfinance a alors touché les ménages les plus défavorisés, parmi lesquels les femmes (D'Espallier et al., 2011 ; Diaz-Serrano et Sackey, 2022), les ménages considérés comme très risqués, les ménages les plus pauvres ou très pauvres (Hudon, 2010, Hudon et Traca, 2011) et a participé à amélioration du bien-être des exclus du secteur bancaire. La microfinance a donc été une réponse aux problèmes économiques majeurs que sont la pauvreté et les inégalités (Ledgerwood, Earne et Nelson, 2013 ; Liñares-Zegarra et Wilson, 2018).

Aujourd'hui, les institutions de microfinance (IMFs) continuent de se développer en intégrant les aspects socio-économiques dans leurs politiques visant particulièrement les femmes (Diaz-Serrano et Sackey, 2022). Les IMFs cherchent donc à combiner les aspects économiques, sociaux et même environnementaux afin de rester durables et de répondre aux objectifs sociaux, initiaux, de réduction de la pauvreté. Dans un contexte de recherche de rentabilité par les entreprises, les IMFs sont tiraillées entre des décisions stratégiques et des combinaisons optimales de facteurs pour rester rentables et pérennes.

En plus des autres institutions présentes dans le secteur financier, la prolifération des IMFs a entraîné une compétition, une recherche tout azimuts du pouvoir de marché, de la rentabilité et de la pérennité. Les choix stratégiques des IMFs peuvent alors être biaisés et conduire celles-ci à s'exposer davantage à des risques financiers divers.

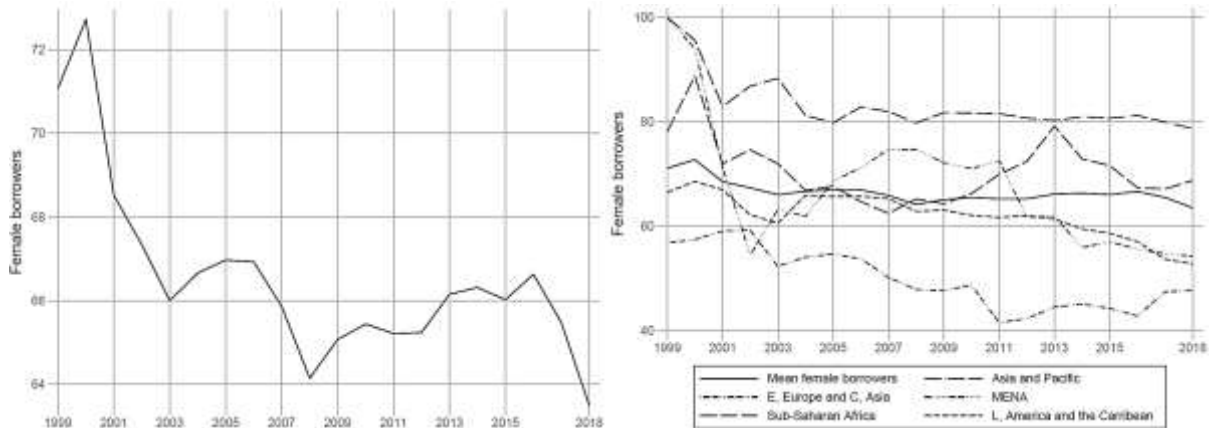
Une littérature importante sur la microfinance s'est intéressée, d'une part, aux facteurs susceptibles d'influencer la rentabilité des IMFs ainsi que leur efficacité, aux techniques de gestion des risques et aux déterminants des risques financiers. Et d'autre part, elle va mettre un accent sur la capacité qu'ont les IMFs à atteindre les femmes et à améliorer leur bien-être (D'Espallier et al., 2011). Plusieurs auteurs d'ailleurs ont mobilisé cette littérature pour justifier l'implication et le ciblage des femmes par les IMFs. C'est le cas, par exemple, de Abdullah and Quayes (2016); Armendariz et Morduch (2005); D'Espallier et al. (2011) qui avancent l'idée selon laquelle les femmes ont un taux de remboursement très élevé par rapport aux hommes. Les réseaux de défense et les sponsors de la microfinance, tels que la Banque Mondiale et le FMI, ainsi que les agences d'aide au développement bilatérales et multilatérales, affirment régulièrement que les femmes sont de bons risques de crédit (D'Espallier et al., 2011; Banque mondiale, 2007).

Mais qu'en est-il aujourd'hui ? Les femmes restent-elles toujours de meilleurs risques de crédit par rapport aux hommes ? Le fait est que notre graphique ci-dessous représente le pourcentage moyen de femmes emprunteuses dans le portefeuille des IMFs dans le monde et dans les différentes régions³. Il en ressort que le pourcentage moyen de femmes emprunteuses décroît au fur et à mesure dans le temps, surtout après la crise financière. En 1999, par exemple, le pourcentage moyen de femmes emprunteuses était largement au-dessus de 70% et s'est considérablement dégradé en 2003, puis en 2008, pour atteindre un niveau bas en 2018 en dessous des 64%. La situation par région confirme ce constat car on peut observer dans le graphique de droite une décroissance globale du pourcentage moyen de femmes emprunteuses. Toutes les dispersions dans la région Europe de l'est et Asie centrale et celles dans la région Amérique latine et Caraïbes sont en dessous du pourcentage moyen par contre celles dans la région Afrique sub-saharienne et dans la région Asie et pacifique sont au-dessus du pourcentage moyen. Seule la région MENA se situe au-dessus du

³ MENA, Afrique subsaharienne, Asie et pacifique, Europe de l'est et Asie centrale, Amérique latine et les caraïbes.

pourcentage moyen de 1999 à 2012 et ensuite en dessous du pourcentage moyen après 2012.

Figure 1. 2. Portefeuille moyen à risque et pourcentage d'emprunteurs féminins.



Source : Calcul à partir des données *Mix Market*.

Une double question nous interpelle. Premièrement est-ce que les femmes restent toujours de « meilleurs risques » ? et deuxièmement pourquoi le pourcentage moyen de femmes emprunteuses décroît dans le portefeuille des IMFs si celles-ci tendent à réduire l'exposition au risque des IMFs ?

L'objectif de cet article est donc d'analyser la relation entre le type de clients et le niveau de risque dans les IMFs et de comprendre la décroissance du pourcentage de femmes emprunteuses. Afin de répondre à cette problématique, nous estimons la relation entre le pourcentage de femmes emprunteuses et le niveau de risque à partir d'un modèle linéaire multivarié sur un échantillon de 508 IMFs situées dans 80 pays du monde entre 1999 et 2018.

Nous mobilisons la théorie de la détection du signal (Spence, 1973), la théorie du compte de contrôle (Hodgman, 1963) et la théorie du portefeuille de Markowitz (Markowitz, 1952), qui permettraient à l'institution de microfinance (IMF) de différencier ses emprunteurs et de trouver des combinaisons de rentabilité optimale pour ses activités afin de choisir les « meilleurs risques ». Ces théories nous semblent appropriées étant donné les objectifs de rentabilité de l'IMF et la forte présence d'asymétrie d'information sur ce marché. Il est donc crucial que l'emprunteur soit un

déposant et que les signaux envoyés par ce dernier à l'agent de crédit soient positifs pour une meilleure évaluation de la solvabilité et du niveau de risque de l'emprunteur.

Les résultats de nos estimations montrent que les IMFs ayant un pourcentage de femmes emprunteuses élevé, un rendement des actifs élevé et une grande taille gèrent mieux les risques que leurs homologues. Un autre résultat est que plus une IMF se dote de provisions pour la dépréciation des prêts, plus son portefeuille à risque augmente. De façon plus intuitive, le niveau de risque des IMFs augmente en période de crise. Enfin, les résultats révèlent également qu'en période d'inflation, le niveau de risque diminue alors qu'il augmente en période de croissance économique.

La deuxième section de cet article présente la littérature existante sur la relation entre le type de clientèle et le risque en microfinance, la troisième section l'approche méthodologique, la quatrième section les données, la cinquième section les résultats empiriques et les interprétations, la sixième section les tests de robustesse et la dernière section conclut.

1.2. Revue de littérature

L'un des objectifs des organismes de régulation et de supervision financière est la réduction et la maîtrise des risques. La littérature économique et financière aborde d'ailleurs de plus en plus cette problématique (Abdullah et Quayes, 2016 ; D'Espallier et al., 2011, 2013 ; Fall et al., 2021 ; Perrin et Weill, 2022 ; Statnik et al., 2022). La réduction ou la maîtrise de ces risques financiers passent par l'analyse des facteurs susceptibles de l'expliquer, même si les résultats restent mitigés sur la relation existante entre ces facteurs et le niveau de risque de l'IMF. Notre intérêt sera porté sur l'un des facteurs explicatifs des risques financiers : le type d'emprunteur.

D'Espallier et al. (2011) mènent une étude sur les emprunteurs et leur capacité de remboursement. Ils utilisent un échantillon de 350 IMFs dans 70 pays sur une période allant de 1998 à 2008. Leur étude met en évidence que les femmes sont moins risquées que les hommes car elles sont plus prudentes que ceux-ci. Leurs résultats confirment

qu'un pourcentage plus élevé de femmes emprunteuses dans les IMFs est lié à un risque de portefeuille plus faible, à moins de radiations et à des provisions plus faibles, en particulier pour les organisations non gouvernementales, les prêteurs individuels et les IMFs réglementées. Ils utilisent également des variables de contrôle spécifiques aux IMFs telles que la taille de l'IMF et l'indicateur du développement humain et trouvent une relation négative (toujours significative pour la taille de l'IMF) entre le pourcentage de femmes emprunteuses et le niveau de risque. Agier et Szafarz (2013) ; De Aghion et Morduch (2021) ; Johnson (2004) ; Todd (1996) et plus récemment Delis et al. (2022) trouvent des résultats similaires sur cette relation entre le pourcentage de femmes emprunteuses et la capacité de remboursement de l'IMF.

Sur la base de l'expérience des villages Grameen au Bangladesh, Todd (1996) et De Aghion et Morduch (2021) soutiennent que les femmes présentent de « meilleurs risques » parce qu'elles sont plus conservatrices ou prudentes dans leurs stratégies d'investissement. Les femmes sont également plus facilement influencées par la pression des pairs et les interventions des agents de crédit, ce qui en fait des paris plus fiables pour les banques inquiètes du remboursement (Goetz et Gupta, 1996 ; Rahman, 2001). C'est d'ailleurs ce problème lié au remboursement des emprunteurs masculins qui a poussé la Grameen Bank vers une clientèle presque entièrement féminine (De Aghion et Morduch, 2021).

Ameen (2004) soutient que les femmes ont un impact positif sur le remboursement car elles ont un coût d'opportunité du temps inférieur à celui des hommes et sont donc plus susceptibles d'avoir des contacts avec l'IMF et les groupes de crédit. De plus, les clientes ont tendance à rester plus près de chez elles plutôt que d'aller travailler, surtout dans les pays en voie de développement. Elles peuvent donc être plus facilement suivies par l'institution prêteuse (De Aghion et Morduch, 2021 ; Goetz et Gupta, 1996).

Dans une étude au Guatemala, Kevane et Wydick (2001) rapportent que les groupes de crédit féminins avaient de meilleurs dossiers de remboursement de prêts que les groupes masculins. Johnson (2004) utilise un échantillon d'associations rotatives

d'épargne et de crédit au Kenya pour montrer que les femmes investissent dans des projets qui offrent un retour sur investissement plus rapide. Les activités commerciales des femmes impliquent souvent un roulement rapide, mieux adapté aux remboursements réguliers exigés par la plupart des IMFs. Agier et Szafarz (2013) trouvent également des résultats similaires sur un échantillon de 34 000 demandes de prêt dans une IMF au Brésil.

Récemment Delis et al. (2022) confirment l'hypothèse selon laquelle les femmes entrepreneures sont des demandeuses de crédit plus prudentes. Leur étude porte sur un échantillon de données de demandes de crédit d'une grande banque européenne à couverture nationale, sur une période allant de 2002 à 2017. Selon les auteurs, les entreprises des hommes demandeurs de crédit ont une probabilité de défaut plus élevée (3 ans après décision d'octroi de crédit) par rapport à celles des femmes demandeuses de crédit et un niveau d'endettement plus élevé.

Certains auteurs ont utilisé un autre prisme pour montrer une fois de plus que les contrats avec les femmes conduisent à de meilleures performances de remboursement que les contrats avec les hommes. C'est le cas de Kaplan et al. (2009) qui montrent que le fait que les femmes soient plus éthiques que les hommes réduirait les risques d'aléa moral. Bien que la préférence des IMFs pour les femmes emprunteuses varie d'un pays à l'autre, Aggarwal et al. (2015) sont d'accord avec Kaplan et al. (2009), et montrent, sur la base d'une étude de plus de 2000 IMFs de 1996 à 2010, que les femmes sont plus dignes de confiance et ont un plus grand impact social.

Contrairement aux études mentionnées ci-dessus, tous les arguments ne sont pas en faveur des femmes en tant que « bons risques » de crédit. Se concentrer sur un segment de clientèle particulier (les femmes), pourrait avoir des effets négatifs sur la performance et la pérennité de l'IMF. Plusieurs études montrent que la corrélation entre le pourcentage de femmes emprunteuses et le risque en microfinance est positif.

En commençant par la banque BRI en Indonésie qui n'a jamais mis l'accent sur les femmes mais a obtenu des taux de remboursement presque parfaits sur plusieurs

années (De Aghion et Morduch, 2021 ; Armendariz et Morduch, 2005). Il s'avère également que les femmes ont juste moins de possibilités de crédit que les hommes et doivent rembourser leurs prêts pour assurer un accès continu au crédit (De Aghion et Morduch, 2021 ; Diaz-Serrano et Sackey, 2022). Plusieurs études indiquent que les prêts contractés par les femmes sont dans certains cas utilisés et contrôlés par les hommes dans leurs ménages (Goetz et Gupta, 1996 ; Kabeer, 2001 ; Mayoux, 2001 ; Rahman, 2001). Dès lors, si ce sont les hommes qui utilisent les prêts, les arguments précédents ne tiennent pas.

Dans la même étude citée ci-dessus, D'Espallier et al. (2011) indiquent que le simple fait que les femmes soient, en moyenne, plus pauvres que leurs homologues masculins et qu'elles soient discriminées (Statnik et al., 2022) implique un remboursement plus difficile. Pour Phillips et Bhatia-Panthaki (2007) qui ont mené une étude sur les entreprises en Zambie en 2006, les femmes sont susceptibles d'être moins en mesure d'honorer leurs contrats de crédit compte tenu de l'importance des femmes entrepreneurs dans des secteurs à faible rentabilité, à faibles opportunités de croissance et à fort compétitivité. En particulier, dans de nombreux pays en développement, certaines activités telles que l'agriculture cadrent moins avec les modalités de la microfinance (Morvant-Roux et al., 2010) car elles sont saisonnières et très risquées.

Les mêmes résultats sont confirmés par Hermes et al. (2018) dans une analyse de la relation entre le développement financier et l'efficacité des IMFs en utilisant un échantillon de 372 IMFs dans le monde. Ils estiment une fonction de coût suivant l'approche d'intermédiation et, en plus des déterminants utilisés par Hermes et al. (2011), ils utilisent un indicateur de développement financier, le nombre d'emprunteurs et des effets fixes région. Ils arrivent aux mêmes conclusions sur l'inefficacité des IMFs spécialisées dans le crédit aux femmes.

Enfin, il existe également des auteurs qui ont montré qu'en contrôlant d'autres facteurs, aucune significativité n'apparaît entre le type d'emprunteur et le niveau de risque. C'est

le cas de Godquin (2004) qui mène une étude sur les IMFs au Bangladesh sur la période 1991-1992 et constate que l'amélioration des taux de remboursement des femmes est due à l'accent mis sur les services non financiers. Pour Bhatt et Tang (2002), aux États-Unis, cette amélioration s'apparente davantage à l'adaptation des méthodologies de prêts aux contextes locaux. Quant à Brehanu et Fufa (2008), en Ethiopie, l'amélioration des taux de remboursement des femmes est due à une méthodologie de groupe, aux opportunités économiques locales et aux modes de subsistance des clients.

Compte tenu du débat et des controverses, la relation entre le type d'emprunteurs et le risque de crédit reste ambiguë. De plus nous avons montré dans l'introduction que le pourcentage de femmes emprunteuses dans les IMFs du monde serait en baisse. Conformément à une grande partie de la littérature sur la microfinance, nous nous proposons de vérifier si l'hypothèse selon laquelle une augmentation de la présence de femmes emprunteuses dans le portefeuille de crédit des IMFs réduit le risque reste vraie et qu'est ce qui expliquerait la baisse du pourcentage de femmes emprunteuses dans les portefeuilles de prêts des IMFs.

1.3. Données

L'échantillon est composé de 508 IMFs, situées dans 80 pays du monde, sur une période de 20 ans, allant de 1999 à 2018. Les données utilisées proviennent de la base de données *Mix Market*, qui est une base de données de la Banque Mondiale sur la microfinance dans le monde, exploitée par le MIX (*Microfinance Information Exchange*) et couvrant les prestataires de services financiers.

L'utilisation de la base de données *Mix Market* est de plus en plus répandue dans la littérature sur la microfinance (Al-Azzam et Parmeter, 2021 ; Blanco-Oliver et al., 2021 ; Clark et Spraggon, 2022 ; Diaz-Serrano et Sackey, 2022 ; D'Espallier et al., 2017, 2011, 2013 ; Fall, 2018 ; Fall et al., 2021 ; Hermes et al., 2011, 2018 ; Statnik et al., 2022). Le MIX est une plateforme de microfinance en ligne qui divulgue des informations sur plus de 2500 IMFs clés dans le monde. Il assure la transparence financière des IMFs, contribuant ainsi à résoudre le principal problème des IMFs lié au manque

d'informations fiables, comparables et accessibles au public. Cependant, l'utilisation de la base de données MIX présente plusieurs limites.

La première est liée au fait que le MIX est une base de données autodéclarée et les IMFs divulguent volontairement des informations. La deuxième est la fiabilité des données : les données du MIX sont de qualité inégale ; le MIX classe donc les IMFs en fonction de leur niveau de transparence et de fiabilité des informations. La troisième est la taille de la base par rapport à la réalité : en réalité, le secteur de la microfinance est composé de centaines de milliers d'IMFs dans le monde entier et la grande majorité d'entre elles ne communiquent pas de données financières au MIX. Parfois, c'est simplement parce que de nombreuses IMFs sont très petites et ont des systèmes d'information très peu fiables.

Nous avons retenu dans notre échantillon 4110 observations sur la période. Nous n'avons gardé que les IMFs qui ont été observées pendant au moins 5 années successives et qui collectent des dépôts, et ce pour deux raisons. La première est que la construction de certaines variables est basée sur les dépôts et la seconde raison est qu'il est difficile de distinguer dans la base de données du *Mix Market* les données des IMFs qui ne collectent pas de dépôts, celles qui collectent en principe les dépôts mais n'ont pas renseigné leur valeur ou celles qui ont renseigné la valeur zéro soit pour dire qu'elles ne collectent pas les dépôts ou pour dire qu'elles ne collectaient pas à ce moment-là. Nous n'avons conservé que les IMFs dont les données étaient complètes pour toutes les variables retenues.

Les tableaux 1 et 2 présentent le nombre d'observations par IMF et par année. Alors que le tableau 1 présente le nombre d'observations par année, le tableau 2 présente le nombre d'IMFs par rapport au nombre d'années pour lesquelles l'IMF est observée. Nous avons plus de 200 observations par année de 2006 à 2014 et 101 IMFs ont été observées 5 années et seulement 1 IMF a été observée 18 et 20 ans.

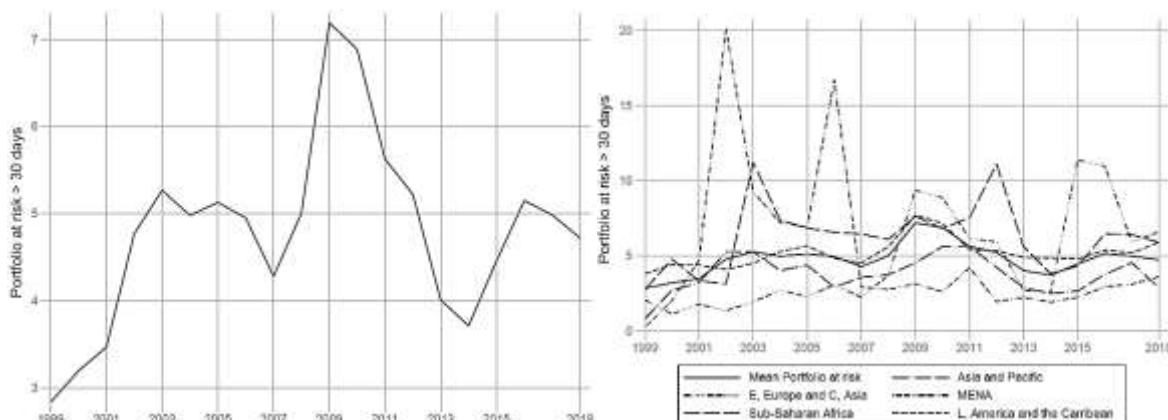
Les tableaux 3 et 4 montrent le nombre d'observations par pays et par région. On constate une concentration en Amérique latine et dans les Caraïbes (2112 observations

et 236 IMFs) et dans la région Asie et Pacifique (1035 observations et 136 IMFs). Puis, une moins importante en Europe de l'Est et Asie centrale (484 observations et 66 IMFs) et en Afrique subsaharienne (365 observations et 55 IMFs). Et enfin, dans les pays de la zone MENA, 114 observations pour 13 IMFs.

Le tableau 5 présente les statistiques descriptives. Le portefeuille à risque moyen est de 5,11% avec une dispersion supérieure à la moyenne de 6,69% avec une valeur minimale de 0,01% et maximale de 98,7% du total des actifs. Le pourcentage moyen d'emprunteurs féminins est de 65,84%, allant de 0,25% à 100% (pour les IMFs qui ne prêtent qu'aux femmes) avec une dispersion de 24,05% du total des actifs. Les provisions pour créances douteuses sont en moyenne de 2,18% avec un rendement moyen des actifs de 2,18% et une taille moyenne de 16,69% du total des actifs. Un taux de croissance moyen de 13,87% (avec une dispersion de 4,21%) et un taux d'inflation moyen de 27,50% (avec une dispersion de 8,31%) du total des actifs. La variable crise est une variable dummy qui prend la valeur 1 durant la crise financière de 2008 à 2010 et la valeur 0 sinon.

La figure ci-après montre l'évolution du portefeuille moyen à risque et du pourcentage des femmes par région respectivement.

Figure 1. 3. Portefeuille moyen à risque et pourcentage d'emprunteurs féminins par région.



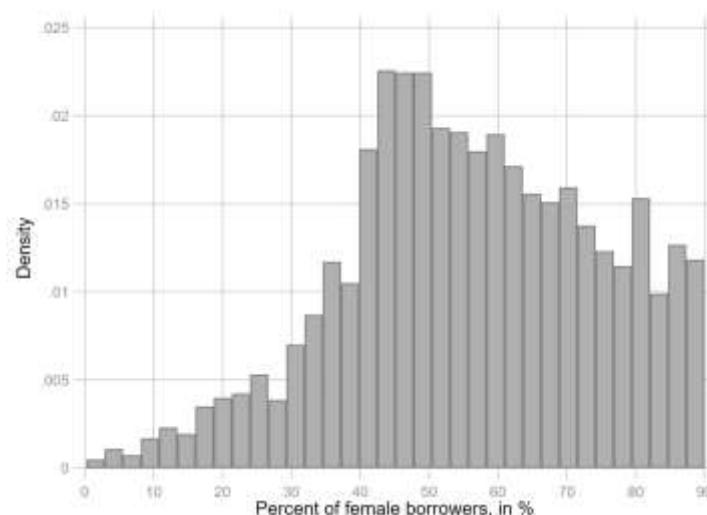
Source : Calcul à partir des données *Mix Market*.

Le graphique (a) montre que l'Afrique subsaharienne a le portefeuille à risque le plus élevé sur l'ensemble de l'échantillon, suivie par la région MENA à partir de 2005. Jusqu'en 2014, la région Europe de l'Est et Asie centrale a le portefeuille le plus faible.

Enfin, sur le graphique (d), nous pouvons voir que le pourcentage de femmes emprunteuses est plus élevé dans la région de l'Asie et du Pacifique et qu'il a une tendance légèrement à la hausse, contrairement à la région Europe de l'Est et de l'Asie centrale où nous observons non seulement un très faible pourcentage de femmes emprunteuses mais également une légère tendance à la baisse. Les régions du MENA, de l'Afrique subsaharienne et d'Amérique latine et les Caraïbes ont une progression presque identique dans un tunnel.

Enfin, la figure 3 présente l'histogramme du pourcentage de femmes emprunteuses. Nous avons exclu de notre échantillon ici les IMFs qui se spécialisent uniquement dans les prêts aux femmes. L'histogramme ci-après montre donc la dispersion du pourcentage de femmes emprunteuses de 0 à 90. Une concentration des femmes se situe dans une fourchette de 43 à 50% et le nombre de femmes emprunteuses passe à plus de 60%.

Figure 1. 4. Histogramme du pourcentage de femmes emprunteuses.



Source : Calcul à partir des données *Mix Market*.

1.4. Méthodologie

Pour valider notre étude empirique nous utilisons des variables financières et macroéconomiques. Les données macroéconomiques sont issues de la base de données des indicateurs de développement de la Banque Mondiale et les données financières proviennent de la base de données *Mix Market*.

Plusieurs études ont examiné la concentration des risques comme responsable de la vulnérabilité des systèmes financiers (Brana, 2013 ; D'Espallier et al., 2013 ; Hideto Dato et al., 2020 ; Strøm et al., 2014). Nous estimons la fonction linéaire multiple suivante :

$$Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt} \quad (1)$$

Où, $Risk_{ijt}$ est notre variable dépendante qui représente le niveau de risque de l'IMF i dans le pays j à la période t . Cette variable est définie comme le solde impayé ; le portefeuille en retard de plus de trente jours. Cette variable a été utilisée par Bibi et al. (2018a, b) ; Blanco-Oliver et al. (2021) ; Boehe and Cruz (2013) ; D'Espallier et al. (2011, 2013) ; Kendo and Tchakounte (2022) ; Strom et al. (2014) comme mesure du niveau de risque des institutions financières.

α_0 est la constante et α_1 est le paramètre de notre variable d'intérêt $WOMAN$ (qui est le pourcentage de femmes emprunteuses), γ_i , la prise en compte des effets fixes pays (ou région dans certains cas) et η_t , la prise en compte des effets fixes de l'année. β est le coefficient attaché à l'ensemble des paramètres des variables spécifiques à la microfinance et θ à l'ensemble des paramètres des variables macroéconomiques.

$WOMAN_{it}$ désigne notre variable d'intérêt qui est le pourcentage de femmes emprunteuses dans l'IMF i à la période t . Une valeur négative de cette variable indiquerait que plus le pourcentage de femmes emprunteuses est représenté dans le portefeuille de l'IMF i à la période t , plus le niveau de risque est faible. Cette variable a été utilisée par Abdullah et Quayes (2016), Bibi et al. (2018a), Blanco-Oliver et al. (2021), D'Espallier et al. (2011, 2013), Fall et al. (2021), Hermes et al. (2011, 2018), ou Othmani (2021).

MFI_{it} représente le vecteur des variables spécifiques à l'IMF. Ce vecteur comprend le ratio de capital, de qualité des actifs, de liquidité et de gouvernance. Ainsi, la variable *Provision* est mesurée par le ratio de dépréciation des prêts par rapport aux actifs. Cette variable fait référence à la qualité de gestion ou au style de management de l'IMF. Elle permet d'évaluer la part des créances douteuses qui ont été provisionnées. Cette variable permet de montrer si l'IMF est préparée à faire face aux chocs. Cette variable a été utilisée par D'Espallier et al. (2011).

La capacité de la microfinance à générer des fonds sera mesurée par les ratios de rentabilité des actifs *ROA* et/ou des fonds propres *ROE*. Alors que le rendement sur actifs, *ROA* désigne le rapport entre le résultat net de l'IMF et le total de ses actifs et le rendement sur fonds propres, *ROE* désigne le rapport entre le résultat net de l'IMF et le total de ses fonds propres. Ils représentent la rentabilité des actifs ou des fonds propres de l'IMF qui quantifie la performance de l'IMF par rapport à ses actifs ou ses fonds propres. En effet, une rentabilité élevée augmente la force de l'IMF et peut réduire le niveau de risque. Cette variable mesure la volatilité du rendement des actifs de l'IMF. En effet, la détérioration de la qualité des actifs a un effet sur la solidité de la microfinance à travers sa performance et donc augmente le niveau de risque. Cette variable a été utilisée par Aggarwal et al. (2015), Hideto Dato et al. (2020), ou Othmani (2021).

La variable *Taille* est un logarithme népérien du total des actifs de l'IMF. Elle indique une probabilité d'avoir un portefeuille de prêts diversifié et une capacité d'innovation, qui peuvent réduire le risque et les prêts non performants. Un signe négatif signifierait que plus l'IMF est grande, moins le risque est associé. Cette variable a été utilisée par Bibi et al. (2018a, b), D'Espallier et al. (2011), Hideto Dato et al. (2020), Othmani (2021).

$MACRO_{jt}$ représente le vecteur des variables macroéconomiques du pays j à la période t , qui comprend le taux d'inflation, la croissance du PIB et l'effet de la crise financière.

L'inflation est l'indice des prix à la consommation. Elle devrait affecter positivement la capacité de remboursement des emprunteurs ; en effet, une inflation plus élevée peut

améliorer la capacité de remboursement des emprunteurs en réduisant la valeur réelle de l'encours de la dette. Cette variable a été utilisée par Bibi et al. (2018a, b) ; Othmani (2021).

Le PIB représente la production, la richesse ou la valeur ajoutée. En période d'expansion économique, les revenus élevés des agents améliorent la capacité de remboursement du prêt, ce qui entraîne une diminution des prêts non performants. Inversement, le montant des dettes est affecté par le taux d'intérêt, surtout en cas de prêt à taux variable. Cette variable a été utilisée par Bibi et al. (2018a), Boehe et Cruz (2013), D'Espallier et al. (2013), Hideto Dato et al. (2020), ou encore Othmani (2021).

ε_{ijt} est le terme d'erreur qui suit une distribution normale avec une moyenne nulle et une variance constante.

Nous avons ajouté une variable *Crisis* pour capturer la variation du niveau de risque des IMFs en période de crise. La crise que nous mettons en avant ici est la crise financière. Il s'agit d'une situation dans laquelle la valeur des IMFs ou des actifs financiers chutent rapidement en raison des fluctuations de l'économie. Cette variable a été utilisée par Di Bella (2011), Efendic et Hadziahmetovic (2017), Reille et Forster (2008), Soldatkova et Cerny (2021), ou Vogelgesang (2003).

1.5. Résultats et analyse

1.5.1 Résultats

Dans le tableau 7, nous utilisons l'estimateur des MCO pour présenter nos résultats sur la relation entre le pourcentage de femmes emprunteuses et le niveau de risque des IMFs. Tout d'abord, nous élaborons pas à pas neuf régressions où nous rajoutons au fur et à mesure en plus de notre variable d'intérêt (le pourcentage de femmes emprunteuses), les variables spécifiques à l'IMF et les variables de contrôle en imposant de la colonne (6) à la colonne (9), des effets fixes pays (ou des effets fixes région) et des effets fixes temporels.

Nos résultats indiquent que le coefficient du pourcentage de femmes emprunteuses est négatif et significatif au moins au seuil de 1% dans toutes les spécifications de notre tableau 7. Cela signifie que plus il y a de femmes emprunteuses, plus le portefeuille à risque est faible, en considérant les différences inobservées dans le temps entre les IMFs et conditionnellement aux variables macroéconomiques et celles spécifiques aux IMFs. Le coefficient du pourcentage de femmes emprunteuses dans la spécification complète (colonne 8 ou 9) est égal à 0,058 points de pourcentage de risque en moins. Une valeur négative de 0,058 suggère qu'une augmentation marginale de femmes emprunteuses de 10% entraîne une diminution du portefeuille à risque de 0.58 pourcent. L'impact est statistiquement significatif pour toutes les estimations et le pourcentage moyen d'emprunteuses pour toutes les IMFs et toutes les années est égal à 65,84%. Nos résultats confirment les résultats obtenus, par exemple, par Abdullah et Quayes (2016), Agier et Szafarz (2013), D'Espallier et al. (2011), De Aghion et Morduch (2021), Delis et al. (2022), ou encore Johnson (2004).

Quelques arguments peuvent être avancés pour expliquer ces résultats. Dans les pays en développement ou dans les pays émergents en particulier, les femmes emprunteuses sont moins risquées que les hommes car elles sont plus prudentes dans leurs stratégies d'investissement. Elles tendent à investir dans des projets qui offrent un retour sur investissement plus rapide.

En ce qui concerne les variables spécifiques à la microfinance, le coefficient du ratio des provisions pour dépréciation des prêts est positif et significatif au seuil de 1 pourcent, les coefficients du rendement des actifs et de la taille de l'IMF sont négatifs et significatifs au seuil de 1% dans toutes nos estimations de base dans le tableau 7. Alors que d'un côté, plus une IMF provisionne, plus elle augmente son portefeuille à risque ; d'un autre côté, une IMF grande et rentable semble opérer avec moins de risques.

Le résultat obtenu de la variable provision pour dépréciation des prêts se justifie car la comptabilisation d'une provision pour dépréciation des prêts signifie que la banque

prévoit à l'avance une perte sur le prêt. En provisionnant, l'IMF subit une perte et réduit son capital d'un montant qu'elle ne sera pas en mesure de recouvrer auprès des emprunteurs. Si nous ne disposons pas d'informations sur la détention de capital réglementaire et volontaire des IMFs, qui conduirait par exemple à ce qu'une institution de microfinance risquée semble bien capitalisée en raison d'une exigence réglementaire plus élevée, le cadre réglementaire est en fait pris en compte par la présence d'effets fixes dans certaines des estimations. Il en va de même pour les IMFs plus prudentes qui préfèrent détenir plus de capital, sous forme de provision, pour des raisons de précaution ou autres. Nos résultats suggèrent que les IMFs dont le portefeuille à risque est plus élevé ont également plus de provision, probablement pour absorber les pertes de prêts futures.

Il n'est pas surprenant que les IMFs de grande taille et rentables possèdent une grande capacité à générer des fonds supplémentaires, à diversifier ses actifs et à innover. Une IMF de grande taille est mieux capitalisée et par conséquent peut faire facilement face aux risques financiers. Les IMFs qui sont plus rentables semblent également gérer leur portefeuille de prêts de manière plus prudente, ce qui pourrait être lié à la menace de perdre une valeur de franchise plus élevée en cas de défaut. Nos résultats sur ce point corroborent ceux obtenus par Abdullah et Quayes (2016) ou Othmani (2021).

Même si les coefficients des variables de contrôle macroéconomiques ne sont pas significatifs lorsque nous imposons des effets fixes-pays ou -région, le coefficient de la variable muette que nous avons intégrée pour capturer simultanément l'effet de la crise est positif et significatif à 1% dans toutes les estimations du tableau 7. Le taux de croissance positif et significatif dans les estimations des colonnes 5, 7 et 9 et l'inflation toujours négatif et significatif au moins à 10% sauf pour l'estimation de la colonne 8 où là, ces variables de contrôle perdent toute significativité, du fait de l'intégration des effets fixes pays et temps dans l'estimation.

Le coefficient de la variable crise est très important, égal à 3,58 points avec les effets fixes pays et 4,21 avec les effets fixes région. Cela signifie que la crise financière

augmente le portefeuille à risque à cause d'une friction des marchés, d'une perte de confiance globale et surtout d'une augmentation de l'incertitude. Pendant la crise financière, la croissance des prêts de l'IMF est limitée par des opportunités d'emprunt plus rares, tandis que le ralentissement économique a un impact négatif sur la qualité des actifs et la rentabilité (Di Bella, 2011). Les résultats confirment l'étude d'Efendic et Hadziahmetovic (2017). Les investissements à cette époque se révèlent plus volatils que prévus, et les attentes de rendement à court terme déterminent de plus en plus les politiques de prix des IMFs qui veulent s'intégrer au marché commercial (Reille et Forster, 2008, Soldatkova et Cerny, 2021).

1.5.2 Mécanismes

Les résultats qui précèdent montrent que plus le pourcentage des femmes augmente dans le portefeuille des IMFs, moins les IMFs sont risquées. Dans cette section, des interactions entre le pourcentage de femmes emprunteuses et certaines variables spécifiques à l'IMFs telles que la taille, le rendement des actifs et les provisions sont intégrées dans l'analyse afin de cerner les mécanismes explicatifs de cette conclusion.

Pour prendre en compte les interactions entre le pourcentage de femmes emprunteuses et les variables spécifiques à l'IMF, nous estimons donc le modèle suivant.

$$Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \varphi WOMAN * MFI_{it} + \beta Z_{ijt} + \gamma_i + \eta_t + \varepsilon_{ijt} \quad (2)$$

Où, comme précédemment indiqué, $Risk_{ijt}$ est notre variable dépendante qui représente le niveau de risque de l'IMF i dans le pays j à la période t . α_0 est la constante et α_1 est le paramètre du pourcentage de femmes emprunteuses, φ est l'ensemble des paramètres des variables spécifiques de l'interaction entre le pourcentage de femmes emprunteuses et les variables spécifiques à la microfinance. γ_i , la prise en compte des effets fixes pays (ou région dans certains cas) et η_t , la prise en compte des effets fixes de l'année. β est l'ensemble des paramètres du vecteur Z_{ijt} des variables macroéconomiques et des variables spécifiques à la microfinance.

$WOMAN * MFI_{it}$ représente la variable d'interaction $WOMAN * Provision_{it}$ lorsque cette interaction est entre le pourcentage de femmes emprunteuses et les provisions pour dépréciation des prêts ; $WOMAN * ROA_{it}$, pour une interaction entre le pourcentage de femmes emprunteuses et le rendement des actifs et enfin $WOMAN * Size_{it}$, pour une interaction entre le pourcentage de femmes emprunteuses et la taille de l'IMF.

Les résultats obtenus dans le tableau 8 nous indiquent que le coefficient de l'interaction entre le pourcentage de femmes emprunteuses et les provisions est négatif et significatif au seuil de 1 pourcent. Ce résultat indique bien que plus il y a de femmes emprunteuses dans le portefeuille de prêts de l'IMF, moins l'IMF constitue des provisions, ce qui diminue leur portefeuille à risque de 0,1 point au moins pour une augmentation de 10%. Nous pouvons aussi lire que le coefficient de l'interaction entre le pourcentage de femmes emprunteuses et le rendement des actifs est positif et significatif au seuil de 1 pourcent.

Ceci signifie que plus il y a de femmes emprunteuses dans le portefeuille de prêts de l'IMF, plus la rentabilité de l'IMF augmente et plus cette IMF fait mieux face aux chocs externes, ce qui permet de réduire le risque. Enfin le coefficient de l'interaction entre le pourcentage de femmes emprunteuses et la taille montre également (pour le modèle à effets fixes région uniquement) un signe positif et une significativité à 5%. Ce qui signifie que, plus il y a de femmes emprunteuses dans le portefeuille de prêts de l'IMF, plus l'IMF est capitalisée, génère davantage de capitaux et est capable de faire face aux chocs externes, ce qui permet également de réduire le risque.

La clientèle permet donc aux institutions de microfinance de réduire leur exposition au risque, d'améliorer leur rentabilité, et de croître plus rapidement. Or, comme signalé ci-dessus, en tendance, la part des femmes dans la clientèle des institutions de microfinance tend à diminuer au cours du temps. La section suivante interroge donc ce paradoxe apparent.

1.5.3 Explication de la diminution du pourcentage de femmes emprunteuses

Au regard des résultats précédents, une hypothèse explicative de la baisse du pourcentage des femmes dans le portefeuille de clientèle des IMFs, est que plus le pourcentage des femmes est élevé, plus les IMFs peuvent accroître leur taille, grâce à la rentabilité accrue associée à la présence de la clientèle féminine.

Dans cette section, nous testons donc le lien entre l'accroissement de la taille de l'IMF et l'accroissement du pourcentage de femmes emprunteuses. Nous étudions la relation entre le taux de croissance (ou de variation) du pourcentage de femmes emprunteuses et le taux de croissance (ou de variation) de la taille de l'IMF. Nous estimons donc les modèles suivants :

$$\Delta Woman_{ijt} = \alpha_0 + \alpha_1 \Delta Size_{it} + \gamma_i + \eta_t + \mu_{ijt} \quad (3)$$

$$\delta Woman_{ijt} = \beta_0 + \beta_1 \delta Size_{it} + \gamma_i + \eta_t + \mu'_{ijt} \quad (4)$$

où $\Delta Woman_{ijt}$ représente le taux de croissance et $\delta Woman_{ijt}$, le taux de variation du pourcentage de femmes emprunteuses dans l'IMF i du pays j à la période t . Les définitions de ces variables sont donc les suivantes, respectivement :

$\Delta Woman_{ijt} = \frac{(Woman_{ijt_{n+1}} - Woman_{ijt_n})}{Woman_{ijt_n}}$, et $\delta Woman_{ijt} = Woman_{ijt_{n+1}} - Woman_{ijt_n}$ où t_n est la période de l'année n .

La variable $\Delta Size_{it}$ représente le taux de croissance et $\delta Size_{it}$, le taux de variation de la taille de l'IMF. Ici encore, les définitions sont les suivantes : $\Delta Size_{ijt} = \frac{(Size_{ijt_{n+1}} - Size_{ijt_n})}{Size_{ijt_n}}$ et $\delta Size_{it} = Size_{ijt_{n+1}} - Size_{ijt_n}$ avec comme précisé précédemment t_n la période de l'année n .

α_0 et β_0 sont les constantes des modèles respectifs (3) et (4) et α_1 est le paramètre de la variable $\Delta Size$ et β_1 , le paramètre de la variable $\delta Size$. Si le taux de croissance (ou de variation) de la taille de l'IMF est positif, une valeur négative α_1 (β_1) indiquerait une

corrélation négative entre l'accroissement (la variation) de la taille l'IMF et le pourcentage de femmes emprunteuses. γ_i , la prise en compte des effets fixes pays et η_t , la prise en compte des effets fixes de l'année.

Le tableau 9 présente les résultats de ces estimations. En utilisant le taux de croissance, le coefficient de la variable $\Delta Size$ est négatif et significatif au seuil de 10% (-0,71). Aussi, en utilisant le taux de variation de ces deux variables, le coefficient de la variable $\delta Size$ reste négatif et significatif au seuil de 1% (-2,27) et même si le coefficient de $\delta Size^2$ est plus faible que celui de $\delta Size$, il reste toujours négatif et significatif au seuil de 1 pourcent, indiquant que plus l'IMF grossit, plus le pourcentage de femmes emprunteuses diminue.

Le graphique ci-dessous montre qu'après la crise financière le nombre de femmes emprunteuses même s'il est important diminue jusqu'en 2018.

Il ressort donc de l'analyse que l'hypothèse selon laquelle plus la clientèle féminine forme une part importante de la clientèle, plus l'institution de microfinance est rentable, plus elle grossit, et plus elle réduit sa part de clientèle féminine est corroborée par les données.

La tendance à la baisse de la part des femmes dans la clientèle des IMFs est donc liée au fait même qu'elles permettent, via la réduction des risques, aux IMFs de croître plus rapidement. Dès lors, en croissant, les IMFs sont forcées de se diversifier, et de réduire la part des femmes dans leur portefeuille de clients. Ces IMFs seraient alors confrontées au risque alors de voir leur niveau de risque augmenter à nouveau. L'analyse de ce dernier point est hors de portée de la présente analyse, et demande certainement une étude spécifique, mais si cette conséquence était avérée, alors une attention particulière des autorités de surveillance devrait être accordée à l'analyse de la croissance des IMFs.

1.6. Tests de robustesse

Pour étayer notre étude nous avons effectué plusieurs tests de robustesse.

Nous avons d'abord effectué des régressions sur plusieurs sous échantillons par région. Le tableau 10 présente les résultats de ces régressions. Le coefficient du pourcentage de femmes emprunteuses est négatif et significatif quelle que soit la région au seuil de 1 pourcent. Par contre ce coefficient est significatif au seuil de 10% pour la région MENA, peut-être à cause de la faible taille de l'échantillon qui est 3% de la taille globale. Par région également plus le pourcentage des femmes augmente dans le portefeuille de prêts, plus le portefeuille à risque diminue avec un impact quasi similaire.

Le deuxième et troisième test de robustesse ont consisté à éliminer de notre échantillon dans un premier temps tous les pays dans lesquels une seule IMF a été observée (tableau 11) et dans un second temps les IMFs qui sont par nature spécialisées dans les prêts aux femmes (dont au moins 90% des prêts sont accordés aux femmes). Les résultats sont stables et robustes à ces sélections. Plus il y a de femmes emprunteuses, plus le rendement des actifs est élevé, plus la taille de l'IMF est grande et en période d'inflation, le portefeuille à risque diminue. Et plus l'IMF provisionne, en période de crise et de croissance, le portefeuille à risque augmente.

Pour prendre en compte l'endogénéité, le tableau 13 nous montre les résultats de l'estimation de notre modèle avec les variables retardées. La significativité de certains coefficients diminue mais le modèle reste globalement stable et significatif.

Pour le cinquième test de robustesse, dans le tableau 14, nous avons choisi des méthodes d'estimation alternative. Les résultats que nous avons obtenus dans le tableau 1, en utilisant les MCO, concernant le pourcentage de femmes emprunteuses restent les mêmes avec la méthodologie des panels avec des effets aléatoires, des GMM et des panels dynamiques.

Enfin le dernier test de robustesse propose des variables alternatives de mesure du risque. En utilisant par exemple le portefeuille à risque à 90 jours, le ratio de couverture contre les risques, les résultats restent statistiquement significatifs et stables. Plus le pourcentage de femmes emprunteuses augmente, moins le portefeuille à risque augmente.

1.7. Conclusion du chapitre 1

L'objectif de cet article est d'analyser la relation entre le pourcentage de femmes emprunteuses et le niveau de risque des IMFs et d'expliquer le paradoxe entre le taux de croissance du pourcentage de femmes emprunteuses et la taille de l'institution financière. A partir d'un panel non équilibré de 508 IMFs avec 4110 observations sur 20 ans allant de 1999 à 2018, nous utilisons le portefeuille à risque (encours, portefeuille en retard > 30 jours) comme variable dépendante.

Nos résultats indiquent que plus il y a de femmes emprunteuses, plus le portefeuille à risque est petit. Ce résultat suggère que les IMFs avec 1 pourcentage supplémentaire de femmes emprunteuses opèrent avec un risque inférieur de 0,03 point de pourcentage à celles avec 1 pourcentage supplémentaire d'emprunteurs masculins, par rapport à un pourcentage moyen de femmes emprunteuses de 65,84%. Ces résultats sont liés au comportement des femmes, qui sont plus éthiques, sensibles, conservatrices ou prudentes dans leurs choix et stratégies d'investissement.

La tendance à la baisse de la part des femmes dans la clientèle des IMFs est lié au fait même qu'elles permettent, via la réduction des risques, aux IMFs de croître plus rapidement. Dès lors, en croissant, les IMFs sont forcées de se diversifier, et de réduire la part des femmes dans leur portefeuille de clients. Ces IMFs seraient alors confrontées au risque alors de voir leur niveau de risque augmenter à nouveau.

Concernant les autres variables spécifiques aux IMFs, les IMFs qui provisionnent beaucoup se préparent éventuellement à un choc important dans le futur, enregistrent donc un risque plus élevé. Les IMFs plus rentables et de plus grande taille, généralement les mieux capitalisées, semblent gérer leur portefeuille de prêts avec plus de prudence, ce qui pourrait être dû à la menace de perdre une valeur de franchise plus élevée en cas de défaut.

Les variables macroéconomiques nous indiquent qu'en période d'inflation, le portefeuille à risque diminue et qu'en période de crise, le portefeuille à risque des IMFs

augmente. Cela s'explique par le fait que la croissance des prêts en microfinance, pendant la crise, est limitée par des opportunités d'emprunt plus rares, tandis que le ralentissement économique a eu un impact négatif sur la qualité des actifs et la rentabilité.

En somme les recommandations de politique économique que nous formulons sont les suivantes. Maintenir l'objectif social des IMFs en développant davantage des programmes de valorisation des emprunteuses féminines tout en contrôlant l'accroissement de la firme. Deuxièmement, les IMFs doivent gérer en amont les crédits à problème afin de réduire les provisions pour dépréciation des prêts à travers la mise en place d'une politique efficace de contrôle des dossiers de crédit et de suivi de tous les emprunteurs. Troisièmement renforcer les politiques sur la détention de la liquidité afin de permettre à l'IMF de faire face aux éventuels chocs externes. Enfin les IMFs devraient renforcer les politiques d'octroi de crédit pendant les périodes d'euphorie et particulièrement en période de crise.

1.8. Appendix chapter 1

Table 1. 1. Number of observations per year

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Asia and Pacific	1	3	7	14	22	32	39	44	48	53	61	71	74	77	85	98	92	87	74	53	1,035
E. Europe & C. Asia	4	8	11	14	25	30	33	37	39	45	38	35	29	32	26	25	20	16	10	7	484
L. America & the Caribbean	11	14	18	31	42	71	98	138	156	174	188	186	186	157	145	138	128	90	74	67	2,112
MENA	2	3	4	5	5	8	8	10	9	9	7	7	7	6	6	5	4	3	3	3	114
Sub-Saharan Africa	3	3	6	9	16	25	33	38	41	38	33	27	19	10	7	14	12	11	11	9	365
Total	21*	31	46	73	110	166	211	267	293	319	327	326	315	282	269	280	256	207	172	139	4,110

Note: *Read, for example, in 1999, just 21 MFIs in our sample are observed, 1 MFI in Asia and Pacific, 4 MFIs in East Europe and Central Asia, 11 MFIs in Latin America and the Caribbean, 2 MFIs in MENA and 3 MFIs in Sub-Saharan Africa. The sample goes from 1999 to 2018.

Source: Authors' computation based on Mix Market.

Table 1. 2. Number of observations by MFIs

Number of observations	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Number of MFIs	0	131*	95	60	37	41	34	28	16	17	14	12	6	9	1	4	1	0	506

Note: *Read, for example, 131 MFIs are observed for 5 years. Then, no MFI are observed successively for 21 years. The sample goes from 1999 to 2018. We have 506 MFIs.

Source: Authors' computation based on Mix Market.

Table 1. 3. Number of MFIs by country

Country	Obs.	MFIs	Country	Obs.	MFIs	Country	Obs.	MFIs
Afghanistan*	19	2	Haiti	36	3	Panama	30	4
Albania	29	4	Honduras	125	15	Papua New Guinea	13	2
Argentina	22	3	India	219	33	Paraguay	36	4
Armenia	18	3	Indonesia	27	4	Peru	164	21
Azerbaijan	73	11	Ivory Coast	5	1	Philippines	106	13
Bangladesh	193	20	Jordan	27	3	Poland	11	2
Benin	31	4	Kazakhstan	25	3	Romania	14	2
Bolivia	223	19	Kenya	23	4	Russia	10	1
Bosnia and Herzegovina	91	10	Kosovo	26	4	Rwanda	21	3
Brazil	51	7	Kyrgyz Republic	42	6	Senegal	5	1
Burkina Faso	12	2	Laos	10	2	Serbia	11	2
Cambodia	91	13	Lebanon	18	2	Sierra Leone	8	1
Cameroon	5	1	Liberia	6	1	Sri Lanka	21	3
Chad	5	1	Malawi	6	1	Tajikistan	32	5
Chile	20	2	Mali	17	3	Tanzania	25	4
China	35	6	Mexico	231	29	Timor-Leste	10	2
Colombia	193	20	Moldova	6	1	Togo	30	3
Congo, Dem. Rep.	7	1	Mongolia	22	2	Tunisia	19	1
Costa	53	7	Montenegro	6	1	Uganda	19	2
Dominican Republic	49	6	Morocco	55	7	Ukraine	5	1
Ecuador	446	45	Mozambique	20	3	Uzbekistan	5	1
Egypt	40	5	Nepal	78	10	Venezuela	9	1
El Salvador	94	12	Nicaragua	225	24	Vietnam	22	3
Ethiopia	26	5	Niger	6	1	West Bank and Gaza	5	1
Georgia	40	5	Nigeria	38	6	Yemen	5	1
Ghana	44	6	North Macedonia	18	2	Zambia	6	1
Guatemala	105	14	Pakistan	136	16	Total	4110	506

Note: *Read, for example, In Afghanistan, for 2 MFIs there are 19 observations. The sample goes from 1999 to 2018. We have the most observations in Latin America and the Caribbean. We have 4,110 observations for 506 MFIs.

Source: Authors' computation based on Mix Market.

Table 1. 4. Number of observations, country and MFIs by region

Region	Obs.	Country	MFIs
Asia and Pacific	1,035	15	136
E. Europe and C. Asia	484	19	66
L. America and the Caribbean	2,112	18	236
MENA	114	6	13
Sub-Saharan Africa	365	22	55
Observations	4,110	80	506

Note: The sample goes from 1999 to 2018. We have the most observations in Latin America and the Caribbean.

Source: Authors' computation based on Mix Market.

Table 1. 5. Summary statistics

Variables	Units	Mean	Std. Dev.	Min.	Max.
Total Assets	Dollar, millions	83.2	222	0.06	2580
Risk, Portfolio at risk 30 days	Percentage	5.11	6.69	0.01	98.7
Woman, Percentage of female borrowers	Percentage	65.84	24.05	0.25	100
Provision, provision for loan impairment	Percentage	2.18	2.65	0.01	34.71
ROA, Return on Assets	Percentage	2.18	6.15	-55.62	21.18
Size, size of MFI, Natural logarithm of total assets	Index	16.69	1.72	11.08	21.67
GDP, Gross Domestic Product growth, Real annual GDP	Percentage	13.87	4.21	0.68	32.06
Inflation, Consumer price index,	Index	27.50	8.31	1.21	66.16
Dummy: Financial crisis, 1= during the crisis from 2008 to 2010	Binary (0,1)	.24	.42	0	1

Note: Averages are shown over the period 1999-2018. Dollar, index or percentages are used where appropriate.

Sources: Mix Market; WDI. Authors' calculations.

Table 1. 6. Correlation matrix

	Risk	Woman	Provision	ROA	Size	GDP	Inflation	Crisis
Risk	1.000							
Woman	-0.173***	1.000						
Provision	0.380***	-0.043***	1.000					
ROA	-0.252***	0.044***	-0.258***	1.000				
Size	-0.103***	-0.191***	-0.040**	0.148***	1.000			
GDP	0.041***	0.178***	0.046***	0.067***	0.043***	1.000		
Inflation	-0.020	-0.149***	0.033**	0.063***	0.106***	0.216***	1.000	
Crisis	0.105***	-0.0219	0.092***	-0.073***	-0.043***	0.0182	0.057***	1.000

Note: Where Risk=Portfolio at risk, Woman=percentage of female borrowers, Provision= Provision for loan impairment, ROA=Return on Assets, Size=Size of MFI, GDP=Real Gross domestic product growth, Inflation=Consumer price index, Crisis, dummy with take value 1 during the crisis from 2008 to 2010. The sample goes from 1999 to 2018 for 3386 observations.

Source: Mix Market; WDI. Authors' calculations.

Table 1. 7. Estimation results: OLS estimator

Dependant variable: Portfolio at risk	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Percentage of female borrowers	-0.048*** (0.005)	-0.043*** (0.005)	-0.042*** (0.005)	-0.048*** (0.005)	-0.054*** (0.005)	-0.058*** (0.005)	-0.055*** (0.005)	-0.058*** (0.005)	-0.058*** (0.006)
Provision for loan impairment		0.940*** (0.096)	0.837*** (0.086)	0.835*** (0.084)	0.815*** (0.084)	0.825*** (0.087)	0.816*** (0.084)	0.824*** (0.087)	0.837*** (0.088)
Return on Assets			-0.174*** (0.024)	-0.157*** (0.024)	-0.155*** (0.024)	-0.137*** (0.023)	-0.148*** (0.023)	-0.131*** (0.023)	-0.139*** (0.024)
Size of microfinance				-0.387*** (0.067)	-0.387*** (0.066)	-0.305*** (0.066)	-0.448*** (0.066)	-0.353*** (0.067)	-0.430*** (0.064)
GDP					0.140*** (0.029)	-0.004 (0.077)	0.139*** (0.029)	0.031 (0.082)	0.146*** (0.033)
Inflation					-0.051*** (0.010)	-0.072* (0.037)	-0.050*** (0.010)	-0.059 (0.044)	-0.035*** (0.011)
Financial crisis					0.904*** (0.241)	0.942*** (0.227)	4.183*** (0.844)	3.584*** (0.858)	4.217*** (0.877)
Constant	8.278*** (0.383)	5.928*** (0.365)	6.432*** (0.364)	13.229*** (1.323)	12.937*** (1.439)	9.897*** (1.647)	11.456*** (1.447)	8.113*** (1.707)	12.202*** (1.445)
Country fixed-effects	No	No	No	No	No	Yes	No	Yes	No
Region fixed-effects	No	No	No	No	No	No	No	No	Yes
Year fixed-effects	No	No	No	No	No	No	Yes	Yes	Yes
Observations	4110	4110	4110	4110	4110	4110	4110	4110	4110
Number of MFIs	508	508	508	508	508	508	508	508	508
R2	0.030	0.169	0.192	0.202	0.214	0.324	0.224	0.333	0.231
Adjusted R2	0.030	0.168	0.192	0.201	0.212	0.310	0.220	0.316	0.226

Note: The sample goes from 2000 to 2018. All the estimations are based on the OLS estimator. The dependent variable is the portfolio at risk and the estimations are made step by step in this table and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. Our main estimation is in column (8) and (9) where we in the same equation control variables and where we introduce both year and country (or region) fixed-effects. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 8. Estimation results: OLS estimator with interaction between percentage of female and MFIs specifics variables

Dependant variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Portfolio at risk								
Percentage of female borrowers	-0.058*** (0.005)	-0.058*** (0.006)	-0.029*** (0.007)	-0.024*** (0.008)	-0.071*** (0.006)	-0.071*** (0.007)	-0.059 (0.048)	-0.169*** (0.055)
Provision for loan impairment	0.824*** (0.087)	0.837*** (0.088)	1.728*** (0.232)	1.931*** (0.263)	0.787*** (0.080)	0.782*** (0.077)	0.824*** (0.087)	0.832*** (0.088)
Return on Assets	-0.131*** (0.023)	-0.139*** (0.024)	-0.127*** (0.021)	-0.131*** (0.021)	-0.548*** (0.088)	-0.655*** (0.105)	-0.131*** (0.023)	-0.144*** (0.025)
Size of microfinance	-0.353*** (0.067)	-0.431*** (0.064)	-0.354*** (0.067)	-0.438*** (0.064)	-0.368*** (0.067)	-0.443*** (0.065)	-0.357** (0.175)	-0.848*** (0.206)
GDP	0.031 (0.082)	0.146*** (0.033)	0.064 (0.082)	0.154*** (0.032)	0.048 (0.083)	0.142*** (0.032)	0.031 (0.082)	0.143*** (0.033)
Inflation	-0.059 (0.044)	-0.034*** (0.011)	-0.047 (0.041)	-0.035*** (0.011)	-0.045 (0.041)	-0.031*** (0.011)	-0.059 (0.044)	-0.033*** (0.011)
Financial crisis	3.584*** (0.858)	4.217*** (0.878)	3.652*** (0.863)	4.302*** (0.869)	3.290*** (0.814)	3.812*** (0.837)	3.583*** (0.861)	4.110*** (0.880)
Percentage of female borrowers*Provisions			-0.014*** (0.003)	-0.017*** (0.003)				
Percentage of female borrowers*Return on assets					0.006*** (0.001)	0.007*** (0.001)		
Percentage of female borrowers*Size							0.000 (0.003)	0.007** (0.003)
Constant	8.113*** (1.707)	12.205*** (1.445)	6.076*** (1.685)	9.862*** (1.499)	9.107*** (1.718)	13.849*** (1.531)	8.190** (3.563)	19.300*** (3.766)
Country fixed-effects	Yes	No	Yes	No	Yes	No	Yes	No
Region fixed-effects	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4110	4110	4110	4110	4110	4110	4110	4110
Number of MFIs	508	508	508	508	508	508	508	508
R2	0.333	0.231	0.346	0.252	0.345	0.253	0.333	0.233
Adjusted R2	0.316	0.226	0.328	0.246	0.328	0.247	0.316	0.227

Note: The sample goes from 2000 to 2018. All the estimations are based on the OLS estimator. The dependent variable is the portfolio at risk and the estimations are made step by step in this table and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \varphi WOMAN * MFI_{it} + \beta Z_{ijt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 9. Estimation results: OLS estimator

Dependent variable: Percentage of female borrowers	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rate, Percentage of female borrowers, t-1			-0.255* (0.152)	-0.255* (0.152)					
Rate, size		0.939 (0.912)					-0.013 (0.018)		
Size square				-0.025** (0.012)					
Rate, size square							0.900*** (0.013)	0.900*** (0.013)	
Variation, Percentage of female borrowers, t-1	-0.232 (0.423)	-1.999 (1.648)	-0.705* (0.400)	-0.343 (0.459)					
Variation, size					-2.561*** (0.338)	-2.387*** (0.414)	-0.251 (0.156)	-0.238 (0.160)	-2.271*** (0.358)
Variation, size square								-0.018 (0.044)	-0.307*** (0.103)
Constant	-45.865 (66.664)	-298.248 (233.956)	-15.142 (81.337)	-18.093 (83.137)	-30.631 (23.370)	-27.047 (23.718)	-0.161 (5.515)	-0.208 (5.501)	-31.446 (24.435)
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1921	1921	1560	1560	1927	1927	1566	1566	1927
Number of MFIs	508	508	508	508	508	508	508	508	508
R2	0.460	0.461	0.920	0.920	0.298	0.298	0.887	0.887	0.301
Adjusted R2	0.433	0.433	0.915	0.915	0.262	0.262	0.880	0.880	0.265

Note: The sample goes from 2000 to 2018. All the estimations are based on the OLS estimator. Here, the dependent variable is the percentage of female borrowers and the estimations are based on specification $\Delta Woman_{ijt} = \alpha_0 + \alpha_1 \Delta Size_{it} + \gamma_i + \eta_t + \mu_{ijt}$ or $\delta Woman_{ijt} = \beta_0 + \beta_1 \delta Size_{it} + \gamma_i + \eta_t + \mu'_{ijt}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 10. Estimation results: OLS estimator by region

Dependant variable: Portfolio at risk	Full Sample	Asia and Pacific	E. Europe and C. Asia	Sub-Saharan Africa	L. America and the Caribbean	MENA						
Percentage of female borrowers	-0.058*** (0.005)	-0.058*** (0.006)	-0.060*** (0.010)	-0.036*** (0.010)	-0.052*** (0.011)	-0.039*** (0.011)	-0.057*** (0.017)	-0.051*** (0.014)	-0.058*** (0.007)	-0.061*** (0.006)	-0.075* (0.040)	-0.279*** (0.072)
Provision for loan impairment	0.824*** (0.087)	0.837*** (0.088)	0.977*** (0.285)	0.903*** (0.257)	1.158*** (0.271)	1.093*** (0.287)	0.885*** (0.194)	0.991*** (0.188)	0.668*** (0.095)	0.669*** (0.091)	0.818 (0.831)	1.698*** (0.638)
Return on Assets	-0.131*** (0.023)	-0.139*** (0.024)	-0.171*** (0.063)	-0.162*** (0.060)	-0.245*** (0.073)	-0.263*** (0.068)	0.085* (0.043)	0.066 (0.043)	-0.141*** (0.029)	-0.137*** (0.028)	0.153 (0.288)	-0.100 (0.209)
Size of microfinance	-0.353*** (0.067)	-0.431*** (0.064)	-0.107 (0.154)	-0.062 (0.151)	0.122 (0.165)	-0.010 (0.155)	-1.227*** (0.435)	-0.851** (0.347)	-0.409*** (0.069)	-0.432*** (0.064)	-1.291 (1.415)	-1.415 (0.916)
GDP	0.031 (0.082)	0.146*** (0.033)	-0.078 (0.165)	0.047 (0.046)	-0.239 (0.189)	0.124 (0.076)	0.034 (0.191)	0.063 (0.091)	0.310** (0.127)	0.315*** (0.043)	0.743 (0.729)	-0.246 (0.228)
Inflation	-0.059 (0.044)	-0.034*** (0.011)	-0.067 (0.078)	0.066*** (0.016)	0.022 (0.093)	-0.013 (0.020)	0.248 (0.167)	0.188** (0.095)	-0.157** (0.062)	-0.165*** (0.023)	-1.360* (0.779)	-0.159 (0.210)
Financial crisis	3.584*** (0.858)	4.217*** (0.878)	-0.851 (1.850)	3.532** (1.548)	4.972*** (1.347)	5.743*** (1.464)	4.791** (2.039)	5.451*** (2.019)	2.737** (1.112)	2.771*** (1.044)	1.671 (4.811)	3.898 (6.118)
Constant	8.113*** (1.707)	12.205*** (1.445)	9.300** (3.661)	2.492 (2.459)	1.017 (3.710)	0.398 (2.997)	19.868*** (5.521)	12.622*** (4.524)	7.520*** (2.814)	14.061*** (1.766)	62.149 (39.176)	50.068** (24.476)
Country fixed-effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Region fixed-effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4110	4110	1035	1035	484	484	365	365	2112	2112	114	114
Number of MFIs	508	508	136	136	66	66	55	55	236	236	13	13
R2	0.333	0.231	0.218	0.146	0.510	0.439	0.345	0.216	0.310	0.288	0.689	0.578
Adjusted R2	0.316	0.226	0.187	0.125	0.462	0.409	0.251	0.158	0.295	0.279	0.577	0.458

Note: The sample goes from 2000 to 2018. All the estimations are based on the OLS estimator on different region. The dependent variable is the portfolio at risk and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. The columns (1) and (2) represents our main estimation with full sample. Columns (3) and (4) represents the Asia and Pacific, columns (5) and (6) the E. Europe and C. Asia, columns (7) and (8) the Sub-Saharan Africa, columns (9) and (10) the L. America and the Caribbean and columns (11) and (12) the MENA. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 11. Robustness test: OLS estimator on sample of countries with more than one MFI

Dependant variable: Portfolio at risk	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Percentage of female borrowers	-0.042*** (0.005)	-0.036*** (0.004)	-0.034*** (0.004)	-0.039*** (0.004)	-0.047*** (0.005)	-0.057*** (0.005)	-0.047*** (0.005)	-0.057*** (0.005)	-0.049*** (0.005)
Provision for loan impairment		0.909*** (0.093)	0.816*** (0.084)	0.813*** (0.083)	0.788*** (0.082)	0.815*** (0.089)	0.789*** (0.082)	0.815*** (0.088)	0.796*** (0.085)
Return on Assets			-0.171*** (0.023)	-0.157*** (0.024)	-0.154*** (0.024)	-0.149*** (0.025)	-0.145*** (0.023)	-0.142*** (0.024)	-0.141*** (0.023)
Size of microfinance				-0.321*** (0.067)	-0.326*** (0.066)	-0.299*** (0.067)	-0.394*** (0.067)	-0.348*** (0.067)	-0.376*** (0.065)
GDP					0.151*** (0.031)	0.048 (0.079)	0.149*** (0.030)	0.081 (0.084)	0.168*** (0.033)
Inflation					-0.041*** (0.010)	-0.073* (0.038)	-0.041*** (0.010)	-0.056 (0.045)	-0.031*** (0.012)
Financial crisis					0.953*** (0.241)	0.906*** (0.232)	3.760*** (0.849)	3.254*** (0.864)	3.738*** (0.850)
Constant	7.757*** (0.339)	5.423*** (0.326)	5.877*** (0.317)	11.549*** (1.261)	10.992*** (1.362)	9.258*** (1.663)	9.970*** (1.433)	7.613*** (1.720)	10.600*** (1.418)
Country fixed-effects	No	No	No	No	No	Yes	No	Yes	No
Region fixed-effects	No	No	No	No	No	No	No	No	Yes
Year fixed-effects	No	No	No	No	No	No	Yes	Yes	Yes
Observations	3928	3928	3928	3928	3928	3928	3928	3928	3928
Number of MFIs	490	490	490	490	490	490	490	490	490
R2	0.024	0.164	0.186	0.194	0.207	0.273	0.218	0.282	0.222
Adjusted R2	0.023	0.164	0.186	0.193	0.205	0.260	0.213	0.266	0.216

Note: The sample goes from 2000 to 2018; it is the observations of countries with more than one MFI. All the estimations are based on the OLS estimator. The dependent variable is the portfolio at risk and the estimations are made step by step in this table and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 12. Estimation results: OLS estimator on sample of MFIs with less than 90 percent of percentage of female borrowers

Dependant variable: Portfolio at risk	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Percentage of female borrowers	-0.034*** (0.008)	-0.042*** (0.008)	-0.041*** (0.007)	-0.050*** (0.008)	-0.060*** (0.009)	-0.057*** (0.007)	-0.062*** (0.008)	-0.058*** (0.007)	-0.067*** (0.009)
Provision for loan impairment		0.993*** (0.112)	0.875*** (0.100)	0.879*** (0.097)	0.864*** (0.097)	0.881*** (0.099)	0.867*** (0.097)	0.880*** (0.099)	0.879*** (0.099)
Return on Assets			-0.194*** (0.029)	-0.174*** (0.029)	-0.172*** (0.028)	-0.149*** (0.028)	-0.162*** (0.028)	-0.140*** (0.027)	-0.157*** (0.028)
Size of microfinance				-0.452*** (0.070)	-0.439*** (0.068)	-0.279*** (0.070)	-0.492*** (0.068)	-0.338*** (0.071)	-0.475*** (0.068)
GDP					0.151*** (0.039)	-0.061 (0.085)	0.149*** (0.039)	-0.002 (0.095)	0.163*** (0.045)
Inflation					-0.054*** (0.011)	-0.091** (0.039)	-0.054*** (0.011)	-0.087* (0.046)	-0.041*** (0.013)
Financial crisis					0.981*** (0.266)	0.989*** (0.247)	3.634*** (1.115)	3.226*** (1.067)	3.477*** (1.122)
Constant	7.583*** (0.519)	5.743*** (0.465)	6.332*** (0.476)	14.383*** (1.463)	13.952*** (1.644)	10.253*** (1.842)	12.903*** (1.756)	8.901*** (2.011)	13.937*** (1.790)
Country fixed-effects	No	No	No	No	No	Yes	No	Yes	No
Region fixed-effects	No	No	No	No	No	No	No	No	Yes
Year fixed-effects	No	No	No	No	No	No	Yes	Yes	Yes
Observations	3928	3928	3928	3928	3928	3928	3928	3928	3928
Number of MFIs	426	426	426	426	426	426	426	426	426
R2	0.009	0.171	0.198	0.211	0.225	0.350	0.236	0.359	0.245
Adjusted R2	0.008	0.170	0.197	0.210	0.223	0.332	0.229	0.338	0.238

Note: The sample goes from 2000 to 2018 and we drop all the MFIs which are particularly lending to women. All the estimations are based on the OLS estimator. The dependent variable is the portfolio at risk and the estimations are made step by step in this table and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 13. Estimation results: OLS estimator using lagged values

Dependant variable: Portfolio at risk	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Risk, t-1	0.185 (0.125)	0.164 (0.116)	0.161 (0.114)	0.159 (0.113)	0.154 (0.111)	0.124 (0.089)	0.152 (0.111)	0.122 (0.088)	0.149 (0.109)
Percentage of female borrowers	-0.042*** (0.007)	-0.043*** (0.006)	-0.043*** (0.006)	-0.047*** (0.007)	-0.052*** (0.008)	-0.055*** (0.008)	-0.053*** (0.008)	-0.054*** (0.008)	-0.050*** (0.008)
Provision for loan impairment, t-1		0.292** (0.128)	0.267** (0.135)	0.269** (0.134)	0.256** (0.130)	0.221* (0.121)	0.254** (0.127)	0.217* (0.116)	0.246** (0.125)
Return on Assets, t-1			-0.073*** (0.024)	-0.064*** (0.022)	-0.064*** (0.022)	-0.056*** (0.019)	-0.058*** (0.022)	-0.050*** (0.019)	-0.054** (0.022)
Size of microfinance, t-1				-0.221*** (0.076)	-0.215*** (0.076)	-0.089 (0.071)	-0.301*** (0.084)	-0.175** (0.076)	-0.265*** (0.080)
GDP					0.117*** (0.037)	-0.002 (0.074)	0.118*** (0.037)	0.083 (0.084)	0.162*** (0.040)
Inflation					-0.036*** (0.012)	-0.126** (0.051)	-0.038*** (0.012)	-0.133** (0.058)	-0.034** (0.013)
Financial crisis					1.157*** (0.236)	1.167*** (0.225)	2.349*** (0.846)	2.251*** (0.770)	2.474*** (0.823)
Constant	6.921*** (1.003)	6.459*** (0.808)	6.682*** (0.845)	10.546*** (1.956)	9.952*** (1.967)	7.336*** (1.967)	10.139*** (1.949)	6.804*** (1.959)	10.158*** (1.973)
Country fixed-effects	No	No	No	No	No	Yes	No	Yes	No
Region fixed-effects	No	No	No	No	No	No	No	No	Yes
Year fixed-effects	No	No	No	No	No	No	Yes	Yes	Yes
Observations	3928	3928	3928	3928	3928	3928	3928	3928	3928
Number of MFIs	426	426	426	426	426	426	426	426	426
R2	0.009	0.171	0.198	0.211	0.225	0.350	0.236	0.359	0.245
Adjusted R2	0.008	0.170	0.197	0.210	0.223	0.332	0.229	0.338	0.238

Note: The sample goes from 2000 to 2018. All the estimations are based on the OLS estimator. The dependent variable is the portfolio at risk and the estimations are made step by step in this table with MFIs lagged values and are based on specification $Risk_{ijt} = \alpha_0 + \alpha_1 WOMAN_{it} + \beta MFI_{it-1} + \theta MACRO_{jt} + \gamma_i + \eta_t + \varepsilon_{ijt}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 14. Robustness tests, alternative method

Dependant variable: Portfolio at risk	OLS	Random effects	Fixed- effects	GMM	Dynamic Panel
Risk, t-1				-0.024 (0.018)	0.088*** (0.017)
Percentage of female borrowers	-0.058*** (0.005)	-0.047*** (0.009)	-0.025 (0.016)	-0.044*** (0.009)	-0.030** (0.014)
Provision for loan impairment	0.824*** (0.087)	0.946*** (0.112)	1.021*** (0.120)	0.892*** (0.165)	1.023*** (0.055)
Return on Assets	-0.131*** (0.023)	-0.117*** (0.029)	-0.096*** (0.030)	-0.104*** (0.037)	-0.115*** (0.024)
Size of microfinance	-0.353*** (0.067)	-0.147 (0.099)	0.100 (0.108)	-0.216** (0.097)	0.103 (0.166)
GDP	0.031 (0.082)	0.071* (0.037)	-0.035 (0.102)	0.131*** (0.043)	-0.093 (0.101)
inflation	-0.059 (0.044)	-0.049*** (0.016)	-0.048 (0.040)	-0.029* (0.017)	-0.036 (0.049)
Financial crisis	3.584*** (0.858)	0.641** (0.262)	0.547** (0.264)	0.589* (0.356)	0.430** (0.201)
Constant	8.113*** (1.707)	9.181*** (2.155)	4.779 (2.931)	8.251*** (2.058)	
Observations	4110	4110	4110	3898	3898
Number of MFIs	508	508	508	508	508
R2	0.333		0.172		
Adjusted R2	0.316		0.171		

Note: The dependent variable is the portfolio at risk. In column (1), our main estimation with OLS estimator. Column 2 = Random effects. Column 3 = Fixed-effects. Column 4 = Cluster, country. Column 5 = GMM and column 6 = Dynamic panel. A constant is included but not reported. Robust standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 1. 15. Robustness tests, alternative variable

	Portfolio at risk 30 days	Portfolio at risk 30 days	Portfolio at risk 90 days	Portfolio at risk 90 days	Risk Coverage	Risk Coverage	Write off ratio	Write off ratio	Loan loss rate	Loan loss rate	Zscore	Zscore
Percentage of female borrowers	-0.058*** (0.005)	-0.058*** (0.006)	-0.044*** (0.004)	-0.041*** (0.005)	0.011*** (0.001)	0.010*** (0.001)	-0.002 (0.002)	0.002 (0.002)	-0.015 (0.016)	-0.011 (0.015)	-0.266*** (0.078)	-0.220*** (0.060)
Provision for loan impairment	0.824*** (0.087)	0.837*** (0.088)	0.659*** (0.096)	0.654*** (0.096)	-0.001 (0.007)	-0.015** (0.006)	0.788*** (0.055)	0.882*** (0.052)	0.678*** (0.096)	0.795*** (0.068)	-2.575*** (0.432)	-3.552*** (0.472)
Return on Assets	-0.131*** (0.023)	-0.139*** (0.024)	-0.150*** (0.024)	-0.154*** (0.024)	0.014*** (0.003)	0.010*** (0.003)	-0.036** (0.015)	-0.017 (0.013)	-0.055** (0.026)	-0.011 (0.015)	0.982*** (0.237)	0.779*** (0.222)
Size of microfinance	-0.353*** (0.067)	-0.431*** (0.064)	-0.177*** (0.055)	-0.175*** (0.051)	0.031** (0.013)	0.061*** (0.012)	-0.031 (0.028)	-0.036 (0.026)	-0.011 (0.044)	-0.098 (0.061)	2.761*** (0.977)	2.196*** (0.844)
GDP	0.031 (0.082)	0.146*** (0.033)	-0.008 (0.077)	0.091*** (0.031)	-0.081*** (0.017)	-0.056*** (0.006)	0.063* (0.034)	0.045*** (0.013)	-0.117 (0.179)	-0.124 (0.162)	-0.294 (1.114)	0.707* (0.381)
inflation	-0.059 (0.044)	-0.034*** (0.011)	-0.064* (0.039)	-0.024*** (0.009)	0.026*** (0.009)	0.009*** (0.003)	-0.006 (0.019)	-0.013*** (0.005)	0.009 (0.057)	0.127 (0.137)	0.291 (0.624)	-0.292* (0.166)
Financial crisis	3.584*** (0.858)	4.217*** (0.878)	1.255** (0.597)	1.744*** (0.580)	-0.996*** (0.267)	-0.991*** (0.279)	0.840 (0.535)	0.717 (0.490)	0.096 (0.691)	0.135 (0.683)	-1.426 (8.123)	5.979 (7.766)
Constant	8.113*** (1.707)	12.205*** (1.445)	6.630*** (1.528)	7.439*** (1.081)	5.616*** (0.527)	3.563*** (0.346)	-0.412 (0.871)	0.487 (0.648)	1.738 (1.930)	1.513 (1.256)	-19.793 (23.769)	5.200 (15.311)
Country fixed-effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Region fixed-effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4110	4110	3787	3787	4089	4089	3973	3973	4050	4050	4089	4089
Number of MFIs	508	508	508	508	508	508	508	508	508	508	508	508
R2	0.333	0.231	0.282	0.201	0.247	0.137	0.536	0.496	0.036	0.027	0.111	0.077
Adjusted R2	0.316	0.226	0.263	0.196	0.227	0.131	0.524	0.492	0.011	0.020	0.088	0.070

Note: In column (1) and (2), our main estimation with Portfolio at risk at 30 days. We use alternative variable (portfolio at risk at 90 days, risk coverage, write off ratio, loan loss rate). Robust standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

2. Bank risks and shareholder origin: Evidence from Central Africa's currency union⁴

2.1. Introduction

One major concern of bank regulators and supervisors in many countries is the persistently high level of non-performing loans recorded in their banking systems, a process that started with the global financial crisis. Problems have been reported at both banks from developed countries (Beck et al., 2015; Nkusu, 2011; Ozili, 2019; Tinta and Sanou, 2021) as well as from developing and emerging market countries (Belaid et al., 2017; Ozili, 2019).

Non-performing loans (NPLs) are the most direct traditional measure of bank risk and represent the main source of bank insolvency in developing and emerging countries (Honohan, 1997; Lanine and Vander Venet, 2006).⁵ Their determinants are multifaceted and include bank-specific factors such as poor management practices or excessive lending (Podpiera and Weill, 2008), but also macroeconomic and institutional factors play a role including sovereign risk spillovers, bursts of asset or commodity prices or financial opacity and lax regulation (Noel et al., 2021).

In this paper, we investigate the determinants of bank risks in the Central African Economic and Monetary Community (CEMAC) focusing on the impact of shareholder origin and structure. We consider four types of banks: locally owned, state owned, foreign African, and foreign non-African banks. In particular, we are interested in whether local banks have managed their loan portfolios better (or not) compared to the other banks to the extent that they might enjoy a comparative advantage of cultural and social proximity to their market. In principle, this informational advantage should improve the efficiency of borrower monitoring and the control of credit risks. As suggested by financial theories (Diamond, 1984), lower levels of asymmetric

⁴ This chapter is co authored with Michael Brei, University of Lille

⁵ The definition of non-performing loans varies from country to country but, typically, they include the stock of loans on which interest or principal payments are more than 90 days due.

information should benefit borrowers since this reduces lenders' exposure to credit risk and monitoring costs which in turn leads to more favorable loan terms and better performance of borrowers. On the other hand, it could be that local banks are riskier if they serve a poorer and riskier clientele rather than, for example, a clientele composed of large exporting firms.

In this study, the main measure of bank risks is the non-performing loan ratio as has been used in numerous studies (Beck et al., 2015; Belaid et al., 2017; Bofondi and Ropele, 2011; Mazreku et al., 2018; Nkusu, 2011; Ozili, 2019). However, we check the robustness of our results using other measures including the Z-Score and the loan provision ratio. A major contribution of this study is the detailed collection of shareholder information on the bank-level, which allows us not only to identify the majority shareholder but also the second and third major shareholders. As we will show, the second shareholder can have an impact in this process and, as such, more diversified shareholder structures may result in outcomes that are more favorable from a supervisory perspective.

Using panel data and the fixed-effects filter (FEF) methodology of Pesaran and Zhou (2018), we investigate whether bank risks depend on shareholder origin and structure. We use information over the period 2000-14 on a sample of 55 commercial banks located in four out of six CEMAC countries: Cameroon (17 banks), Chad (12), Congo (15) and Gabon (11). Our results suggest that locally owned banks operate with higher non-performing loan ratios than the other types of banks, notably after controlling for bank-specific and macroeconomic conditions. More specifically, we find that their NPL ratio is by 8.6 percentage points (p.p.) higher compared to an average of 10.7 p.p.. Interestingly, we find that the origin and type of the second largest shareholder has an impact on bank risks. More specifically, if the second largest shareholder of a locally owned bank is the government, then banks risks are by 0.038 p.p. higher for each percentage point more of ownership. If the second largest shareholder is a foreign entity, then bank risks are by -0.248 p.p. lower for each percentage of ownership if the

entity comes from other African countries and by -0.034 p.p. for each percentage of ownership if it comes from countries outside of Africa. Evaluated at the average ownership share, for instance of African second largest shareholders of 29.27 percent, NPL ratios at locally owned banks are by only 3.01 p.p. higher compared to the other banks. This highlights a positive role played by foreign shareholders in banks that are in majority locally owned. Our findings thus suggest that the specific shareholder structure of banks warrants additional supervisory attention. Finally, we provide some evidence that larger and better capitalized banks operate with higher NPL ratios, while more profitable banks with lower NPL ratios.

The remainder of the paper is structured as follows. The next section presents the related literature. The third and fourth sections present the data and methodology. The fifth section presents the empirical results and the final section concludes.

2.2. Related literature

There is no consensus about the advantages of highly diversified international banking sectors compared to purely domestic ones. Host country regulators are interested in the efficiency gains of foreign bank entry but they are concerned with contagion stemming from parent bank distress. The results of the empirical literature on this subject are mixed. For instance, while Dages et al. (2000) and Peek and Rosengren (2000) find a stability enhancing role of foreign banks in emerging markets due to their diversification and international scope, Claessens et al. (2001) and Wu et al. (2017) provide evidence that risks at local banks increase in response to foreign bank entry to compensate for lower intermediation margins.⁶

To investigate the comparative advantage argument of locally owned banks over others, Pelletier (2018) studies the distance factor using a sample of more than 600 banks from the Sub-Saharan region over the period 2003-13. She finds that

⁶ As Brock and Suarez (2000) argue in the case of the Latin American experience, regulators overly permissive attitude towards the entry of new banks can pose a threat to financial system stability, especially, when many or large entrants compete aggressively with the existing banks for costumers by lowering loan rates and increasing deposit rates to levels that are unsustainable.

geographical distance between home and host countries matters. In order to better monitor and control borrowers, the knowledge of the economic banking environment is essential (Berger and DeYoung, 2001). This is particularly true in developing countries with large informal sectors, important information asymmetries and lack of historical documentation (Maimbo et al., 2011).⁷ In such a context, benefits of local experience are important and useful. In other studies such as in Sufi (2007) and Vu et al. (2015), distance is used as a proxy for a bank's ability to acquire soft information about borrowers.

Along these lines, Berger and DeYoung (2001), Claessens and Van Horen (2014) and Mian (2006) have provided evidence that the closer foreign banks are to the local market, the fewer non-performing loans they incur and therefore the better they perform. Stein (2002) shows that a large lender-borrower distance reduces the incentives for bank managers to acquire imperfectly observed project information. The authors all conclude that locally owned banks are better able to work with and manage local information.

A number of studies have investigated the role of government ownership in explaining bank risks but again the results are mixed. While Hu et al. (2004) find that non-performing loan ratios have been lower at state owned banks in Taiwan, Micco et al. (2007) and Pelletier (2018) find the opposite for large samples of banks. In Aghion et al. (1998) and Weill (1998) it is not the type of ownership that determines the level of non-performing loans but rather the competitiveness of the market. Banks in countries with more competitive banking markets are more likely to be efficient and innovative.

According to Pelletier (2018) local banks do not perform as well as foreign banks because the latter come from well-developed regulatory systems and they have recourse to superior risk management techniques, financial instruments and technologies (Berger et al., 2000). It has also been reported that locally owned banks

⁷ In line with this view, Brei et al. (2020) provide evidence for Sub-Saharan Africa that credit risks are lower in countries where credit registries exist.

exhibit higher interest expenses than their foreign competitors, because they do not benefit from the affiliation to a large banking group. Moreover, it has been observed that local banks serve less transparent and riskier borrowers (Beck et al., 2015) compared to a wealthier clientele of foreign owned banks (Berger et al., 2008; Beck et al., 2013). Hermes and Lensink (2004) provide evidence that financial liberalization and higher foreign bank presence can alleviate lending problems and improve capital allocation.

In addition to shareholder structure, many studies highlight the importance of other bank-specific factors in the determination of bank risks. These include (excessive) credit growth (Lucia et al., 2021), efficiency (Weill, 2006), bank size (Khemraj and Pasha, 2009; Lucia et al., 2021; Ozili, 2019) and profitability (Anastasiou et al., 2020; García-Marco and Robles-Fernández, 2008; Godlewski, 2005; Louzis et al., 2012; Lucia et al., 2021; Podpiera and Weill, 2008). More generally, it has been suggested that macroeconomic factors such as GDP growth (Nkusu, 2011), interest rates (Tinta and Sanou, 2021; Bofondi and Ropele, 2011) and inflation (Khemraj and Pasha, 2009; Brei et al., 2020) play a role in this process. Finally, several other factors have been investigated including the unemployment rate, money supply, financial deepening and the degree of openness, and credit culture (Ozili, 2019; Ekanayake and Azeez, 2015).

2.3. Data

We collect data from different sources. Financial information specific to the various banks comes from the Central African Banking Commission (COBAC)'s regulatory financial statements of banks (CERBER).⁸ Unfortunately, we only have access to this information for the period 2000-14. We combine this data with hand-collected information on the shareholder structure and origin of banks using their webpages, complemented by information on the global ultimate owner as in Pelletier (2018) and

⁸ The acronym CERBER stands for "Collecte, Exploitation et Restitution aux Banques et Etablissements Financiers des Etats Réglementaires". From the data of this system, COBAC establishes the SYSCO rating for the evaluation of CEMAC's banks.

Lepetit et al. (2012). Lastly, we merge this data with macroeconomic variables obtained from the World Development Indicators (WDI).

Our sample consists of all banks that were active at some point during the 15-year sample period in four CEMAC countries: Cameroon, Chad, Congo and Gabon. Our sample of banks is comprised of 46 different entities of which nine changed the majority shareholder during our sample period.⁹ We treat banks prior to and after the change in ownership as separate entities which implies that our sample consists of 55 different cross-sections. Of the 55 banks, 21 banks are majority locally owned (10 private and 11 state owned) and 34 banks are in majority foreign owned (16 African and 18 non-African).

Looking at the broader structure of these banking markets, we observe in Table 1 that the Cameroonian banking system is larger and composed of more banks, especially privately owned banks equally dispersed across shareholder origin. Banks' total assets account on average for 31% of GDP in Cameroon compared to less than 14% in the other countries. In the other banking markets, there are fewer local-private banks while there are more foreign- and state-owned entities. In terms of bank risk, we observe that it is much higher in Cameroon and Chad (with NPL ratios of 14.90% and 13.13%) whereas they are much lower in Congo and Gabon (2.96% and 7.44%). In general, banks operate on average with high capital ratios, the least capitalized banks operate in Cameroon with an average capital ratio of 11.76%.

Table 2 provides summary statistics across the different types of banks. We observe that foreign non-African banks operate with lower non-performing loan ratios (7.82%) compared to the other banks. The highest NPL ratio is observed for local-private banks (16.01%) followed by local state owned-banks (11%) and foreign African banks (10.55%). When considering the alternative measures of bank risks, we observe also higher provisioning ratios at foreign non-African banks, which could be an indication

⁹ These are AMITY, CBC-CAM, UBC in Cameroon, FBT, CBT, BAC-CHA in Chad, COFIPA, in Congo and BGFI-GAB and UBG in Gabon.

of more prudent provisioning but also of riskier lending. In terms of Z-Scores, or distance to default, state-owned banks appear most risky. In terms of assets, foreign African banks have the lowest loan-to-assets ratios with a slightly higher involvement in interbank lending. On the liability side, depositors provide the majority of funds with a notable difference for state owned banks for which equity ratios are much higher compared to the other banks.

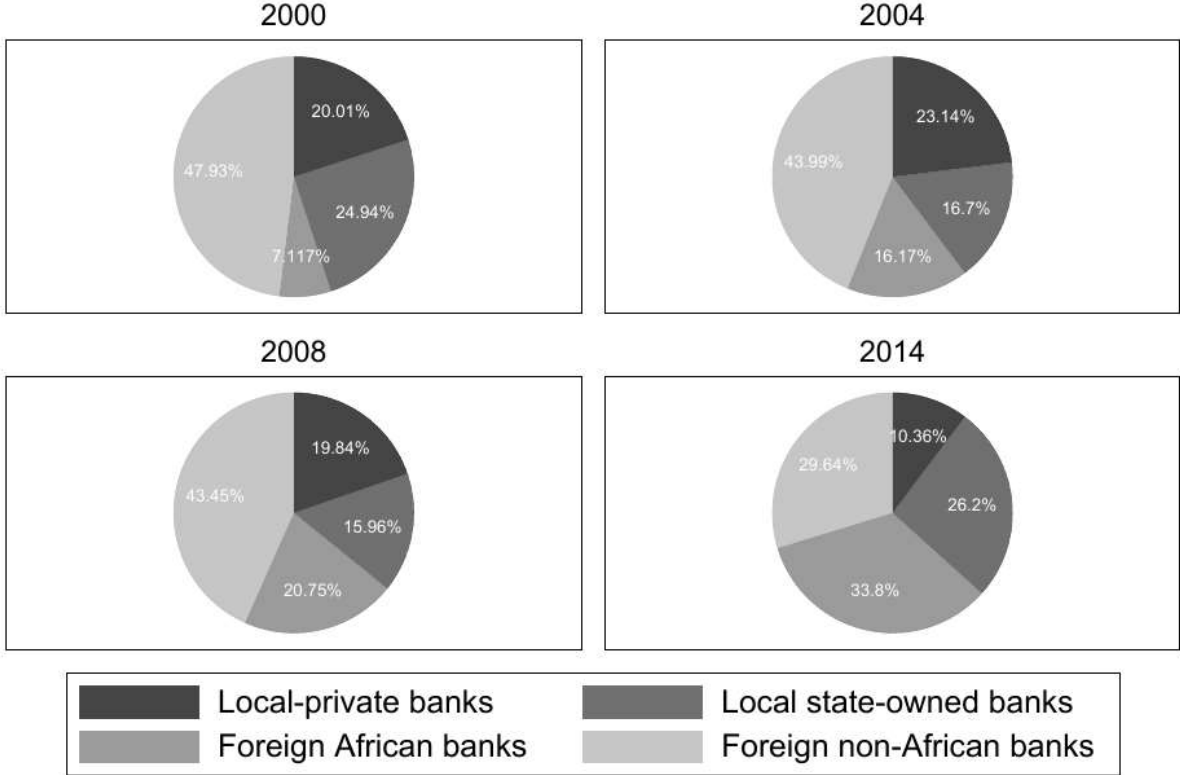
Table 3 shows summary statistics and the definitions of the regression variables. Our dependent variable, the non-performing loan ratio, ranges from 0 to 93%, with a mean of 10.7%.

As can be seen, we distinguish the four types of banks using dummy variables that are equal to one, when a particular shareholder owns at least 50 percent of a bank's capital, and zero otherwise. The first category are local banks for which the majority shareholder comes from one of our four CEMAC countries. We distinguish local banks that are privately owned from those that are owned by the government. The second category includes foreign banks for which the majority shareholder either comes from outside Africa or from within Africa (including the Maghreb countries and South Africa) but outside CEMAC region. In cases, where several shareholders come from a specific country, we follow Pelletier (2018) and aggregate the shares of each owner from that country before assigning it to a particular type. When banks change the majority ownership from one type to another, as in nine cases, we consider them as separate entities.

Figure 1 below shows the evolution of the average shareholder structure. As can be seen at the beginning of our sample period, banks were predominately owned by foreign non-African shareholders (48% of banks) followed by local banks (20% private and 25% state owned). At the end of our sample, foreign shareholders from Africa have become more important controlling 34% of the banks, followed by foreign non-African banks (30%) and state-owned local banks (26%). There is therefore evidence that

foreign African banks gained market share in the CEMAC region at the detriment of foreign non-African and local private banks.

Figure 2. 1. Shareholder evolution in CEMAC banks

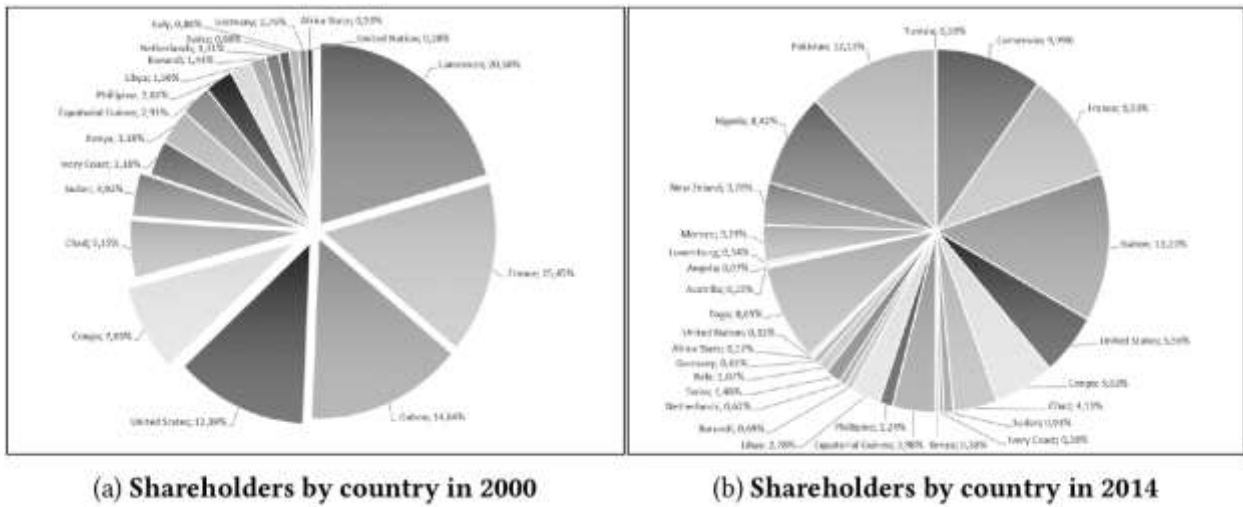


Source: COBAC reports, commercial bank reports. Authors’ calculations.

As of end-2014, the proportion of banks with shareholders from the CEMAC region stands at 36%, those with a majority shareholder from West Africa is 23%, and from France we count 16%. The remaining cumulative capital represents banks with shareholders from North Africa (6%), the United States (4%) and other countries (13%).

Figure 2 shows the shareholder structure by country of origin at end-2000 and end-2014, respectively. As can be seen, the shareholder origin in 2000 is dominated by six countries: Cameroon (20.58%), France (15.45%), Gabon (14.64%), United States (12.39%), Congo (7.85%) and Chad (5.15%). In 2014, the shareholder structure is much more dispersed with eight countries taking the lead: Gabon (13.19%), Pakistan (12.13%), Cameroon (9.99%), France (9.93%), Togo (8.65), Nigeria (8.42), Congo (5.63%), United States (5.56%) and Chad (4.11%).

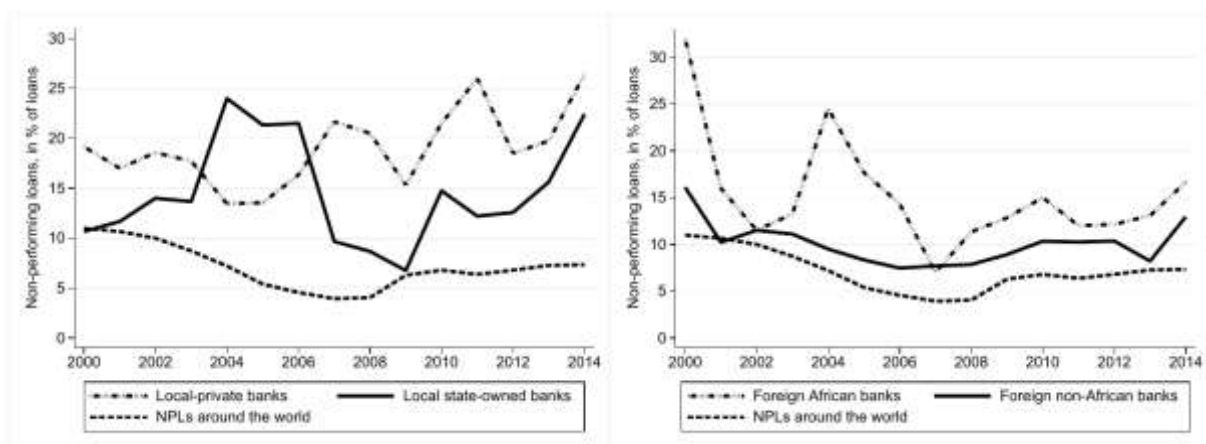
Figure 2. 2. Shareholder origin by country



Source: CERBER; COBAC and bank reports. Authors' calculations.

Next, we examine the ratio of non-performing loans over time and across our different types of banks. As can be seen in Figure 3, problem loans represent a much higher fraction of loans compared to banks from all parts of the World (based on data from the World Bank). Foreign non-African banks record the lowest and least volatile NPL ratios followed by foreign banks from Africa. Local private banks record the highest ratios except for the period 2004-07 when NPLs of state-owned banks skyrocketed. Moreover, the levels of non-performing loans of these two types of local banks in 2014 are both alarming with an increasing trend that surpasses a level of 20% of loans.

Figure 2. 3. Non-performing loan ratios by type of shareholder



Source: CERBER; COBAC reports; World bank. Authors' calculations.

2.4. Methodological approach

One major problem in empirical panel studies is that the traditional fixed effects estimator cannot accommodate the inclusion of regressors that are largely time invariant. This is because the two are collinear and all time-invariant effects are absorbed by the fixed effects. We thus use the fixed-effects filter (FEF) model proposed by Pesaran and Zhou (2018). The model allows estimating a fixed effects model including time-invariant variables using a two-step approach.

In the first step, the FEF procedure uses the fixed effects model to estimate the impact of the time-varying regressors on the dependent variable. The residuals from the first stage regression are, in turn averaged over time across cross-sections and regressed on an intercept and the time-invariant regressor. As Pesaran and Zhou (2018) demonstrate, the FEF estimator is unbiased and consistent in settings where there is a large cross-sectional dimension and a small-time dimension, given that the fixed effects are uncorrelated with the time-invariant regressor. This approach relaxes the restriction that a known subset of time-varying regressors is uncorrelated with the individual fixed effects.

Our empirical model to estimate the impact of shareholder origin on bank risk-taking can be summarized as follows:

$$y_{ijt} = \alpha_i + \beta Shareholder_i + \gamma X_{it-1} + \delta Z_{jt} + \varepsilon_{ijt} \quad (1)$$

where y_{ijt} represents the non-performing loan ratio of bank i in country j in year t . The fixed effects are denoted by α_i , the vector $Shareholder_i$ is a dummy variable indicating the type of the majority shareholder, and X_{it} and Z_{jt} are vectors of bank-specific and macroeconomic control variables, respectively. The error term is denoted by ε_{ijt} .

Our key coefficients of interest are those associated with the shareholder variable. To be more precise, a positive coefficient $\beta > 0$ indicates that banks of a particular type have operated with higher non-performing loans, relative to the omitted category

(foreign non-African banks) and conditional on the control variables and other time-invariant differences across banks.

The vector of bank-specific variables includes bank size (logarithm of total assets), capitalization (equity divided by total assets) and profitability (net income over total assets). We lag these variables to mitigate potential endogeneity concerns. These controls are likely to determine the ability of banks to effectively manage their loan books. For instance, larger banks might have lower NPL ratios because their dominant market position allows them to reduce adverse selection problems in lending markets. They might also serve larger and wealthier clients that are less likely to default compared to smaller, less diversified and poorer customers. As for bank capitalization and bank profitability, banks' franchise values should be higher with larger ratios and thus they should have fewer incentives to take on risks. The empirical literature is vast on these subjects, see amongst others Alessi et al. (2021), Anastasiou et al. (2020), Hu et al. (2004), Khemraj and Pasha (2009), Klein (2013), Lee and Rosenkranz (2020), Louzis et al. (2012), Noel et al. (2021), Ozili (2019), Podpiera and Weill (2008), and Shamshur and Weill (2022).

We add a parsimonious set of macroeconomic variables known to influence bank risk (Claessens and Van Horen, 2014; Van Horen, 2007). More specifically, we include real GDP growth, CPI inflation, and the Herfindahl-Hirschman Index (HHI). We expect that banks operating in high growth environments with stable prices operate with lower non-performing loans ratios. However, this depends, as one could argue that higher inflation enhances the loan repayment capacity of borrowers by reducing the real value of outstanding debt. We included as a measure for local market structure the HHI calculated by the sum of the squared market shares of each bank in a given country. A higher HHI indicates more market concentration. Banking sector competition is generally seen as a driver of investment and growth. It limits market dominance and cost of credit and enhances access to credit for small entrepreneurs and poorer households. Despite its potential benefits, however, tighter competition can also have

negative side effects in the form of excessive competition by market entrants and reduced profit margins leading to increased risk-taking incentives of incumbent banks. Indeed, Brei et al. (2020) find a U-shaped relationship between competition and bank risks in Sub-Saharan Africa. The macro factors included in our study have been used in amongst others in Anastasiou et al. (2020), Claessens and Van Horen (2014), Louzis et al. (2012), Mazreku et al. (2018), Nkusu (2011), Noel et al. (2021), Ozili (2019), Sengupta and Vardhan (2017), Weill (1998) and Yin (2021).

Our results should however be interpreted with caution. Our objective here is to determine whether there are significant and robust correlations between the dummy variables representing shareholder origin and the level of risk in the banking industry, but we do not attempt to show causality. We cannot exclude the existence of reverse causality (risks affecting shareholder origin), however, as mentioned above changes in ownership only affected a small percentage of the banks in our sample.

2.5. Results and discussion

Table 4 presents the results of the baseline regressions using the FEF approach of Pesaran and Zhou (2018). We estimate three regressions where we augment the model with shareholder variables including first bank-specific determinants and then macroeconomic control variables.

Our results indicate that the coefficient for locally owned banks is positive and significant across all specifications. This means that local-private banks operated with higher non-performing loan ratios compared to the other banks, taking into account unobserved time-invariant differences across banks and conditional on the bank-specific and macroeconomic control variables. The coefficient in the full specification is equal to 8.6 indicating that locally owned banks operated with an 8.6 percentage points higher NPL ratio compared to the other banks. The impact is not only statistically important but also economically to the extent that the average NPL ratio across all banks and all years is equal to 10.7 percentage points. It corroborates our visual

inspection in Figure 3, but here we control for size, capitalization, profitability and other factors influencing borrowers' capacity to repay their loans.

As discussed in the literature review, there are a number of potential explanatory factors for why locally owned banks may have riskier loan books. On one hand, it could be that these banks serve a riskier clientele excluded from accessing the other types of banks. This might be particularly important for our sample of countries where information on credit history and formal documentation is limited or non-existent, contract enforcement and regulations are weak, transparency is low and the informal sector is large (Claessens and Van Horen, 2012). In this case, a higher NPL ratio is not surprising and acceptable from a regulator's perspective as long as the banks have sufficient capital to absorb losses associated with loan defaults. On the other hand, the results could be an indication of local-private banks having poorer technological expertise in credit screening and monitoring (Claessens, 2017). Foreign banks might be in a better position to develop risk management techniques and adopt new financial instruments and technologies (Berger et al., 2000). This comparative advantage over local-private banks could in turn allow them to select a better segment of borrowers.

All of our bank-specific control variables are significant. While larger and better capitalized banks record higher NPL ratios, more profitable banks appear to operate with less credit risks. Unfortunately, we do not have information on regulatory versus voluntary capital holdings since risky banks can appear well capitalized because of a higher regulatory requirement. The same is true for more prudent banks preferring holding more capital due to precautionary and other motives. Nevertheless, our results suggest that banks with riskier loan books also have more capital, thus increasing their capacity to absorb future loan losses. Bank size and profitability are indicators of the ability to generate economies of scale and to cope with adverse shocks. In this sense, larger banks might be in a better position to absorb borrower defaults due to their size and diversification, and thus they operate with riskier loan books. However, it could also be that large banks suffer from increased complexity and diseconomies of scale as

suggested by Boyd and Graham (1998) and Lobeze (2010). Finally, banks that are more profitable seem to manage their loan portfolio more prudently, which could be due to the threat to lose a higher franchise value in case of default.

Even if the macroeconomic control variables such as GDP growth and the Herfindahl-Hirschman index are not significant, the coefficient of inflation is significant and negative. Its means that banks record lower problem loans in environments where inflation is higher, conditional on the shareholder structure and other control variables. One argument made in the literature is that higher inflation may enhance the loan repayment capacity of borrowers by reducing the real value of outstanding debt, see Mazreku et al. (2018); Nkusu (2011); Sengupta and Vardhan (2017).

Next, we augment our baseline model to include an interaction term of our dummy variable for the type of the majority shareholder with the share of ownership of the second largest shareholder. Our model can thus be represented as follows:

$$y_{ijt} = \alpha_i + \beta Shareholder_i + \beta^*(Shareholder_i \cdot Share_i^{2nd}) + \gamma X_{it-1} + \delta Z_{jt} + \varepsilon_{ijt} \quad (2)$$

where $Share_i^{2nd}$ is the average ownership share of bank i over our sample period. This specification allows us to see whether the second largest shareholder has an impact on the majority shareholder's riskiness of its loan book. For instance, if we find that β^* is negative, then the presence of the second shareholder is associated with lower credit risks. We check the results when interacting all three majority shareholder types with the ownership share of the second largest shareholder, but this resulted in insignificant results, presumably due to over parametrization. We thus focus here only on the results when interacting only the dummy variable of locally owned banks with the second largest shareholder variable.

The results shown in Table 5 reveal that local-private banks tend to operate with riskier loan books, conditional on the control variables, but the type of the second largest shareholder has an impact on a bank's credit risk. As can be seen in column (2), where we interact the majority shareholder dummy variable with a variable representing the

share of ownership of banks for which the second largest owner are state owned banks, we find that

$$\partial y_{ijt} / \partial \text{Shareholder}_i^{\text{local|2nd state}} = 8.002 + 0.038 \cdot \text{Share}_i^{\text{2nd,state}}$$

Evaluated at the mean of the second largest shareholder's ownership share of local state-owned banks of 29.36 percentage points, we find that majority locally owned banks operate with $8.002 + 0.038 \cdot 29.36 = 9.12$ p.p. higher NPL ratios compared to the other banks. It appears thus that minority state ownerships are associated with higher credit risks at locally owned banks in the CEMAC region. This finding thus suggests that banks in which the second largest shareholder is the government warrant additional attention compared to banks in which this is not the case. This could be linked to heightened conflicts of interest and other governance issues that are present in such configurations (Hamdani and Yafeh, 2013; Teen, 2017).

Next, we estimate two more models in which we interact the majority shareholder variable with the ownership share of the second largest owner, when the latter is foreign owned. As before we distinguish between African and non-African foreign ownership. The results are shown in columns (3) and (4) of Table 5. Interestingly, we find in both cases that credit risks are lower at locally owned banks when the second largest shareholder is a foreign entity. This points to positive spillovers of foreign minority shareholders, which could take the form of technological but also managerial improvements in locally owned banks from the CEMAC region. More specifically, evaluated at the respective means, we find the following relationships:

$$\partial y_{ijt} / \partial \text{Shareholder}_i^{\text{local|2nd,African}} = 10.27 - 0.248 \cdot 29.27 = 3.01$$

$$\partial y_{ijt} / \partial \text{Shareholder}_i^{\text{local|2nd,non-African}} = 8.88 - 0.034 \cdot 13.23 = 8.43$$

Therefore, the largest impact on credit risks of locally owned banks have foreign banks from Africa when they act as the second largest shareholder. This represents an interesting finding pointing to a disciplining role for foreign banks, especially when

they come from less distant countries, both in physical and cultural terms. The results for the other control variables remain robust to these modifications.

Finally, we tested our results for robustness using alternative measures of bank risks and alternative estimators. In the first two robustness checks, we use the Z-Score and loan provision ratio as alternative measures. The latter is a forward-looking measure of credit risks and the former a measure for the distance to default. We calculated the Z-Score using a 3-rolling window as the sum of the average return of assets and total equity divided by the standard deviation of the return on assets (De Young and Torna, 2013). The results are shown in columns (1) and (2) of Table 6. They confirm our previous results on higher credit risks at local private banks from the CEMAC region. More specifically, locally owned banks operated with significantly lower Z-Scores, conditional on the control variables, and with higher loan provision ratios.

Next, we re-estimated our baseline regression using the Hausman and Taylor (1981) estimator. The results are shown in column (3) and they go into the same direction as our results based on the FEF estimator. Finally, we estimate a dynamic model including the NPL ratio lagged by one year and following the procedure of Kripfganz and Schwarz (2019), which allows including time-invariant regressors along with bank fixed effects. As can be seen in column (4) are results on higher credit risks at locally owned banks are robust to this modification.

2.6. Conclusion chapter 2

The present paper examines the relationship between bank risks and shareholder origin in four countries of Central Africa's currency and economic union. Our findings highlight that locally owned banks operated with significantly higher credit risks compared to their state- and foreign-owned counterparts. The results are economically important suggesting that banks owned by private investors from the CEMAC region operated with 8.6 percentage points higher NPL ratios than the other banks, compared to an average NPL ratio of 10.7 percentage points. This finding may be linked to poorer management practices, credit screening and monitoring technology, but also to the

fact that locally owned banks serve a riskier and poorer clientele with less credit history and otherwise limited access to financial intermediation.

Interestingly, we find that the origin and type of the second largest shareholder has an impact on credit risks observed at locally owned banks. While state-owned second largest shareholders contributed to higher risks at locally owned banks, foreign-owned second largest shareholders have contributed to lower risks. The risk-reducing impact is strongest when the second largest shareholder comes from the African region.

Our findings suggest that the specific shareholder structure of banks warrants additional supervisory attention. The negative impact of state-owned second largest shareholders could be linked to heightened conflicts of interest and other governance issues (governments are not in the front line and thus less accountable), whereas the positive impact of foreign-owned second largest shareholders could be linked to technological but also managerial improvements. The fact that the largest risk-reducing impact on local banks is associated with second largest shareholders from Africa represents an interesting finding that deserves further study.

2.7. Appendix chapter 2

Table 2. 1. Summary statistics by country

	Cameroon	Chad	Congo	Gabon	All banks
No. of local-private banks	6	2	1	1	10
No. of local state-owned banks	1	3	4	3	11
No. of foreign African banks	4	4	4	4	16
No. of foreign non-African banks	6	3	6	3	18
Total banks	17	12	15	11	55
NPLs	14.90	13.13	2.96	7.44	10.73
ROA	1.93	1.79	3.94	2.29	2.34
Cash	4.36	5.41	4.42	3.04	4.32
Loans to private	48.33	36.38	39.05	44.04	43.01
Loans to public	5.55	14.57	3.81	5.67	7.31
Other loans	4.42	6.99	3.26	1.99	4.27
Central bank lending	5.62	2.68	2.51	3.23	3.88
Interbank lending	3.58	1.85	3.68	2.56	3.07
Securities	2.22	2.30	1.82	1.18	1.94
Fixed assets	9.20	10.60	8.30	10.00	9.51
Other assets	16.72	19.22	33.15	28.29	22.69
Deposits to private	57.68	42.80	61.92	46.79	52.72
Deposits to public	15.31	17.25	11.98	9.28	13.85
Deposits to non-residents	1.71	6.12	1.54	1.60	2.66
Deposits to others	4.26	1.82	3.83	2.35	3.22
Interbank borrowing	0.91	0.98	0.04	0.40	0.66
Short term borrowing	5.10	2.74	3.43	4.84	2.77
Long term borrowing	2.26	2.32	2.51	5.21	2.77
Other liabilities	1.02	6.94	1.09	3.06	2.82
Total equity	11.76	19.03	14.64	26.46	17.10
Total assets, % of GDP	31.01	13.33	9.89	4.73	17.51
CPI inflation, annual	2.46	3.27	2.92	2.12	2.65
GDP Growth, annual	4.23	8.64	5.11	2.87	5.10
Herfindahl-Hirschman, index	0.15	0.19	0.27	0.32	0.22

Note: In percent of total assets (except for NPLs which are in percent of total loans). Unweighted averages are shown over the period 2000-14. The panel above shows the number of banks across type and country. "Local-private banks" are banks with majority local shareholders (inside CEMAC), "Local state-owned banks" are banks with a majority owned by the state, "Foreign African banks" are banks with majority African shareholders (inside Africa but outside CEMAC), and "Foreign non-African banks" are banks with majority foreign shareholders (outside Africa).

Sources: CERBER; WDI; COBAC reports. Authors' calculations.

Table 2. 2. Summary statistics across different types of banks

	Local private banks	Foreign African banks	Foreign non-African banks	Local state owned banks	All banks
NPL ratio	16.01	10.55	7.82	11.00	10.73
Provisions ratio	0.43	0.93	4.33	1.47	1.56
Z-Score	7.25	5.01	4.41	2.03	5.43
Cash	5.44	5.58	3.08	3.88	4.32
Loans to private	44.28	36.77	43.86	49.81	43.02
Loans to public	6.60	7.76	7.35	7.53	7.31
Loans to other	5.38	5.42	3.44	2.80	4.27
Central bank lending	4.26	2.93	5.12	1.36	3.88
Interbank lending	2.39	4.51	2.92	2.02	3.07
Securities	1.41	5.00	0.90	0.30	1.94
Fixed assets	9.34	7.39	9.67	13.17	9.51
Other assets	20.90	24.66	23.66	19.12	21.34
Deposits from private	53.75	57.21	55.59	34.58	52.72
Deposits from publics	13.35	12.98	15.61	11.11	13.85
Deposits from non-residents	2.71	2.17	2.30	4.47	2.66
Deposits from others	3.17	2.95	3.57	2.73	3.22
Interbank borrowing	1.25	0.32	0.65	0.33	0.66
Short-term borrowing	4.09	5.74	3.46	3.81	4.21
Long-term borrowing	2.17	2.41	1.95	6.77	2.77
Other liabilities	7.08	2.52	4.42	1.24	2.81
Total equity	12.43	13.69	12.43	34.95	17.10
Observations	100	112	180	62	454

Note: Simple averages are shown for different types of banks over the period 2000-14.
Sources: CERBER; COBAC reports. Authors' calculations.

Table 2. 3. Summary statistics and variable definitions

Variable name	Definition	Measure	Obs.	Mean	Std. Dev.	Min	Max
NPL	Non-performing loan ratio	Non-performing loans to total loans	454	10.73	14.58	0	93
Provisions	Loan provision ratio	Provisions to total loans	451	1.56	6.14	0	68.88
Z-Score	Bank solvency ratio	(Average ROA + total equity) /std. deviation of ROA	363	5.43	7.92	-4.65	49.80
Local-private banks	Private domestic banks (CEMAC)	=1 if % of share is majority local	454	0.22	0.41	0	1
Foreign African banks	African private banks outside CEMAC	=1 if % of share is majority African	454	0.24	0.43	0	1
Foreign non-African banks	Non-African private banks	=1 if % of share is majority foreign	454	0.39	0.48	0	1
Local state-owned banks	Public banks local	=1 if % of share is majority state	454	0.13	0.34	0	1
Share local-private banks	Private domestic banks (CEMAC)	Percent share of majority local	454	15.19	24.89	0	100
Share Foreign African banks	African private banks outside CEMAC	Percent share is majority African	454	22.86	36.52	0	100
Share Foreign non-African banks	Non-African private banks	Percent share is majority Foreign	454	33.89	37.21	0	100
Share Local state-owned banks	Public banks local	Percent share is majority state	454	17.38	25.10	0	100
Equity	Capital ratio	Equity to total assets	454	17.10	17.42	2.78	100
ROA	Return on assets	Net income to total assets	454	2.33	2.67	-5.38	8.51
Size	Bank size	Logarithm of total assets	454	11.42	1.20	7.17	14.03
CPI Inflation	Annual CPI inflation	Percent change in consumer prices	454	2.65	3.24	-8.97	12.43
GDP growth	Annual real GDP growth	Real GDP growth	454	5.10	5.25	-6.61	33.62
HHI	Herfindahl-Hirschman Index	Squared sum of market shares	454	0.22	0.09	0.12	0.93

Note: Unweighted averages are shown over the period 2000-14. Percentages are used where appropriate.

Sources: CERBER; COBAC reports. Authors' calculations.

Table 2. 4. Estimation results

Dependent variable y=NPL ratio	(1)	(2)	(3)
Local-private banks	8.197*** (1.784)	9.038* (5.861)	8.642* (5.752)
Foreign African banks	2.736 (1.721)	4.465 (4.648)	4.546 (4.546)
Local state-owned banks	3.184 (2.106)	-1.008 (2.931)	-0.558 (2.841)
Equity, t-1		0.207*** 0.088	0.192** (0.084)
Size, t-1		3.039** (1.721)	2.702* (1.706)
ROA, t-1		-1.640*** (0.476)	-1.562*** (0.488)
CPI Inflation			-0.184** (0.084)
GDP growth			-0.026 (0.099)
HHI			-13.52 (11.06)
Number of banks	55	55	55
Observations	454	408	408
Adjusted R ²	0.039	0.017	0.009

Note: The dependent variable is the NPL ratio. The estimations are based on specification (1) and done with the FEF estimator of Pesaran and Zhou (2018). A constant is included but not reported. Robust standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 2. 5. Impact of second largest shareholder

Dependent variable y=NPL ratio	(1)	(2)	(3)	(4)
Local-private banks	8.642*	8.002*	10.27**	8.884*
	(5.752)	(5.925)	(5.554)	(5.756)
Foreign African banks	4.546	4.557	4.310	4.555
	(4.546)	(4.554)	(4.509)	(4.552)
Local state-owned banks	-0.558	-0.550	-1.641	-0.563
	(2.841)	(2.844)	(2.706)	(2.842)
Local-private * Local state-owned (2 nd shareholder)		0.038**		
		(0.019)		
Local-private * Foreign African banks (2 nd sh.)			-0.248***	
			(0.020)	
Local-private * Foreign non-African banks (2 nd sh.)				-0.034***
				(0.012)
Equity, t-1	0.192**	0.193**	0.220***	0.193**
	(0.084)	(0.084)	(0.078)	(0.084)
Size, t-1	2.702*	2.773*	2.019*	2.756*
	(1.706)	(1.736)	(1.305)	(1.720)
ROA, t-1	-1.562***	-1.568***	-1.450***	-1.567***
	(0.488)	(0.489)	(0.416)	(0.488)
CPI Inflation	-0.184**	-0.180**	-0.196***	-0.181**
	(0.084)	(0.084)	(0.081)	(0.084)
GDP growth	-0.026	-0.023	-0.038	-0.024
	(0.099)	(0.099)	(0.095)	(0.099)
HHI	-13.52	-12.76	-14.70*	-12.87
	(11.06)	(10.98)	(11.04)	(10.94)
Number of banks	55	55	55	55
Observations	408	408	408	408
Adjusted R ²	0.009	0.016	0.019	0.010

Note: The dependent variable is the NPL ratio. The estimations are based on specification (2) and are done with the FEF estimator of Pesaran and Zhou (2018). A constant is included but not reported. Robust standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 2. 6. Robustness tests

	(1)	(2)	(3)	(4)
Dependent variable y:	Z-Score	Provisions ratio	NPL ratio	NPL ratio
y, t-1				0.897*** (0.033)
Dummy: Local-private banks	-1.984* (1.543)	5.730* (3.747)	8.875** (4.522)	1.940*** (0.675)
Dummy: Foreign African banks	-1.788 (1.574)	1.141 (0.941)	0.939 (3.559)	0.001 (0.823)
Dummy: Local state-owned banks	-3.494 (2.980)	0.002 (1.159)	1.009 (4.441)	0.491 (0.665)
Equity, t-1	0.073* (0.052)	0.104* (0.066)	0.133** (0.052)	0.029 (0.023)
Size, t-1	0.338 (0.894)	1.131* (0.769)	-1.542*** (0.256)	-0.283** (0.137)
ROA, t-1	1.036*** (0.274)	-0.153 (0.129)	-0.100 (0.135)	-0.288*** (0.100)
CPI Inflation	-0.016 (0.067)	-0.129** (0.061)	0.058 (0.096)	-0.058 (0.066)
GDP growth	-0.005 (0.098)	-0.056 (0.045)	2.023** (0.787)	-0.203 (0.343)
HHI	-9.398* (6.589)	-0.085 (1.671)	-13.721 (9.386)	-6.930* (3.971)
Number of banks	55	55	55	55
Observations	408	408	320	320
Adjusted R ²	0.007	0.017		

Note: The dependent variable in column (1) is the Z-Score, in column (2) the loan provision ratio, and in columns (3) and (4) the NPL ratio. Columns (1) and (2) are estimated by the FEF estimator of Pesaran and Zhou (2018), column (3) by the Hausman-Taylor estimator, and column (4) is a dynamic model estimated by sequential (two-stage) regression of Kripfganz and Schwarz (2019). A constant is included but not reported. Robust standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

3. Parametric estimation of the determinants of inefficiency of microfinance institutions in the WAEMU and CEMAC countries¹⁰

3.1. Introduction

Microfinance has become a major player in the fight against poverty. In developing countries, microfinance mobilises funds in the informal sector for people excluded from the traditional banking sector and/or those who are financially limited. Bangoura et al. (2016); Clark and Spraggon (2022); Diaz-Serrano and Sackey (2022) show that microfinance improves the income of the poor and reduces inequality by increasing the number of borrowers while simultaneously being financially sustainable.

Microfinance institutions (MFIs) are developing strategies to improve their financial and social performance (Hermes and Hudon, 2018) to produce and offer more financial services to low-income households. Viability and sustainability require management style, optimal cost management, respect for constraints, and specific objectives. The principal main of this study is to analyse the determinants of the inefficiency of MFIs in West and Central Africa. This concerns the Economic and Monetary Community of Central Africa (CEMAC), which includes six countries: Cameroon, Congo, Gabon, Equatorial Guinea, Central African Republic, and Chad, and the West African Economic and Monetary Union (WAEMU), which includes eight countries: Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, and Togo.

Traditional banks and microfinance institutions can be considered as two types of financial intermediaries of different essences, but they often have the same objective: to collect savings from surplus agents for the financing of projects deemed profitable (Fall, 2009, 2011). Moreover, stylised facts for the period 1980-2019 in the WAEMU and CEMAC countries clearly show an increase in complementary banking microfinance. Moreover, as Kouakou (2020) shows, this combination of banking and microfinance activities would only be beneficial for growth. While formal banks learn about proximity intermediation, MFIs learn about banking knowledge. This conception of the financial institution guides the choice of products (outputs) and production factors (inputs) in this study.

¹⁰ This chapter is co-authored with Thomas Blavet, Post-doctoral researcher, Paris School of Economics (PSE), Institut des politiques publiques

Nevertheless, banks and microfinance differ in their intermediation logic, scale of their operations, temporality of their contracts, and mechanisms used to select and monitor projects (Fall, 2011). In the WAEMU and CEMAC countries, the legal status of banks and MFIs is another distinction. Banking institutions are supervised by the central bank and regulated by banking law, while microfinance structures depend on the Ministry of Economy and Finance and are regulated by a specific law. Banks are monetary financial institutions because they have the power to create money, whereas MFIs do not have this licence. MFIs are non-monetary institutions that operate solely based on the resources they collect.

Economic and financial literature models banking and microfinance inputs and outputs through two main approaches: production and intermediation. The production approach considers that banks produce various categories of deposits, loans, and other services using physical factors, such as physical capital, labour, materials, and area (Benston, 1965; Bell and Murphy, 1968; Berger and Humphrey, 1991). The intermediation model¹¹ considers financial institutions as agents (or intermediaries) that move funds between agents with financing needs and those with financing capacities. In this view, the factors of production are labour, physical capital, and sometimes equity to convert financial capital such as deposits and other funds into loans, securities, investments, and other income-generating assets. The institution then produces intermediation services to the extent that its outputs emanate from the firm's assets in different types of loans and investments, and the financial costs of accounts are recorded in the liabilities (Sealey Jr and Lindley, 1977).

¹¹ The intermediation approach is divided into three components.

The first component considers financial intermediation as the main activity of the bank. Deposits, other liability accounts, and real resources are considered as inputs and loans, while balance sheet assets (which use the funds that generate most of the returns received by the bank) are considered as outputs (Ohene-Asare, 2011; Sealey Jr and Lindley, 1977).

The second component (user cost) was proposed by Barnett (1978), Donovan (1978), and Hancock (1985) to determine whether deposits were a product or an input. Under this component, banks transform non-financial inputs such as labour, capital, and purchased materials into financial products. User costs categorise the inputs and outputs of a bank product according to their net contribution to the bank's turnover or the signs of their derivatives in a bank profit function. The financial returns on an asset must be greater than the opportunity cost of funds for a financial product to be considered an output (or conversely the financial cost on the claim must be less than the opportunity cost).

The last component of value-added concerns the modelling of the bank's behaviour. It has been developed by Berger et al. (1987) and Berger and Humphrey (1992). Here, the outputs are represented by the supply of loans and the inputs by the labour and physical capital that are used.

There are several reasons for choosing the intermediation approach to analyse the efficiency of MFIs in this study. First, Berger and Mester (1997) note that the intermediation approach is more appropriate, as financial institution managers focus on reducing total costs, and not only non-interest rate costs. Ohene-Asare (2011) confirms that this approach encompasses bank's total costs and does not exclude interest expenses, because these expenses constitute a significant part of the bank's total cost, and their elimination could bias the empirical results. The second reason, as given by Sealey Jr and Lindley (1977), is the nature of financial institutions' businesses. As financial institutions specialise in the transformation of deposits and credits, the deposits collected constitute part of the funds used to grant credits and make investments. Deposits are, therefore, considered as inputs and not outputs, as in the production approach which may be more appropriate, as Ohene-Asare (2011) points out, for studies of efficiency at the bank branch level.

For Ferrier and Lovell (1990), the intermediation approach is the best when the objective is the economic viability of the financial institution, as it incorporates all general banking costs, unlike the production approach which focuses mainly on operating costs. There is no consensus on the use of some outputs and inputs in the analysis of financial institutions' efficiency, although the intermediation approach is dominant.

As mentioned above, the objective of this study is to analyse the determinants of the inefficiency of MFIs in the WAEMU and CEMAC countries. Given that MFIs vary from one area to another, depending on the specificities of each financial system, poverty levels, extent of subsidies, and involvement of public authorities (Fall and Servet, 2010), we use the methodology developed by Wang and Ho (2010). One of the first contributions of this study is the use of the model of Wang and Ho (2010), which has not yet been used in the microfinance sector, to our knowledge. This estimation method makes it possible to distinguish, for each institution, time-invariant heterogeneity from time-varying inefficiency. The heterogeneity of each institution is necessary for at least two reasons. The first is to estimate the production technology by considering heterogeneity in the form of fixed effects. This heterogeneity is reflected in the estimation of the production technology by a different constant for each institution, and thus, results in a different part of the production cost (in the case of the estimation of a cost function). The second reason is to estimate the inefficiency correctly. If

heterogeneity is not considered, a part of it is reflected in the inefficiency estimation. This leads to overestimation or underestimation.

Although necessary, considering heterogeneity by integrating fixed effects into the estimation of technology may cause estimation problems. Indeed, the latter is potentially subject to an incidental parameter problem, because there are as many effects to be estimated as there are institutions in the sample. The estimation of these fixed effects is problematic in cases in which each institution is observed for a limited number of years.

To avoid this potential problem of incidental parameters while distinguishing heterogeneity from inefficiency, Wang and Ho (2010) propose a first difference or within-transformation. These methods estimate production technology without being subject to this incidental parameter problem, as fixed effects will be removed from the estimation, but the production technology will still be correctly estimated.

We use Wang and Ho's (2010) method to estimate a translog cost function to characterise MFIs' production technology and analyse the determinants of inefficiency. To the best of our knowledge, another contribution of this study is that it is the first to decompose operational expenses into administrative, financial, and depreciation expenses to estimate the loan production technology. The estimates are carried out on a sample of 102 MFIs from eight countries of West and Central African economies for a period of 16 years from 2003 to 2018.

This study highlights that in the WAEMU and CEMAC economies, three determinants are important: percentage of women borrowers, market share concentration, and age of the firm. MFIs that specialise in lending to women are less efficient, and the youngest MFIs are the most efficient. We also find that the less competition there is in the microfinance sector at the local level, the more efficient it is.

The remainder of this paper is organised as follows. Section 2 presents related literature. Section 3 presents the methods used to consider the determinants of inefficiency and, in particular, the methods used to decompose inefficiency from heterogeneity. Especially, this section presents the approach of Wang and Ho (2010) which is applied in the remainder of the study. This section also presents the estimation strategy that decomposes operational expenses into administrative, financial, and depreciation expenses to estimate the loan production technology, ensuring that homogeneity is imposed, and presents the specification

of the inefficiency determinants. Section 4 presents the sample of microfinance institutions in the WAEMU and CEMAC countries and the data used. Finally, Section 5 presents the empirical results and interpretations of the results.

3.2. Related literature

Existing literature dealing with the measurement of MFI inefficiency or efficiency applies two main approaches: the parametric and non-parametric approach.

Since Benston (1965), Berger and Humphrey (1991), and Sealey Jr and Lindley (1977), inefficiency or efficiency measurement models applied in other fields have been imported into the financial sector.

4.2.1 Analysis of the determinants of inefficiency using data envelopment models

Many authors have focused on data envelopment analysis (DEA) to analyse the efficiency of MFIs. Without claiming to be exhaustive, we present a few key studies related to our study.

Nghiem et al. (2006) focus on 46 MFIs in Vietnam, using labour and non-labour costs as inputs and the number of savers, borrowers, and groups as outputs. They conclude that the average technical efficiency of MFIs in Vietnam is 80 percent and that the age and location of the MFI significantly influence the efficiency of these MFIs. Gutiérrez-Nieto et al. (2007) examine the efficiency of MFIs in Latin America. Using as inputs the number of loan officers and operating expenses and as outputs the interest income and fees, the gross loan portfolio, and the number of outstanding loans, they show the presence of a country effect as the location and nature of the MFI influence technical efficiency. They are joined by Haq et al. (2010), who examine 39 MFIs in Asia, Africa, and Latin America and find that the nature of the MFI, especially NGOs, is more efficient. Gutiérrez-Nieto et al. (2009) further focus on financial and social efficiency in 89 MFIs worldwide. They use total assets, costs, and number of employees as inputs and outputs; first, loans and revenues to measure financial efficiency; and second, the number of female borrowers and the poverty index to measure social efficiency. They find a weakly positive relationship between outreach and financial efficiency. Bassem (2008), on the other hand, analyses the efficiency of a panel of 35 MFIs in the Mediterranean area from 2004 to 2005 and finds a negative relationship between MFI size and efficiency.

Segun and Anjugam (2013) examine another aspect of MFIs: client service delivery. In a sample of 27 MFIs in 25 countries in Saharan Africa, they conclude that MFIs are inefficient in performing their financial intermediation function. Using outreach and financial viability as an angle of observation for 52 rural banks in Cameroon, Piot-Lepetit and Nzongang (2014) use a multi-DEA methodology to measure the efficiency of rural banks in Cameroon and make a trade-off between outreach and financial viability. Lebovics et al. (2016) find no relationship between financial and social efficiency. In a sample of 28 MFIs in Vietnam, they use variable inputs such as total liabilities, operating costs, and number of employees, and use gross loan portfolios and financial income as financial outputs and poverty outreach and number of depositors as social outputs.

In an extension of the studies using the data envelopment methods mentioned, Fall (2018) uses Simar and Wilsons (2007) truncated double-bootstrap method to analyse the technical efficiency of MFIs in the UEMOA zone. Fall (2018) finds that economic profitability is a key determinant of financial and social efficiency. Similarly, MFIs with a non-commercial profile are the most efficient from a social point of view. In the following section, we present the main studies using the stochastic frontier (SF) method to analyse the determinants of MFI inefficiency.

4.2.2 Analysis of the determinants of inefficiency using stochastic frontiers

The application of stochastic frontiers (SFA) to analyse the efficiency of MFIs has been quite recent. However, we can cite the works of Desrochers and Lamberte (2005), Hermes et al. (2011), Oteng-Abayie (2011), Paxton (2007), Servin et al. (2012), and Mimouni et al. (2022), who focused on SFA methods for MFIs.

Desrochers and Lamberte (2005) investigate whether rural cooperative banks in the Philippines minimise agency costs in their management. In a sample of 50 rural cooperative banks from 1995 to 1999, they use, on the one hand, the intermediation approach which considers the firm as a producer of two goods (loans and deposits) and, on the other hand, an SFA and free distribution approach to estimate a cost function. Outputs are estimated as the number of accounts, amount of loans and investments, and inputs as the value of deposits, capital, wages, and interest. They conclude that agency costs significantly reduce the cost efficiency of rural

cooperative banks. Thus, an increase in management remuneration would result in improved bank performance and higher productivity. Finally, they find that more profitable cooperative banks are better able to cope with external shock.

Gregoire and Tuya (2006) examine efficiency by MFI type in Peru. In a sample of 28 MFIs with 1,864 observations over the period 1999 to 2003, they use Battese and Coelli's (1995) methodology to estimate a cost function through the SFA approach. Following the intermediation approach, the loan portfolio is the only output they retain. Labour and physical capital represent necessary inputs and deposits as fixed inputs. They conclude that only the concentration index, size, and credit to the agricultural sector are negatively correlated with the inefficiency of MFIs in Peru. In contrast, for this sample, the coefficient of the average loan portfolio and MFI type are positive and statistically significant with the inefficiency of these MFIs.

Paxton (2007) uses an SF method to analyse the technical efficiency of 190 semi-formal MFIs in Mexico by estimating a translog production function. The dependent variable is the logarithm of the volume of outstanding loan portfolios, investments, and demand deposits, and the inputs are the logarithms of capital, labour, and loaned funds. Using Wang's (2002) model and cross-sectional data from 2001, Paxton (2007) concludes that technological tools (number of computers per employee), average loan portfolio size, outreach (average loan portfolio per borrower), and MFI age are positively correlated with the technical efficiency of MFIs in Mexico. In a similar lode, Masood and Ahmad (2012), use the methodology developed by Battese and Coelli (1995) to measure the level of efficiency and the determinants of inefficiency on an unbalanced panel of 40 MFIs in India over the period 2005 to 2008. They conclude that MFI age is a positive determinant of efficiency, although size does not explain it. They also find that the larger the outreach of the MFI, the more effective the MFI is and that geographical location affects the effectiveness of MFIs, as those operating in southern states appear to be more effective than their counterparts in northern states.

Similarly, Oteng-Abayie (2011), using an intermediation approach, uses Cobb-Douglas on 135 MFIs located in Ghana from 2007 to 2010. These results confirm those obtained by Masood and Ahmad (2012) and Paxton (2007). There is a positive relationship between efficiency and age of the MFI and a positive relationship between MFI efficiency and outreach, but a negative relationship with the number of deposits per saver. They also find a positive relationship

between efficiency and operational expenses, loans per loan officer, and deposits per loan officer.

Quayes et al. (2013) confirm the results obtained by their predecessors. Using cross-sectional data on 45 MFIs in Bangladesh in 2013, Quayes et al. (2013) estimate a cost function based on the methodology developed by Battese and Coelli (1995), following the intermediation approach. The output is the average loan portfolio, while the prices are the price of labour, cost of capital, cost of borrowed funds, and cost of deposits and fixed inputs to highlight the determinants of inefficiency, such as the age of the MFI, size, average loan portfolio, and total loans. They conclude that the age of the MFI (not significant), total membership, average loan portfolio, and local loans are negatively correlated with MFI inefficiency. Riaz (2015) estimates a Cobb-Douglas function by applying the one-step methodology developed by Battese and Coelli (1995) on an unbalanced panel ranging from 2007 to 2013 of MFIs in Pakistan. He uses the intermediation approach to identify three inputs (cost per borrower, financial expenditure, and total assets) and two outputs (financial margin and average loan portfolio). He concludes that, on the one hand, age and the number of branches are significantly and negatively correlated with the inefficiency of MFIs in Pakistan and, on the other hand, the number of staff, number of women borrowers, and average loan portfolio per borrower are significantly and positively correlated with the inefficiency of these MFIs.

In addition, Hermes et al. (2011) measure the outreach and efficiency of 435 MFIs worldwide from 1997 to 2007. They estimate a cost function using the intermediation approach that describes as output the average loan portfolio and as inputs the price of a unit of labour per year, interest per unit of deposit, and use as determinants of inefficiency, the age of the MFI, percentage of female borrowers, average loan portfolio per borrower, and type of loans provided primarily by the MFI. They find a positive and significant coefficient between the age of the MFI and inefficiency; that is, younger MFIs are more efficient than older MFIs. According to Hermes et al. (2011, 2018), younger MFIs have enough time to learn from the failures of older MFIs and are therefore more cautious, and hence more efficient. They also find a positive and significant relationship between the percentage of female borrowers and inefficiency: the more an MFI specialises in lending to women, the more inefficient it becomes. They also found a positive relationship between individual loans, village loans, and inefficiency. On the contrary, they find a negative relationship between the average loan portfolio per borrower, group

lending, and mixed lending. The same results are confirmed by Hermes et al. (2018) in an analysis of the relationship between financial development and MFI efficiency using a sample of 372 MFIs worldwide. They again estimate a cost function following the intermediation approach. In addition to the determinants used by Hermes et al. (2011), use a financial development indicator, the number of borrowers, and region fixed effects. They reach the same conclusions about the efficiency of young MFIs and the inefficiency of MFIs specialising in lending to women. Conversely, in a recent study, Fall et al. (2021) find that gender diversification increases the efficiency of MFIs. They use a non-parametric method (Free Disposal Hull) as well as its robust version of order α , on a sample of 680 MFIs in six countries for the year 2011.

Kumar and Sensarma (2017) analyse the efficiency of MFIs in India using a stochastic distance function approach. They find an inverse relationship between inefficiency and the percentage of female borrowers, microfinance size, profitability, and leverage in Indian microfinance in a panel of 75 MFIs from 2004 to 2011. Hermes et al. (2011, 2018) find a positive relationship between inefficiency and the age of MFIs.

Servin et al. (2012) in a sample of 315 MFIs, for 1681 observations, in 18 Latin American countries over the period from 2003 to 2009, analyse the technical efficiency of MFIs and find that the ownership structure and the nature of the MFI¹² are associated with technical efficiency. In addition, they show that non-governmental MFIs and cooperatives have less efficient technologies than banks and non-financial institutions with respect to their objectives.

There is still controversy regarding the link between competition and the efficiency of financial institutions. Two conflicting approaches underlie the relationship between competition and firm efficiency: structure-conduct-performance (SCP) paradigm and efficient structure hypothesis. While the SCP paradigm concludes that there is a negative correlation between market power and the profitability and efficiency of firms, the efficient structure hypothesis states a positive correlation, even if most authors find that competition improves the efficiency of institutions.

¹² These include non-governmental organizations, cooperatives, credit unions, rural banks, non-financial institutions

Empirical studies on the effects of competition on the efficiency of MFIs date back to the 2000s, and have mainly focused on Latin America.

This is the case of Christen (2000) who focuses on commercialization and mission drift of MFIs in Latin America. After defining the commonality between commercialisation and competition, the author shows that competition leads to increased market penetration and, in some countries, to market saturation, as well as to the deterioration of portfolio quality. Extreme market saturation can be observed, resulting from the effects of increased competition in the Bolivian MFI sector (Dannon et al., 2019).

Navajas et al. (2003) highlight the ambiguous effects of competition in a study of two MFIs in Bolivia. According to them, competition leads to innovation on the one hand and to the reduction of lenders' possibilities to subsidise unprofitable activities on the other. Moreover, McIntosh and Wydick (2005) confirm these results by indicating that competition between MFIs amplifies information asymmetry and, in particular, related adverse selection. MFIs do not have sufficient information about clients before they grant loans. They then show that increased competition between lenders can reduce the ability of MFIs to cross-subsidise poor and less-poor borrowers.

Several indicators are commonly used to measure the competition. Baquero et al. (2012) use the HHI¹³ to measure competition in the microfinance industry in a sample of 279 MFIs in 69 countries from 2002 to 2008. The results show a significant difference in competitive conditions for commercially oriented and non-profit-oriented MFIs.

Mersland et al. (2011) use Panzar and Rose's (1987) H-statistic on a sample of 405 MFIs in 73 countries from 1998 to 2010. The results show that on average, MFIs do not exercise monopoly or collusive oligopoly power.

Assefa et al. (2013) use the Lerner statistic to assess the impact of the microfinance market structure on the efficiency of MFIs. They use a sample of 362 MFIs in 73 countries from 1995 to 2009. They show that increased competition is generally negatively associated with MFI performance.

¹³ The Herfindahl-Hirschman Index (HHI) measures market concentration or the number of firms producing a good.

Kar (2016) uses the Bonne (2008) indicator to quantify the impact of marginal cost on MFI performance in ten Asian and Latin American countries. The results obtained by the author show a significant decrease in competition between MFIs in Bangladesh and Bolivia due to the partial reconstitution of the market power of large MFIs in these countries.

Finally, Fecher and Pestieau (1993) analyse the correlation between efficiency and concentration in the financial sector and find a negative correlation. In another framework, Kouakou (2020) shows that the microfinance market could be shared with banks, and that in case of competition, banks win and the efficiency of MFIs decreases.

Recently, Mimouni et al. (2022) evaluate how subsidies and deposit mobilisation affect the cost inefficiency of MFIs. The authors use data from the Mix Market database on 1,582 MFIs in 92 countries from 2003 to 2018 and employ a baseline cost SF approach, a two-step system GMM. The findings of their study suggest that deposits alleviate cost inefficiency, while subsidies worsen it, and that cost inefficiencies are highly correlated with key microfinance indicators. Negative relationship with operational self-sufficiency and positive relationship with microcredit interest rates. Lower microcredit interest rates are among the other indicators of the social impact of microfinance, such as the depth of reaching the poorest borrowers, represented by the percentage of female borrowers.

Table 1 summarises the studies developed in the SF analysis framework in MFIs.

To reconcile the results of different studies, a meta-analysis was performed by Fall et al. (2018). They show that the average technical efficiency scores of MFIs have increased over time, although there is heterogeneity depending on the methodological approach used. On the one hand, they find higher scores for studies using more inputs and outputs, as well as for those using an output approach. On the other hand, they find lower scores for studies with a large number of MFIs and those estimating social efficiency. Finally, they find that African MFIs have low performance.

Some studies analyse the determinants of MFI inefficiency using alternative estimation methods rather than the DEA and SF approach.

Hermes and Hudon (2018) conduct a systematic review of approximately 170 papers discussing the determinants of the financial and social performance of MFIs. Their study shows that the most important determinants addressed in the literature are MFIs' characteristics, such as size,

age, type of organisation, quality of organizational governance, and macroeconomic conditions. According to this study, a consensus is far from being reached for each determinant.

Bartni and Chitnis (2016), Caudill et al. (2009), Cull et al. (2007, 2009), D’Espallier et al. (2013b, 2017a), Gohar and Batool (2015), Narwal and Yadav (2014), Rashid and Twaha (2013), Rai (2015), Wijesiri et al. (2015), Wu et al. (2016), and Zhou et al. (2020) analyse the impact of age, size, number of offices, number of personnel on MFI performance, percentage of female borrowers, GDP, inflation, market power, and competitiveness. Table 2 shows the characteristics of the literature on some determinants of microfinance inefficiency, using the SF approach and alternative estimation methods.

3.3. Consideration of the determinants of inefficiency and distinction from heterogeneity

3.3.1 Methodological issues

To estimate the efficiency of production, we have on the one hand parametric methods such as SFs and Aigner and Chu’s (1968) method, and non-parametric methods such as DEA and Free Disposal Hull methods.

The SFs were developed by two papers published simultaneously: Meeusen and Van Den Broeck (1977) and Aigner et al. (1977). We can examine the determinants of the level of inefficiency.

In the literature, two-step estimation methods are used to determine the level of inefficiency and explain this level by considering exogenous variables. As we have seen in the previous section, many studies dealing with MFIs have estimated inefficiency using the DEA method and then regressed the level of technical inefficiency on exogenous variables used as proxies for the determinants of inefficiency. In the context of SF methods, an equivalent strategy has been proposed by Pitt and Lee (1981), but the estimation of the determinants of inefficiency in two steps may cause a problem because we must assume in the first step, when choosing the distribution hypothesis, that the inefficiency and the random term are homoscedastic by assuming that the variance of the inefficiency and the random term are constant. However, if we have variables that explain the difference in inefficiency between firms, we can not assume that inefficiency is homoscedastic, because ignoring this information in the first step will lead

to biased and non-convergent parameter estimates. Wang and Schmidt (2002) show that the two-step estimation of inefficiency and inefficiency determinants causes an omitted variable bias if the production technology is correlated with the variables capturing the determinants of inefficiency. This omitted variable bias problem affects the estimation of the level of inefficiency and the link between the determinants and inefficiency, even in the absence of a correlation between the technology variables and inefficiency determinants.

Therefore, one-step estimation methods were developed to avoid omitted variable bias and inconsistent parameter estimates. There are three strategies for considering the determinants of inefficiency in a one-step estimation. The first strategy is to account for the determinants of inefficiency using the inefficiency distribution assumption. Instead of assuming that the mean of inefficiency is constant and identical for all firms, Kumbhakar et al. (1991), Huang and Liu (1994), and Battese and Coelli (1995) propose to relax this assumption of constant mean of inefficiency by proposing different algebraic forms for the parameterization of the mean of inefficiency assumption. This strategy is called 'KGMHLBC' in the literature on SF estimation because of the authors' initials. The authors' strategy is to consider exogenous variables that capture the determinants of inefficiency and assume a firm-specific mean.

The second strategy considers the determinants of inefficiency based on the variance of the inefficiency distribution assumption. This method was developed by Caudill and Ford (1993), Caudill et al. (1995), and Hadri (1999) and is called 'CFCFGH'. This method relaxes the assumption of homoscedasticity by having a different variance for each firm depending on the determinants of inefficiency.

The third strategy developed by Wang and Schmidt (2002) combines the 'KGMHLBC' approach with the 'CFCFGH' approach to take the determinants of inefficiency, both in the mean and in the variance of the distributional assumption about inefficiency. The rationale for Wang and Schmidt's (2002) approach is that there is no reason to assume that the determinants will impact the mean but not the variance, or that the determinants will impact the variance but not the mean of inefficiency. To parameterise the mean and variance, Wang and Schmidt (2002) suggest using the same determinant. One of the advantages of this approach is that it relaxes the assumption of monotonicity between the determinants and the level of inefficiency whereas the 'KGMHLBC' and 'CFCFGH' approaches did not allow for a non-monotonic

relationship between inefficiency and the determinants unless the variables were squared or an interaction between the variables was taken.

In the next section, we describe the data used, which are panel data observations. Working with panel data will have consequences for distinguishing between inefficiency and heterogeneity. Greene (2005a,b) is the first to address the distinction between inefficiency and heterogeneity in his studies, estimating the efficiency of healthcare systems in 194 countries over a five-year period. As these countries differ widely in terms of their economic and cultural characteristics, Greene (2004) focus on country heterogeneity, particularly the distinction between the economic and cultural characteristics of different countries and the efficiency of their healthcare systems. Greene (2004, 2005a,b) develop a true random effects model by decomposing the error term into three random terms: a random term for firm-specific and time-varying technical inefficiency, a random term for firm-specific and time-varying shock, and finally a random term for firm-specific but time-invariant heterogeneity. To estimate this true random effects model, Greene proposes the use of a distribution assumption for each random effect and use the maximum likelihood method. Colombi et al. (2014) use the model developed by Greene by adding a specific random effect for time-invariant technical inefficiency to distinguish between permanent and transient technical inefficiency. They propose using the maximum likelihood, where the sum of the four random effects has a closed-skewed normal (CSN) distribution. This result was demonstrated by Arellano-Valle and Azzalini (2006), and Gonzalez-Farias et al. (2004).

Greene also develop the true fixed-effects model by decomposing the error term into two random terms: a random term for firm-specific and time-varying technical inefficiency and a random term for firm-specific random shocks. Unlike the true random-effects model, this model considers time-invariant heterogeneity in the form of a firm-specific fixed effect. This method is relatively simple because it is enough to add as many dichotomous variables as there are firms in the panel. This model could be subject to an incidental parameter problem if we have a few years of observations and many firms. Greene (2005b) shows that the incidental parameter problem does not cause a significant bias in the estimated parameters when the number of years of observation is high.

To estimate the inefficiency of MFIs, we use the model of Wang and Ho (2010) which allows to consider the determinants of inefficiency in panel data and to distinguish the heterogeneity of

inefficiency, an important element as demonstrated by Greene and which was not considered by the models 'KGMHLBC' and 'CFCFGH'. The estimated model is as follows:

$$y_{it} = \alpha_i + x_{it}\beta + \varepsilon_{it}, \quad (1)$$

$$\varepsilon_{it} = v_{it} - u_{it}, \quad (2)$$

$$v_{it} \sim N(0, \sigma_v^2), \quad (3)$$

$$u_{it} = h_{it} * u_i^*, \quad (4)$$

$$h_{it} = f(Z_{it}\delta), \quad (5)$$

$$u_i^* \sim N(\mu, \sigma_u^2), \text{ where } i = 1, 2, \dots, N \text{ and } t = 1, 2, \dots, T. \quad (6)$$

For the sake of clarity, Wang and Ho's (2010) method is presented for the case of balanced panels, but it is valid for unbalanced panels¹⁴. This model is based on Wang and Schmidt's (2002) model which assumes that the shape of the inefficiency distribution is the same for all firms in the panel by not including the determinants of inefficiency in the mean and variance of the distribution assumption but uses an inefficiency-multiplying function using the variables used as proxies for the determinants.

This function, called the scaling function, allows the horizontal axis to be stretched or shrunk, but the shape of the inefficiency distribution is the same for all firms; that is, a half-normal distribution or a truncated normal distribution with the same parameter values for the mean and variance. This argument is one of the main advantages of Wang and Schmidt's (2002) model. The second argument is that the parameters of the determinants of inefficiency are semi-elastic, and the interpretation in terms of semi-elasticity is retained regardless of the distributional assumption of inefficiency. To eliminate the potential problem of incidental parameters due to the estimation of firm fixed effects α_i Wang and Ho (2010) propose using a first difference or a within-transformation to eliminate the fixed effects.

Here, we present a model that eliminates fixed effects via within-transformation. These equations are obtained from Wang and Ho (2010). Through a within-transformation, the sample mean of each panel is subtracted from every observation in the panel. Thus, the

¹⁴ Wang and Ho (2010), Estimating fixed-effect panel stochastic frontier models by model transformation, page 290, section 2.3.1.

transformation removes the time-invariant individual effect (α_i) from the model. The following notation is useful for understanding the model: $\omega_i = (1/T) \sum_{t=1}^T \omega_{it}$, $\omega_{it} = \omega_{it} - \omega_i$, and stacked vector of ω_{it} for a given i is $\tilde{\omega}_i = (\omega_{i1}, \omega_{i2}, \dots, \omega_{iT})'$. The model after transformation is:

$$\tilde{y}_i = \tilde{x}_i \beta + \tilde{\varepsilon}_i, \quad (7)$$

$$\tilde{\varepsilon}_i = \tilde{v}_i - \tilde{u}_i, \quad (8)$$

$$\tilde{v}_i \sim MN(0, \Pi), \quad (9)$$

$$\tilde{u}_i = \tilde{h}_i u_i^*, \quad (10)$$

$$u_i^* \sim N^+(\mu, \sigma_u^2), \quad i = 1, 2, \dots, N. \quad (11)$$

The variance-covariance matrix of \tilde{v}_i is

$$\Pi = \begin{bmatrix} \sigma_v^2(1 - 1/T) & \sigma_v^2(-1/T) & \dots & \sigma_v^2(-1/T) \\ \sigma_v^2(-1/T) & \sigma_v^2(1 - 1/T) & \dots & \sigma_v^2(-1/T) \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_v^2(-1/T) & \sigma_v^2(-1/T) & \dots & \sigma_v^2(1 - 1/T) \end{bmatrix}, \quad (12)$$

$$= \sigma_v^2 \left[I_T - \frac{\iota \iota'}{T} \right], \quad (13)$$

$$= \sigma_v^2 M, \quad (14)$$

where ι is a $T \times 1$ vector of 1's and $u_{it} = u_{it} - u_i = h_{it} u_i^* \left(\frac{1}{T} \sum_{i=1}^T h_{it} \right) = (h_{it} - h_i) u_i^* = h_{it} u_i^*$.

The authors show that the first and within transformations are mathematically equivalent. This transformation was used for the estimates in this study.

3.3.2 Estimation method

To our knowledge, Wang and Ho's (2010) methodology, which distinguishes heterogeneity from inefficiency, has not yet been used in the analysis of the inefficiency. We characterise production technology using a translog cost function. The translog functional form allows for great flexibility and is the best for estimating a cost function (Assefa et al., 2013; Farvaque et al., 2012; Gagne and Ouellette, 1998; Hermes et al., 2011, 2018; Karimu et al., 2021). We decompose operating expenses into three variable inputs: administrative, financial, and depreciation expenses, taking care to impose homogeneity of degree one by dividing the total

cost and input prices by the price of depreciation and amortisation. Our analysis focuses on MFIs in West and Central African countries.

The total translog cost function that we estimate is the following:

$$\begin{aligned}
\ln\left(\frac{TC_{it}}{DEP_{it}}\right) = & \beta_1 \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right) + \beta_2 \ln\left(\frac{ADM_{it}}{DEP_{it}}\right) + \beta_3 \ln\left(\frac{FIN_{it}}{DEP_{it}}\right) + \beta_4 \ln(GLP_{it}) \\
& + 0.5\beta_5 \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right)^2 + 0.5\beta_6 \ln\left(\frac{ADM_{it}}{DEP_{it}}\right)^2 + 0.5\beta_7 \left(\frac{FIN_{it}}{DEP_{it}}\right)^2 + 0.5\beta_8 \ln(GLP_{it})^2 \\
& + \beta_9 \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right) \ln\left(\frac{ADM_{it}}{DEP_{it}}\right) + \beta_{10} \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right) \ln\left(\frac{FIN_{it}}{DEP_{it}}\right) \\
& + \beta_{11} \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right) \ln(GLP_{it}) + \beta_{12} \ln\left(\frac{PERSO_{it}}{DEP_{it}}\right) Trend \\
& + \beta_{13} \ln\left(\frac{ADM_{it}}{DEP_{it}}\right) \ln\left(\frac{FIN_{it}}{DEP_{it}}\right) + \beta_{14} \ln\left(\frac{ADM_{it}}{DEP_{it}}\right) \ln(GLP_{it}) + \beta_{15} \ln\left(\frac{ADM_{it}}{DEP_{it}}\right) Trend \\
& + \beta_{16} \ln\left(\frac{FIN_{it}}{DEP_{it}}\right) \ln(GLP_{it}) + \beta_{17} \ln\left(\frac{FIN_{it}}{DEP_{it}}\right) Trend + \beta_{18} \ln(GLP_{it}) Trend \\
& + \beta_{19} Trend + 0.5\beta_{20} Trend^2 + v_{it} + u_{it}
\end{aligned} \tag{15}$$

where TC_{it} represents the total cost of an MFI i in year t , $PERSO_{it}$ represents the price of labour calculated as total expense on personnel per number of employees of the MFI; ADM_{it} represents the price of administration calculated as total expense on administration per number of employees of the MFI; FIN_{it} represents the price of interest expense calculated as total interest expense per dollar of deposit; DEP_{it} represents the price of capital depreciation and amortisation calculated as total depreciation and amortisation expense over the MFI's total fixed assets. Finally, GLP_{it} represents the MFI's gross loan portfolio.

Several control variables were added to the estimations to control for the overall macroeconomic conditions and differences in development across countries. The interaction between country-level macroeconomic variables and microfinance indicators has been documented by Al-Azzam and Parmeter (2021), Bangoura (2016), Gregoire and Tuya (2006), Hermes et al. (2009, 2011, 2018), D'Espallier (2013a), Masood and Ahmad (2012), and Mimouni et al. (2022).

We include gross domestic product (GDP), consumer price index (Inflation) and Human Development Index (HDI). Real GDP growth, which controls for overall developmental and technological progress, is used as an indicator of economic growth. High economic growth may increase micro-enterprise returns and demand for microcredit, allowing MFIs to increase

interest rates. High growth may also raise household incomes and reduce demand for microcredit and interest rates. Inflation is used as an indicator of overall living standards. Higher inflation rates lead to a higher dispersion of prices, resulting from the cost of time and activities needed to search for the lowest prices (Benabou, 1992). In addition, higher inflation rates can lead to an increase in bad debt and its associated management which increases MFIs' costs. We also use the HDI to assess the level of development of countries based strictly on economic data, but on the quality of life of their citizens. We estimate GDP and HDI individually because of collinearity.

In addition to Table 1, which summarises a number of studies on the determinants of MFIs and clearly shows that there is no consensus on the relationship between different determinants and MFI inefficiency, Hermes and Hudon (2018) survey the determinants of MFI performance. They cross-reference 170 studies and find that the most relevant determinants are size, age, and macroeconomic conditions. We then specify our model as follows:

$$z_{it} = \delta_1 Women_{it} + \delta_2 HHI_{it} + \delta_3 Age_{it} + \delta_4 Equity_{it} + \delta_5 ALB_{it} + \delta_6 ASB_{it} + \delta_7 LLR_{it}. \quad (16)$$

where z_{it} represents the vector of inefficiency determinants of firm i in period t .

$Women_{it}$ represents the percentage of female borrowers out of all borrowers in the total portfolio of each MFI for each year. A high value for this variable could indicate the extent and specification of the MFI in lending to women (usually associated with poor borrowers). A positive sign of this coefficient indicates that MFIs that specialise in lending to women are less efficient. This variable has been used, for example, by Alinsunurin (2014), Hermes et al. (2011, 2018), and Mimouni et al. (2022), among others, to incorporate the social outreach of the MFI.

HHI_{it} represents the HHI, which measures the concentration of the local market at a given time. The HHI is calculated by squaring the market share of the gross loan portfolio of each MFI competing in a country each year and then adding across these squared shares. A larger HHI value conveys a greater concentration. A value close to zero indicates a purely competitive microfinance industry and a value of one indicates a purely monopolistic industry. A negative sign of this variable indicates that the less competition there is, the more efficient the MFIs are. An increase in the number of banks leads to a decrease in each bank's profit and a low optimal level of efficiency to compensate for the loss of profit due to competition (Weill, 1998). This

variable has also been used by Al-Azzam and Parmeter (2021), Demsetz (1973), Gregoire and Tuya (2006), and Nurboja and Košak (2017).

Age_{it} is a measure of the age of a microfinance institution. It is the natural logarithm of the number of years the institution has existed since its inception. It captures the number of years of experience of the MFI since its creation and the behaviour of the firm over time. In general, there are two different approaches to hypothesising the effects of firm age on efficiency: the ecological approach based on Hannan and Freeman (1984), and the evolutionary approach based on Jovanovic (1982). The addition of this variable makes it possible to test the hypothesis that older and more experienced MFIs are more efficient. The alternative hypothesis could be that older institutions have had to learn to cope with microfinance practices through trial and error, while more recently established institutions can benefit from the knowledge of microfinance practices accumulated over the past decades. The new MFIs can then outperform older institutions in terms of efficiency. The truth of the first hypothesis implies a negative and significant coefficient for the variable Age , whereas for the alternative hypothesis, the coefficient will be positive. This variable was used by Fall (2018), Hermes and Hudon (2018), Hermes et al. (2011, 2018), Mimouni et al. (2022), Narwal and Yadav (2014), Oteng-Abayie (2011), Quayes et al. (2013), Rai (2015), and Wijesiri and Meoli (2015).

$Equity_{it}$ represents the ratio of equity to total assets. It measures the strength and risk-taking differences of an MFI. This variable has been used by Berger and Mester (1997), Dietsch and Lozano-Vivas (2000), Grigorian and Manole (2006), Hermes et al. (2011, 2018), and Lozano-Vivas et al. (2001).

ALB_{it} represents the logarithm of the average loan portfolio per borrower. Like the $Woman$ variable, it measures social outreach, so a high value of this variable could indicate a lower outreach correlated with the exclusion of the poor from the MFI's target segment. This variable has been used by Fall (2018), Hermes et al. (2011, 2018), Quayes et al. (2013), and Schreiner (2002).

ASB_{it} represents the average savings balance per saver. It is the ratio of total deposits by the number of savers, and indicates the social outreach of the MFI. A high (lower) value for this variable would indicate the rich (poor) nature of the MFI's clients. This variable was used by Oteng-Abayie (2011).

LLR_{it} represents the loan loss provision divided by the gross loan portfolio. It considers differences in the risk-taking strategies among MFIs. This variable has been used by Fries and Taci (2005), Lensink et al. (2008), and Hermes et al. (2011, 2018).

3.4. Data

We use unbalanced panel data with a sample of 102 MFIs located in Central Africa and West Africa over a 16-year period from 2003 to 2018. The data used come from the Mix Market database, a World Bank database on microfinance worldwide, operated by the Microfinance Information Exchange (MIX) and covering thousands of financial service providers. There were 530 observations during this period.

The use of the Mix Market database is growing in the microfinance literature (Al-Azzam and Pameter, 2021; Fall, 2018; Fall et al., 2021; Hermes et al., 2018; Karimu et al., 2021; Mimouni et al., 2021). MIX is an online microfinance platform that discloses information on more than 2,500 MFIs worldwide. It also provides financial transparency for MFIs, thus addressing the main problem of MFIs related to the lack of reliable, comparable, and publicly available information. However, the MIX database has several limitations. The first is sample selection bias, which we did not control for in this study. The MIX is a self-reported database, and MFIs voluntarily disclose information. The second factor is the reliability of the data. MIX data are of uneven quality; MIX ranks MFIs according to their level of transparency and reliability. The third is the size of the base relative to reality. In reality, the MFI sector comprises hundreds of thousands of institutions worldwide, the vast majority of which do not report financial data to MIX. Sometimes, this is simply because many MFIs are very small and have unreliable information systems.

In our sample, we retained only the MFIs that collected deposits for two reasons. The first reason is that the construction of some variables is based on deposits, and the second reason is that it is difficult to distinguish between the data of MFIs that do not collect deposits, those that collect but did not fill in the value, or those that fill in the value zero either to say that they do not collect or that did not collect at that moment. We also retained the MFIs whose data were complete for all the variables and deleted all the MFIs with aberrant data.

Table 3 presents the number of observations per year, and Table 4 presents the number of MFIs in relation to the number of years for which the MFI was observed. The vast majority of 530 observations are concentrated between 2006 and 2017.

Table 5 shows the distribution of the MFIs by country. We have retained only those observations for which, in a given country in a given year, the number of MFIs is greater than two; the objective is to eliminate from the sample MFIs that are not subject to competition.

Table 6 presents the descriptive statistics of the variables in the model (the technology, control, and inefficiency determinant variables), and Table 7 presents the definitions of all the variables used in this study. The definitions are taken from the Mix Market and the International Monetary Fund website.

Table 8 provides a correlation matrix for all the variables used. There is no significant correlation between the explanatory variables. There is a strong correlation between the logarithm of the gross loan portfolio and the logarithm of the total cost, because the more loans an MFI grants, the more its total cost increases. The same level of correlation can be observed in Hermes et al. (2011, 2018).

3.5. Results and discussion

Table 9 shows the estimation results. The procedure used to generate these results is as follows. As mentioned before, Wang and Ho's (2010) method that we used simultaneously estimates the production technology and the determinants of inefficiency. With respect to the cost function, we perform estimations using the specification of Equation (16) without control variables. Our baseline estimate is shown in column (5), in which we include only the technology variables and the set of inefficiency determinants.

The coefficient for *Women* is positive and significant at the 1 percent level across all specifications, which means that MFIs in West and Central African countries that specialise in lending to women are less efficient or more cost-inefficient than MFIs that serve the general population.

Although much of the literature focuses on the positive impact of female borrowers on MFI efficiency, the impact of targeting women on cost inefficiency remains empirically ambiguous. The focus on female borrowers in microfinance programs has been inspired by the belief that

women are more likely to repay, and the growing influence of donor agencies (Weber, 2006). However, specialising in lending to women may be more cost-inefficient because women have less access to formal credit markets and receive smaller microloans (D'Espallier et al., 2011, 2013; Basharat et al., 2015). In this sample of West and Central African countries, women are indeed associated with a lower average loan balance per borrower, with a correlation of -0.32. In developing countries, as is the case in West and Central African countries, women tend to be less mobile, less educated, and more likely to need additional training and other services. These borrowers require additional and special follow-up. These results are consistent with those reported by D'Espallier et al. (2011, 2013) and Mimouni et al. (2022). These factors, together with the fact that women borrow smaller amounts, reinforce the inefficiency of costs. Therefore, MFIs that specialise in lending to women should continue to lend to women but should diversify to improve their efficiency (D'Espallier et al., 2011, 2013; Hermes et al., 2011, 2018; Riaz, 2015).

The results of the estimation of equation (16) show that specialisation in lending to women increases the inefficiency of MFIs in the WAEMU and CEMAC countries. We examine these results by creating four dummy variables according to the percentage of female borrowers. The first quartile represents MFIs that are least specialised in lending to women. The dummy variable (Quartile 1. Women) takes the value of 1 when the MFI is in the 25 percent of MFIs with the lowest percentage of women borrowers. Conversely, the fourth quartile represents the MFIs that are most specialised in lending to women and takes the value of 1 when the MFI is among the 25 percent of MFIs with the highest rate of women borrowers. The fourth quartile is used as the reference. Thus, our model can be represented as follows:

$$z_{it} = \gamma Women_{it}^{Quartiles} + \delta_1 HHI_{it} + \delta_2 Age_{it} + \theta X_{it}. \quad (17)$$

where $Women_{it}^{Quartiles}$ represents the vector of the quartiles of the percentage of female borrowers of firm i in period t , γ is the parameter of different quartiles to estimate, and X_{it} the MFI-specific variables (*Equity*, *ALB*, *ASB*, *LLR*). This specification allows us to determine whether the percentage of female borrowers has an impact on the inefficiency of MFIs.

For example, if we find that γ is negative with the coefficients of the first quartile higher than the second quartile and the coefficients of the first and second quartiles higher than the third quartile, then as the MFI specialises in lending to women, it is less efficient. These estimates are

presented in Table 11 from columns (2) to (4). The reference quartile (fourth quartile) represents MFIs with the highest percentage of female borrowers. More precisely, the results indicate significance at the 5 percent level for the first and second quartiles, with coefficients of -0.071 and -0.063, respectively. The third quartile is non-significant; nevertheless, it has a negative coefficient and is lower than the first and second quartiles (-0.028), confirming that the more female borrowers there are, the less effective MFIs are.

The coefficient of the variable *HHI* is significant and negative at the 1 percent level across all specifications, meaning that the less competition there is in the MFI sector at the local level, the more efficient they are. Our results agree with those found by Assefa et al. (2013), Gregoire and Tuya (2006), Rai (2015), and Wijesiri and Meoli (2015), but are contrary to Ayayi and Sene (2010), Cull et al. (2007), Dannon et al. (2019), Narwal and Yadav (2014), Wijesiri et al. (2015), and Wu et al. (2016).

This seemingly counterintuitive result can be explained by the fact that firms in a competitive situation seeking to expand their loan portfolios do not contain their costs (Nurboja and Košak, 2017). Based on a theoretical model, Weill (1998) demonstrates that an increase in the number of banks leads to a reduction in their efficiency. Indeed, when the number of banks increases, the profit of each bank reduces for a given level of efficiency. Thus, to reach the minimum profit level, banks are forced to modify their production technology (without considering the competition which reacts in the same way). Following the modification of its technology, the increase in the efficiency of a bank implicitly causes a reduction in the profit of its competitors, which leads the latter to react to compensate for this loss of profit. Therefore, the increase in the efficiency of each bank leads to a reduction in profit and vice versa. Consequently, as new banks enter the sector, each bank is forced to reduce its efficiency to compensate for the loss of profit due to this new competition. Previous studies, such as Demsetz (1973) and Fecher and Pestieau (1993), also show a negative correlation between the efficiency of financial institutions and the level of competition.

Another finding of the estimation of equation (16) is that competition increases the inefficiency of MFIs in the WAEMU and CEMAC countries. In the same way as for the specialisation of MFIs in lending to women, we checked the result on the level of competition by creating four dummy variables according to the value of the *HHI* and thus the level of competition. The first quartile represents MFIs that are most subject to strong competition. This dummy variable (Quartile 1

HHI) takes the value of 1 when the MFI is part of the 25 percent of MFIs that are in the most competitive markets. Conversely, the fourth quartile represents the MFIs that are the least competitive, and therefore, are in more concentrated markets. This fourth quartile (Quartile 4 HHI) takes the value 1 when the MFI is in the top 25 percent of MFIs with the highest HHI (indicating that competition is low and the market is highly concentrated). The fourth quartile is used as the reference.

$$z_{it} = \delta_1 Women_{it} + \gamma^* HHI_{it}^{Quartiles} + \delta_2 Age_{it} + \theta X_{it}. \quad (18)$$

where $HHI_{it}^{Quartiles}$ represents the vector of the quartiles of the degree of competition of firm i in period t , γ^* the parameters of different quartiles to estimate, and X_{it} the MFI-specific variables (*Equity*, *ALB*, *ASB*, *LLR*). This specification allows us to determine whether the percentage of HHI has an impact on the inefficiency of MFIs.

For example, if we find that γ^* is positive with the coefficients of the first quartile higher than the second quartile and the coefficients of the first and second quartiles higher than the third quartile, then competition worsens the efficiency of MFIs. These estimates are presented in Table 12 from columns (2) to (4). The reference quartile (fourth quartile) represents the highest concentration market, where there is less competition or few MFIs. More precisely, the results indicate significance at the 1 percent level for all specifications: 0.071, 0.064 and 0.044, respectively. Once again, as we expected, the more female borrowers there are, the less effective the MFIs are.

The variable *Age* is significant, with a positive coefficient at the 1 percent level in all specifications, meaning that the youngest MFIs in West and Central African countries are more efficient. Our results are consistent with the findings of Fall (2018), Hermes et al. (2011, 2018), Kumar and Sensarma (2017), Nghiem et al. (2006), Narwal and Yadav (2014), Oteng-Abayie (2011), Rai (2015), Singh et al. (2013), Tewari (2016), Wijesiri and Meolli (2015), and Zamoure et al. (2021). The younger MFIs in our sample would benefit from the knowledge of microfinance practices that have been accumulated in the past. They benefit from existing information and knowledge to cope better with shocks and manage to improve the efficiency of their activities. However, as mentioned by Hermes and Hudon (2018), young organisations have the advantage of backwardness, and they may more easily adopt new management information systems and develop mobile banking platforms. They may benefit from recent technologies or innovations

when starting their operations. The more mature the institution, the more it is stuck in older and less efficient processes that make it comparatively less efficient. Therefore, according to Rai (2015), young MFIs grow faster and hold higher-quality assets.

On the other hand, Lundvall and Battese (2000) highlight aging liability. It was explained that older firms tend to employ capital of earlier vintage, which is less productive than the industry average and reduces their efficiency.

The variable *ALB* is not significant in explaining the inefficiency of MFIs in West and Central African countries.

The coefficient of the variable *ASB* is weakly significant, and it seems that the more savers there are in the portfolio of West and Central African country MFIs, the more efficient they are. Therefore, these MFIs must be mobilised in the collection of savings. Similar results are obtained by Oteng-Abayie (2011).

In addition to the decomposition of the HHI and female borrowers, additional tests were performed, as shown in Table 10. In Table 10, after adding control variables such as GDP, inflation, and HDI, the results remain robust to these modifications.

3.6. Conclusion chapter 3

This study aimed to analyse the determinants of MFI inefficiency in the WAEMU and CEMAC countries using the methodology developed by Wang and Ho (2010) to consider the heterogeneity of each institution. This estimation method makes it possible to distinguish between the time-invariant and time-varying inefficiencies for each institution. Considering heterogeneity is necessary to correctly estimate production technology and the determinants of inefficiency.

Using a sample of 102 MFIs with 530 observations, we estimated production technology using a translog total cost function. Applying Wang and Ho's (2010) method, we find that the true determinants of inefficiency in West and Central African countries are the percentage of female borrowers, HHI, and age of MFI. The older the MFI, the less efficient it is, and MFIs that specialise in lending to women are also less efficient.

Another variable that explains the inefficiency of MFIs in West and Central African countries is the competition indicator which is also significant. This shows the importance of local market

concentration of MFIs as a determinant of their performance. Although this result is normatively opposed to policies of deregulation of the banking sector in most countries in order to increase competition in the banking sector, our conclusion on the MFI sector in West and Central African countries refute the argument of policymakers that high competition would increase the competitiveness of banks.

The results remained robust and significant after the addition of control variables. To improve the efficiency of MFIs in West and Central African countries, we suggest several ways forward. The first is the improvement and control of regulation; the oldest MFIs need to be better supervised, and follow-up liberalisation remains indispensable in the sector. Second, MFIs diversify their portfolios without specialising in particular client segments, particularly women.

3.7. Appendix chapter 3

Table 3. 1. Survey on stochastic frontier literature on microfinance

N°	Authors	Data	Sample Period	Number of Observations	Estimate Methodology	Estimate Function	Countries/ Regions
1	Desrochers and Lamberte (2005)	Panel	1995-1999	50	Coelli (1996)	Production	Philippines
2	Gregoire and Tuya (2006)	Panel	1999-2003	1,864	Battese et Coelli (1995)	Cost	Peru
3	Paxton (2007)	Cross-section	2001	190	Wang (2002)	Production	Mexico
5	Hermes et al. (2011)	Panel	1997-2007	435	Battese et Coelli (1995)	Cost	World
6	Oteng-Abayie (2011)	Panel	2007-2010	135	Battese et Coelli (1995)	Cost	Ghana
7	Masood and Ahmad (2012)	Panel	2005-2008	40	Battese et Coelli (1995)	Production	India
8	Servin et al. (2012)	Panel	2003-2009	1,681	Servin et al. (2012) *	Production	Latin America
9	Quayes et al. (2013)	Cross-section	2004	45	Battese et Coelli (1995)	Cost	Bangladesh
10	Bos and Millone (2015)	Panel	2003-2010	3,880	Battese et Coelli (1988)	Cost	World
11	Riaz (2015)	Panel	2007-2013	148	Battese et Coelli (1995)	Cost	Pakistan
12	Abdulai and Tewari (2016)	Panel	2003-2013	619	Battese et Coelli (1995)	Cost	Africa
13	Mor (2016)	Cross-section	2014	78	Coelli et Battese (1996)	Production	India
14	Bensalem and Ellouze (2017)	Panel	2007-2013	723	Battese et Coelli (1995)	Production	World
15	Kumar et Sensarma (2017)	Panel	2004-2011		Coelli (1996)	Cost	India
16	Kendo (2017)	Panel	2004-2011	1,205	Kendo (2017) *	Cost	Africa
17	Pal and Mitra (2017)	Panel	2006-2013	6,162	Battese et Coelli (1995)	Production	World
18	Hermes et al. (2018)	Panel	2008-2009	977	Battese et Coelli (1995)	Cost	World
19	Mimouni et al. (2022)	Panel	2003-2018	4,294	Battese et Coelli (1995)	Cost	World

Note: *In these articles, a methodology was developed by the authors.

Source: Authors

Table 3. 2. Characteristics of the literature on determinants of microfinance inefficiency and excepted sign.

N°	Authors	Data	Sample Period	Countries / Regions	Determinants of Inefficiency														
					HHI	H-Stat	CON	LER	BOO	WOM	AGE	SIZ	EQU	ALB	ASB	GDP	HDI	INF	
Stochastic frontier approach (SFA)																			
1	Desrochers and Lamberte (2005)	Panel	1995-1999	Philippines	*							-	+	*					
2	Gregoire and Tuya (2006)	Panel	1999-2003	Peru	+										+	+			
3	Paxton (2007)	Cross-section	2001	Mexico															
4	Hermes et al. (2011)	Panel	1997-2007	World						+	+								
5	Oteng-Abayie (2011)	Panel	2007-2010	Ghana						+	+				+	-			
6	Masood and Ahmad (2012)	Panel	2005-2008	India								-	*	*					
7	Quayes et al. (2013)	Cross-section	2004	Bangladesh								*	- (1)						
8	Bos and Millone (2015)	Panel	2003-2010	World											*				
9	Riaz (2015)	Panel	2007-2013	Pakistan						+	-				+	-			
10	Abdulai and Tewari (2016)	Panel	2003-2013	Africa								-	*						
11	Mor et al. (2016)	Cross-section	2014	India											*				
12	Bensalem and Ellouze (2017)	Panel	2007-2013	World								-	*	+	-	*			
13	Kumar and Sensarma (2017)	Panel	2004-2011	India								-	*	+					
14	Kendo (2017)	Panel	2004-2011	Africa											-	*			
15	Pal and Mitra (2017)	Panel	2006-2013	World												-	+		
16	Hermes et al. (2018)	Panel	2008-2009	World								+	+			-	*		
17	Mimouni et al. (2022)	Panel	2003-2018	World												-	+	+	
Alternative methods																			
1	Cull et al. (2007)	Panel	1999-2002	World															
2	Caudill et al., 2009	Panel	2003-2004	E. Europe & C. Asia															
3	Ayayi and Sene (2010)	Panel	1998-2006	World								+							
4	Narwal and Yadav (2014)	Panel	2005-2011	India									+						
5	Gohar and Batool (2015)	Panel	2005-2009	Pakistan									+	-	*	+	-	*	
6	Wijesiri et al. (2015)	Cross-section	2010	Sri Lanka									+				+	*	
7	Wijesiri and Meoli (2016)	Panel	2009-2012	Kenya									+						
8	D'Espallier et al. (2017a)	Panel	1993-2011	World														-	*
9	Fall (2018)	Cross-section	2009	Uemoa															
10	Dannon et al. (2019)	Panel	2010-2014	Uemoa															

Note: HHI=Herfindahl-Hirschman Index, H-Stat=Panzar and Rosse (1977) Statistic, CON=Concentration of k-biggest banks, LER=Lerner index, BOO=Boone indicator, WOM=Percentage of female borrowers, AGE=Age of MFI, SIZ=Size of MFI, EQU=Equity or capital ratio, ALB=Average loan balance, ASB=Average savers balance. (-) means negative relation between the determinant and inefficiency of MFI, that is, a decrease in inefficiency as the value of the variable increases. (+) means positive relationship between the determinant and inefficiency of MFI, that is, an increase in inefficiency as the value of the variable increases. (*) means that variable is used but not significant at least at 10 percent level.

Source: Authors

Table 3. 3. Number of observations per year

Years	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Number of observations	4*	8	13	25	35	42	47	48	59	50	45	43	38	33	25	15	530

Note: *Read, for example, in 2003, just 4 MFIs in our sample are observed, 8 MFIs in 2004 and 15 MFIs in 2018. The sample covers 2003 to 2018.

Source: Authors' computation based on Mix Market.

Table 3. 4. Number of observations by MFIs

Number of observations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Number of MFIs	24	8	10	7	14	5	5	5	8	8	2	0	3*	1	2	0	530

Note: *Read, for example, three MFIs are observed for 13 years. Then, no MFI are observed successively for 12 years or 16 years. The sample covers 2003 to 2018.

Source: Authors' computation based on Mix Market.

Table 3. 5. Number of IMFIs by country

Countries	Benin	Burkina Faso	Cameroon	Ivory Coast	Mali	Niger	Senegal	Togo	Total
Number of IMFIs	15	15	13	17	12	10	11	9	102
Number of observations	120	70	70	44	52	40	82	52	530

Note: The sample covers 2003 to 2018. We have the most observations in Benin and Senegal for the 15 MFIs observed.

The observations are broadly similar for the other countries in our sample. Unfortunately, we kept only Cameroon as country in the CEMAC area due of missing data and outliers.

Source: Authors' computation based on Mix Market.

Table 3. 6. Summary statistics

Variables	Units	Mean	Sd. Dev.	Min.	Max.
Total cost	Dollar	4774521	7789559	18923	8.09e+07
Personnel expense	Dollar	1609949	2228398	5098	1.16e+07
Administration expense	Dollar	1721466	2806477	6227	2.37e+07
Depreciation and amortization expense	Dollar	480637.1	939266.3	454	7053714
Financial expense	Dollar	962469.3	2741985	4	4.74e+07
Gross loan portfolio	Dollar	2.39e+07	3.83e+07	2171	2.35e+08
Number of personnel	Number	239.9671	320.2496	3	2009
Fixed assets	Dollar	2827139	5690187	5219	6.54e+07
Total deposits	Dollar	2.36e+07	4.80e+07	30262	2.82e+08
Trend	1 à 16	9.267925	3.521995	1	16
Human Development Index (HDI)	Index	.4602358	.0557562	.314	.557
Gross domestic product per capita (GDP)	Index	978.6969	315.3348	465.0038	1600.765
Consumer price index, Inflation	Index	2.194425	2.491432	-2.248021	11.30511
Personnel price	Index	5888.935	3205.85	1049.713	18147
Administration price	Index	6293.9	3744.365	1043.968	31891.59
Financial price	Index	.0668801	.0946967	7.90e-06	1.406891
Depreciation and amortization price	Index	.3128816	.4928535	.0096581	5.923357
Age	Index	2.417401	.6922115	0	3.912023
Herfindahl-Hirschman index (HHI)	Index	.4539107	.1958038	.2198687	.9768976
Percentage of female borrowers (Women)	Percentage	53.40635	25.67197	.11	100
Financial independence ratio (Equity)	Index	.2243348	.3086748	-4.077847	.9734545
Average loan balance (ALB)	Index	6.379672	1.024557	3.375591	8.957542
Average savers balance (ASB)	Index	4.904111	1.094078	.9746972	7.730952
Loan Loss Rate (LLR)	Index	1.105158	3.78544	-22.31	43.12

Note: Averages are shown over the period 2003-18. Dollar, index or percentages are used where appropriate.

Sources: Mix Market; WDI. Authors' calculations.

Table 3. 7. Definition of variables

Variables	Definition
Total cost	The sum of the costs of labour input, the costs of fixed capital, and the remuneration of deposits calculated. Total cost of the MFI.
Personnel expense	Includes wages and salaries, other short-term employee benefits as bonuses and compensated absences, post-employment benefit expense, termination benefit expense, share-based payment transactions, other long-term benefits, and other employee benefits.
Administrative expense	Non-financial expenses excluding personnel directly related to the provision of financial services or other services that form an integral part of a financial institution's financial services relationship with clients.
Depreciation and amortization expense	Systemic allocation of an asset (tangible or intangible) according to its useful life.
Financial expense	Includes all financial income and other operating revenue generated from non-financial services. Operating income also includes net gains (losses) from holding financial assets (changes on their values during the period and foreign exchange differences). Donations or any revenue not related with a financial institution's core business of making loans and providing financial services are not considered under this category.
Gross loan portfolio	All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off.
Number of personnel	The number of individuals actively employed by an entity. This number includes contract employees or advisors who dedicate a substantial portion of their time to the entity, even if they are not on the entity's employees' roster.
Fixed assets	Tangible assets held by an enterprise for use in the production or supply of goods or services or for administrative purposes, and are expected to be used during more than one period, net of accumulated depreciation.
Total deposits	The total value of funds placed in an account with a financial institution that are payable to a depositor. This includes accounts such as current / transactional accounts, term accounts, interest bearing accounts, and e-money accounts.
Trend	A dummy variable which runs from 1 to 16 to account for technology changes over time.
Human Development Index (HDI)	A statistic composite index of life expectancy, education, and per capita income indicators, which is used to rank countries into four tiers of human development.
Gross domestic product (GDP)	All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off.
Inflation, consumer price index	The index number that measures changes in the prices of goods and services purchased or otherwise acquired by households, which households use directly, or indirectly, to satisfy their own needs and wants.
Personnel price	Relative price of personnel expense.
Administrative price	Relative price of administrative expense.
Financial price	Relative price of financial expense.
Depreciation and amortization price	Relative price of depreciation and amortization expense.
Age	The age of the MFI, that is, the number of years since its establishment.
Herfindahl-Hirschman Index (HHI)	An index measuring market concentration, measuring the number of firms producing a good. It is calculated as the sum of the MFI's market shares squared.
Percentage of female borrowers (Women)	The number of individuals who currently have an outstanding loan balance with the financial institution or are primarily responsible for repaying any portion of the gross loan portfolio. Individuals who have multiple loans with a financial institution should be counted as a single female borrower. Number of active female borrowers / Number of active borrowers.
Financial independence ratio (Equity)	An indicator used to determine the level of dependence of a company on external financing.
Average loan balance (ALB)	Gross loan portfolio / Number of active borrowers.
Average savers balance (ASB)	Deposits / Number of depositors.
Loan Loss Rate (LLR)	(Write-offs - Value of loans recovered) / Average gross loan portfolio.

Note: The definitions are taken from Mix Market and International Monetary Fund website.

Table 3. 8. Correlation matrix

	TC	PERSO	ADM	FIN	GLP	HDI	GDP	LLR	AGE	HHI	WOM	EQU	ALB	ASB	INF
TC	1.00														
PERSO	0.60	1.00													
ADM	0.53	0.66	1.00												
FIN	0.22	0.26	0.19	1.00											
GLP	0.95	0.59	0.46	0.19	1.00										
HDI	0.34	0.12	0.00	0.12	0.33	1.00									
GDP	0.39	0.31	0.28	0.09	0.35	0.75	1.00								
LLR	0.09	0.08	0.04	0.07	0.08	0.02	0.09	1.00							
AGE	0.40	0.08	0.07	-0.01	0.42	0.15	-0.03	-0.03	1.00						
HHI	-0.20	-0.20	-0.10	-0.28	-0.22	-0.36	-0.38	-0.02	0.03	1.00					
WOMEN	-0.26	-0.05	-0.29	-0.02	-0.25	-0.05	-0.06	-0.01	-0.33	-0.01	1.00				
EQUITY	-0.14	0.06	-0.06	-0.07	-0.07	-0.18	-0.16	-0.03	-0.02	0.00	0.24	1.00			
ALB	0.37	0.30	0.28	0.13	0.40	0.27	0.31	0.11	0.15	-0.00	-0.32	-0.18	1.00		
ASB	0.32	0.18	0.31	0.00	0.33	0.26	0.34	0.07	0.16	-0.06	-0.33	-0.16	0.44	1.00	
INFLATION	-0.06	-0.11	-0.06	-0.05	-0.05	-0.08	-0.06	0.11	-0.03	-0.09	-0.03	-0.06	0.00	0.06	1.00

Note: Where TC=Total cost, PERSO=Personal price (natural logarithm), ADM=Administrative price (natural logarithm), FIN=Financial price (natural logarithm), GLP=Gross loan portfolio, HDI=Human Development Index, GDP=Gross domestic product, LLR=Loan loss rate, Age=Age of the microfinance (natural logarithm), HHI= Herfindahl-Hirschman index, WOM=Women, EQU=Equity, ALB=Average loan balance (natural logarithm), ASB=Average savers balance (natural logarithm). There is a strong correlation between gross loan portfolio and total cost because naturally the more loans an MFI grants, the more its total cost increases. This same level of correlation can be observed in Hermes et al. (2011, 2018).
Source: Mix Market; WDI. Authors' calculations.

Table 3. 9. Estimation results

	(1)	(2)	(3)	(4)	(5)
<i>The cost frontier</i>					
In(Personnel price/ Depreciation and amortization price)	0.403 (0.422)	0.403 (0.422)	0.403 (0.422)	0.403 (0.422)	0.425 (0.425)
In(Administrative price/ Depreciation and amortization price)	0.555 (0.390)	0.555 (0.390)	0.555 (0.390)	0.555 (0.390)	0.530 (0.394)
In(Financial price/ Depreciation and amortization price)	0.172 (0.172)	0.172 (0.172)	0.172 (0.172)	0.172 (0.172)	0.175 (0.173)
In(Gross loan portfolio)	0.242 (0.222)	0.242 (0.222)	0.242 (0.222)	0.242 (0.222)	0.252 (0.222)
In(Personal price/ Depreciation and amortization price) ²	0.237*** (0.069)	0.237*** (0.069)	0.237*** (0.069)	0.237*** (0.069)	0.234*** (0.069)
In(Administrative price/ Depreciation and amortization price) ²	0.061 (0.054)	0.061 (0.054)	0.061 (0.054)	0.061 (0.054)	0.064 (0.054)
In(Financial price/ Depreciation and amortization price) ²	0.014 (0.009)	0.014 (0.009)	0.014 (0.009)	0.014 (0.009)	0.014 (0.009)
In(Gross loan portfolio) ²	0.039** (0.015)	0.039** (0.015)	0.039** (0.015)	0.039** (0.015)	0.039** (0.015)
In(Personnel price/ Depreciation and amortization price) × In(Administrative price/ Depreciation and amortization price)	-0.122** (0.050)	-0.122** (0.050)	-0.122** (0.050)	-0.122** (0.050)	-0.122** (0.050)
In(Personal price/ Depreciation and amortization price) × In(Financial price/ Depreciation and amortization price)	-0.012 (0.022)	-0.012 (0.022)	-0.012 (0.022)	-0.012 (0.022)	-0.011 (0.022)
In(Personal price/ Depreciation and amortization price) × In(Gross loan portfolio)	-0.083*** (0.021)	-0.083*** (0.021)	-0.083*** (0.021)	-0.083*** (0.021)	-0.082*** (0.021)
In(Personnel price/ Depreciation and amortization price) × Trend	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)	0.009 (0.009)
In(Administrative price/ Depreciation and amortization price) × In(Financial price/ Depreciation and amortization price)	-0.013 (0.020)	-0.013 (0.020)	-0.013 (0.020)	-0.013 (0.020)	-0.014 (0.020)
In(Administration price/ Depreciation and amortization price) × In(Gross loan portfolio)	0.033* (0.018)	0.033* (0.018)	0.033* (0.018)	0.033* (0.018)	0.032* (0.018)
In(Administration price/ Depreciation and amortization price) × Trend	-0.006 (0.009)	-0.006 (0.009)	-0.006 (0.009)	-0.006 (0.009)	-0.005 (0.009)
In(Financial price/ Depreciation and amortization price) × In(Gross loan portfolio)	0.020*** (0.006)	0.020*** (0.006)	0.020*** (0.006)	0.020*** (0.006)	0.020*** (0.006)
In(Financial price/ Depreciation and amortization price) × Trend	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)
In(Gross loan portfolio) × Trend	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)
Trend	0.026 (0.069)	0.026 (0.069)	0.026 (0.069)	0.026 (0.069)	0.025 (0.069)
Trend ²	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)
<i>The inefficiency equation</i>					
Women	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.001)	0.002*** (0.001)
Herfindahl-Hirschman Index	-0.146*** (0.041)	-0.146*** (0.041)	-0.130*** (0.042)	-0.160*** (0.049)	-0.161*** (0.048)
Age	0.750***	0.748***	0.711***	0.730***	0.732***

	(0.118)	(0.118)	(0.121)	(0.124)	(0.123)
Equity		-0.041 (0.083)	-0.040 (0.081)	-0.013 (0.082)	-0.017 (0.082)
Average loan balance			0.015 (0.012)	0.021 (0.014)	0.020 (0.014)
Average savers balance				-0.026* (0.015)	-0.027* (0.015)
Loan loss rate					0.001 (0.002)
Vsigmas	-4.192***	-4.191***	-4.193***	-4.187***	-4.190***
_cons	(-54.81)	(-54.83)	(-54.89)	(-55.00)	(0.076)
Usigmas	-2.342**	-2.323**	-2.294**	-2.420**	-2.404**
_cons	(-2.48)	(-2.47)	(-2.33)	(-2.48)	(0.967)
Number of microfinance institutions	102	102	102	102	102
Observations	530	530	530	530	530

Note: The sample covers 2003 to 2018. All the estimations are based on the Wang and Ho (2010) methodology. Estimations are made step by step in this table and are based on specification (15) for the technology and (16) for the determinants of inefficiency. The vector of inefficiency determinants is: $z_{it} = \delta_1 Women_{it} + \delta_2 HHI_{it} + \delta_3 Age_{it} + \delta_4 Equity_{it} + \delta_5 ALB_{it} + \delta_6 ASB_{it} + \delta_7 LLR_{it}$. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 3. 10. Robustness tests: estimations with control variables

z_{it} = vector of inefficiency	(1)	(2)	(3)	(4)	(5)	(6)
<i>The cost frontier</i>						
<i>Control variables</i>	No	Yes	Yes	Yes	Yes	Yes
<i>GDP growth</i>		0.000 (0.000)			0.000 (0.000)	
<i>Human development indicator</i>			-1.367 (1.919)			-1.449 (1.915)
<i>Inflation, Consumption Price Index</i>				0.004 (0.003)	0.004 (0.003)	0.004 (0.003)
<i>The inefficiency equation</i>						
Women	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.000)
Herfindahl-Hirschman index	-0.166*** (0.050)	-0.157*** (0.048)	-0.162*** (0.048)	-0.166*** (0.050)	-0.167*** (0.050)	-0.158*** (0.048)
Age	0.740*** (0.124)	0.727*** (0.123)	0.737*** (0.122)	0.740*** (0.124)	0.745*** (0.123)	0.731*** (0.121)
Equity	-0.019 (0.084)	-0.013 (0.080)	-0.024 (0.083)	-0.019 (0.084)	-0.027 (0.085)	-0.021 (0.081)
Average loan balance	0.019 (0.014)	0.020 (0.014)	0.019 (0.013)	0.019 (0.014)	0.018 (0.014)	0.019 (0.013)
Average savers balance	-0.028* (0.015)	-0.027* (0.015)	-0.026* (0.015)	-0.028* (0.015)	-0.027* (0.015)	-0.026* (0.015)
Loan loss rate	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)
Vsigmas	-4.190*** (0.076)	-4.190*** (0.076)	-4.192*** (0.076)	-4.198*** (0.076)	-4.199*** (0.076)	-4.201*** (0.076)
Usigmas	-2.404** (0.967)	-2.449** (0.965)	-2.360** (0.965)	-2.412** (0.954)	-2.455*** (0.951)	-2.368** (0.951)
Number of microfinance institutions	102	102	102	102	102	102
Observations	530	530	530	530	530	530

Note: The sample covers 2003 to 2018. Column (1) represents our main estimation. All the estimations are based on the Wang and Ho (2010) methodology. We added step by step control variables, here there are: GDP growth, Human Development Indicator, and inflation. The results in columns (2) to (6) are still the same. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively, and the vector of inefficiency determinants is: $z_{it} = \delta_1 Women_{it} + \delta_2 HHI_{it} + \delta_3 Age_{it} + \delta_4 Equity_{it} + \delta_5 ALB_{it} + \delta_6 ASB_{it} + \delta_7 LLR_{it}$.

Table 3. 11. Robustness tests: quartile Women

z_{it} = vector of inefficiency	(1)	(2)	(3)	(4)
<u>The cost frontier</u>				
<u>Control variables</u>	No	No	Yes	Yes
GDP growth				0.000 (0.000)
Human development indicator			-1.112 (1.919)	
Inflation, Consumption Price Index			0.004 (0.003)	0.004 (0.003)
<u>The inefficiency equation</u>				
Women	0.002*** (0.001)			
Herfindahl-Hirschman index	-0.166*** (0.050)	-0.172*** (0.048)	-0.171*** (0.048)	-0.179*** (0.049)
Age	0.740*** (0.124)	0.717*** (0.120)	0.718*** (0.119)	0.732*** (0.120)
Equity	-0.019 (0.084)	-0.019 (0.077)	-0.022 (0.077)	-0.028 (0.080)
Average loan balance	0.019 (0.014)	0.023* (0.013)	0.022* (0.013)	0.022* (0.013)
Average savers balance	-0.028* (0.015)	-0.019 (0.014)	-0.019 (0.014)	-0.020 (0.014)
Loan loss rate	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
Quartile 1. Women		-0.071** (0.029)	-0.071** (0.028)	-0.073** (0.029)
Quartile 2. Women		-0.063** (0.025)	-0.062** (0.025)	-0.063** (0.026)
Quartile 3. Women		-0.028 (0.020)	-0.027 (0.020)	-0.028 (0.020)
vsigmas	-4.190*** (0.076)	-4.191*** (0.076)	-4.199*** (0.076)	-4.199*** (0.077)
_cons	-2.404** (0.967)	-2.075** (0.922)	-2.060** (0.912)	-2.146** (0.908)
Number of microfinance institutions	102	102	102	102
Observations	530	530	530	530

Note: The sample covers 2003 to 2018. Column (1) represents our main estimation. All the estimations are based on the Wang and Ho (2010) methodology. The results in column (2) are based on estimation without control variables and in columns (3) and (4), we added control variables. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively, and the vector of inefficiency determinants is: $z_{it} = \gamma Women_{it}^{Quartiles} + \delta_1 HHI_{it} + \delta_2 Age_{it} + \theta X_{it}$.

Table 3. 12. Robustness tests: quartile HHI

z_{it} = vector of inefficiency	(1)	(2)	(3)	(4)
<u>The cost frontier</u>				
<u>Control variables</u>	No	No	Yes	Yes
GDP growth				0.000 (0.000)
Human development indicator			-1.852 (1.902)	
Inflation, Consumption Price Index			0.004 (0.003)	0.004 (0.003)
<u>The inefficiency equation</u>				
Women	0.002*** (0.001)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Herfindahl-Hirschman index	-0.166*** (0.050)			
Age	0.740*** (0.124)	0.749*** (0.124)	0.748*** (0.121)	0.759*** (0.123)
Equity	-0.019 (0.084)	-0.028 (0.082)	-0.034 (0.081)	-0.041 (0.084)
Average loan balance	0.019 (0.014)	0.010 (0.014)	0.009 (0.014)	0.008 (0.014)
Average savers balance	-0.028* (0.015)	-0.025* (0.014)	-0.024* (0.014)	-0.025* (0.014)
Loan loss rate	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	0.001 (0.002)
Quartile 1. Herfindahl-Hirschman index		0.070*** (0.021)	0.070*** (0.021)	0.071*** (0.021)
Quartile 2. Herfindahl-Hirschman index		0.064*** (0.017)	0.062*** (0.016)	0.064*** (0.017)
Quartile 3. Herfindahl-Hirschman index		0.044*** (0.013)	0.042*** (0.012)	0.044*** (0.013)
Vsigmas	-4.190*** (0.076)	-4.211*** (0.076)	-4.227*** (0.076)	-4.222*** (0.076)
Usigmas	-2.404** (0.967)	-2.649*** (0.976)	-2.571*** (0.953)	-2.663*** (0.961)
Number of microfinance institutions	102	102	102	102
Observations	530	530	530	530

Note: The sample covers 2003 to 2018. Column (1) represents our main estimation. All the estimations are based on the Wang and Ho (2010) methodology. The results in column (2) are based on estimation without control variables and in columns (3) and (4), we added control variables. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively, and the vector of inefficiency determinants is: $z_{it} = \gamma^* HHI_{it}^{Quartiles} + \delta_1 Women_{it} + \delta_2 Age_{it} + \theta X_{it}$.

4. Shareholder origin, market power and bank profitability:

Evidence from Cameroon

4.1. Introduction

The banking sector in the Economic and Monetary Union of Central African States (CEMAC) countries was long characterised by a strong presence of foreign banks that were gradually taken over by the state in the 1970s. At that time dominated by public capital, an essentially interventionist monetary policy and a lack of respect for regulation, the CEMAC banking system went through a period of significant crisis and profound restructuring and reorganisation (Avom and Eyeffa, 2007).

Today, despite the level of risk, and especially after a profound restructuring in the 1980s, one of the remarkable evolutions have been the almost total, if not total, disengagement of the state from bank ownership. Since then, banks in the sub-region appear to be relatively stable. The deregulation of the sector and the globalisation of the industry have led to a proliferation of financial institutions in Central Africa.

We can therefore observe an increase in the number of banks and a diversification of the shareholder structure, which was initially dominated by a few groups (or countries). For example, the shareholding from Africa increased from 4.57 percent in the 2000s to 25.04 percent in 2014, while the shareholding from outside Africa decreased from over 55.48 percent to 33.32 percent. As for the structure of local shareholders, we observe a fluctuation in a range of 20 percent and 40 percent of shareholders of Cameroonian origin, between 2000 and 2014. We can also observe a change in the market structure with an increase in the number of banks in Cameroon from 8 banks in 2000 to 13 banks in 2014. The origin of the main shareholders of banks in Cameroon between 2000 and 2014 is dominated by Cameroon (35.58 percent), the United States (15.85 percent), France (15.66 percent), Nigeria (12.20 percent) and slightly Togo (6.31 percent).

Located in Central Africa on the Gulf of Guinea, Cameroon is one of the important countries in the CEMAC sub-region, accounting for more than 65 percent of all

economic activity in the area. Since the 2000s, Cameroon has undergone a strong financial liberalisation that has increased the proliferation of financial institutions and the degree of competitiveness. Despite an increase in the number of branches throughout the country, the Cameroonian banking market still seems to be characterised by a high concentration of banking activities and limited access to financial services.

The problem of consolidation of French and European banks attracts particular attention. In an environment of persistently low profitability, a new concentration movement in the European banking sector with several announcements of merger operations is topical (Silvia et al., 2021; Couppey-Soubeyran et Nicolas, 2021). According to Couppey-Soubeyran and Nicolas (2021), this movement will increase the concentration of the European banking sector and, more broadly, market power in order to generate rents by setting prices beyond what they would be if competitive pressure were greater. So, would the almost oligopolistic Cameroonian banking market not benefit from remaining concentrated?

Although Boyd and De Nicolo (2005) show that banks in a more concentrated system tend to increase their risk-taking, concentrated banking systems increase market power and profits. It is therefore of particular interest to assess the effects of structural change in the Cameroonian banking system on its performance indicators and profitability. What would be the impact of a less concentrated market, a diversified ownership structure, with a large number of banks on the profitability of banks in Cameroon?

A number of studies analysed the effects of market power or competition on the profitability of banks based on different indicators¹⁵. Commonly used indicators are Herfindahl-Hirschman index (Azar et al, 2022; Lapteacru, 2017; Pelletier, 2018; Wang et al, 2020; Weill, 1998), Panzar and Rosse's H-statistic (Lapteacru, 2017; Lapteacru and

¹⁵ Most authors use the Herfindahl-Hirschman Index (HHI) as the main indicator used to measure the degree of competition following the structural approach. Otherwise, some use business concentration ratios such as the concentration ratio of the three, four or five largest financial institutions.

Nys, 2011), concentration of shares held by the ρ -largest banks (Léon and Zins, 2020; Weill, 1998), Lerner's index (Alexakis and Samantas, 2020; Klein and Weill, 2022; Lapteacru, 2017; Wang et al, 2020) or the Boone indicator (Boone, 2001, 2008; Chen and Hsu, 2022).

The objective of this paper is to analyse the relationship between the geographical origin of shareholder, market power and bank's profitability in Cameroon. Using a multivariate linear model, I regress bank's profitability on the variables of ownership structure and market power. I have an unbalanced panel of 14 commercial banks located in Cameroon, observed successively over 15 years from 2000 to 2014. I perform additional tests to corroborate our results using subsamples, alternative variables and estimation methods.

The results show that ownership structure and competition are important determinants of bank profitability in Cameroon. They show, on the one hand, that banks with Cameroonian shareholders and banks with African shareholders are more profitable than other banks (with foreign shareholders outside Africa). On the other hand, the results show that competition worsens the profitability of banks and that a concentrated banking market is more profitable.

The second section of the paper reviews theoretical and empirical studies on the relationship between ownership structure, market structure and bank profitability. The third section discusses the methodology and specification of the model. The fourth section presents the data for my study. The fifth section presents the results of the empirical analysis and the sixth section presents the robustness tests and finally a last section concludes and develops the policy implications.

4.2. Related literature

The literature in this field can be divided into two parts one studying the relationship between the origin of shareholder and bank profitability, and one the relationship between market power and bank profitability.

4.2.1 Bank profitability and shareholder structure

The main ratios and indicators used in the literature to measure bank profitability are return on assets (Bouzgarrou et al., 2018; Dietrich and Wanzenried, 2014; Pelletier, 2018), return on equity (Bouzgarrou et al., 2018; Dietrich and Wanzenried, 2014; Pelletier, 2018), bank interest spread or net interest margin (Bouzgarrou et al., 2018; Dietrich and Wanzenried, 2014; Saona, 2016)¹⁶.

The literature on the relationship between shareholder structure and bank profitability remains ambiguous and inconclusive. Much of the economic and financial literature presents foreign banks as the best, least risky, most efficient and most profitable in the banking market (Berger et al., 2000; Pelletier, 2018). Alongside this literature, there is another that shows the opposite, especially in developing countries: local banks are more profitable than their foreign counterparts (Claessens et al., 2001; Doğan, 2013; Hasan and Hunter, 1996; Havrylchuk, 2006; Kraft et al., 2006; Mahajan et al., 1996; Pelletier, 2018).

A very common argument for the performance of local banks compared to foreign banks is the distance between the host country and the bank's home country. Here, the bank's knowledge of the local environment allows it to monitor and control borrowers (Berger and DeYoung, 2001; Freixas and Rochet, 2008). This is particularly true in developing economies where markets are characterised by low transparency, a large informal sector and non-existent documentation (Maimbo et al., 2011).

This is also the case for San et al. (2011) who examined data from banks in Malaysia (9 domestic banks and 12 foreign banks) over the period 2002 to 2009 to analyse their performance. Using a data envelopment methodology, they find that domestic banks are more efficient and competitive than foreign banks.

¹⁶ Return on assets, denoted ROA is defined as a profit before tax divided by total assets. This ratio measures income generated by the assets financed by the bank. Net interest margin, denoted NIM, is defined as the net interest income divided by total assets. It represents the amount earned on interest activities. Return on equity, denoted ROE, is defined as the net income divided by equity. This variable measures the generated profits from the capital.

Matthew and Laryea (2012) also compared the financial performance of domestic and foreign banks operating in Ghana between 2005 and 2011. They examined the profitability, size, liquidity, asset quality and capital adequacy of these banks and found that domestic banks have a higher return on assets and equity than foreign banks. They also found that foreign banks had more liquidity, better capital adequacy, larger size and higher quality assets than domestic banks.

The same is true for Doğan (2013) who evaluated the financial performance of foreign and domestic banks operating in the Turkish banking sector. Based on the data of 10 domestic and 10 foreign banks over the period 2005-2011, the author concludes that the asset quality, stock returns, total assets and management efficiency of domestic banks are higher than those of foreign banks. On the other hand, the author also finds that domestic banks have a lower capital adequacy ratio than foreign banks.

According to Levine (1996), the lower performance of domestic banks is due to the coexistence of domestic and foreign banks. The entry of foreign banks can impact on domestic banks in terms of potential costs and lower profitability. Although they bring potential benefits in terms of better allocation of resources and quality of financial services in the banking sector, they stimulate competition and encourage local banks to implement more advanced and costly banking skills and technologies. Stiglitz (1993) found that domestic banks face higher costs to compete with foreign banks with the direct consequence of lower profitability.

In contrast to the authors mentioned above, in their work on the financial performance of banks, Demirgüç-Kunt and Huizinga (2000) find that the performance of foreign banks is superior to that of domestic banks. They use a sample of banks operating in both developed and developing countries over the period 1988 to 1995.

Subsequently, Chantapong (2005), in a study of the Thai banking market, compared the performance of domestic and foreign banks over the period 1995 to 2000. The results of his work showed that foreign banks have higher profitability than domestic

banks. Similarly, Balasundaram (2008) finds that foreign banks perform better than domestic banks in terms of liquidity, profitability and interest income in a study of the financial performance of a panel of banks located in Bangladesh over the period 1999 to 2006.

Bouzgarrou et al. (2018) examined the profitability of domestic and foreign banks after and during the financial crisis in the summer of 2007 and found that foreign banks were more profitable than domestic banks especially during the 2008 financial crisis. Their robustness tests confirm the results for foreign banks in developing countries as opposed to foreign banks in emerging countries. They use panel data from 170 commercial banks operating in France over a 13-year period from 2000 to 2012.

This is a result found by Claessens et al. (2001) on a sample of banks located in 80 countries over the period 1988-1995. They show differences in net interest margins, overheads, taxes paid and profitability of foreign and local banks. They show differences in net interest margins, overheads, taxes paid and profitability of foreign and local banks. They conclude that foreign banks have higher profits than domestic banks in developing countries but find the opposite for foreign banks in developed countries. Similarly, Pelletier (2018), considering the heterogeneity of foreign banks, conducted a study on a sample of 657 banks worldwide including 47 banks located in Sub-Saharan Africa over a 10-year period from 2003 to 2012. The author shows that the better performance exhibited by foreign banks in developed and emerging countries is related to greater operational efficiency and lower cost of funding. African regional banks, which started their expansion abroad more recently, are less able to generate interest income than domestic banks.

Referring to the theory of the *institutional voids advantage theory*¹⁷ developed by Khanna and Palepu (2006, 2010), Claessens and Van Horen (2012) show that it is not

¹⁷ The "*institutional voids advantage theory*" according to which multinational enterprises in developing countries that make local investments have an adaptation advantage over those that are distant. This advantage is justified by their ability to cope with difficult institutional environments.

necessarily the ownership structure that determines the profitability of the bank but the environment in which it is located. They agree with Claessens et al. (2001) and Pelletier (2018) in confirming that foreign banks are particularly profitable in developing countries and more generally in countries with limited credit information and weak contract enforcement, weak regulation and an inefficient banking sector. They go on showing that foreign banks setting up in developing countries have a good workforce and a strong regulatory system leading to better risk management and a wider range of financial products. These banks can easily compete and make high value-added investments (Berger et al., 2000).

On the other hand, the work of Jha and Hui (2012), which focuses on the local market in Nepal, shows that domestic and foreign banks are more profitable than state-owned banks, but that the profitability between banks and the level of efficiency of domestic and foreign private banks are identical. They use a sample of 18 commercial banks operating in Nepal over the period 2005 to 2011. They also show that the profitability of assets of these banks is significantly affected by capital adequacy ratio, interest expense to total loans and net interest margin, while capital adequacy ratio has a significant effect on the profitability of capital ratio.

On the other hand, Alam et al. (2011) also find that domestic banks operating in Pakistan between 2006 and 2009 are less profitable and have less liquidity than public banks. Although their results showed that national banks have a larger asset size than state-owned banks. The same is true for Micco et al. (2007), who study the Pakistani market and investigate whether the performance of public and private banks is determined by political considerations during the period 1995-2002. They also find that public banks in developing countries have lower profitability and higher costs than private banks, without finding a strong correlation between bank ownership and performance for banks in industrial countries.

Finally, Iannotta et al. (2007) present a study on the relationship between ownership structure, risk taking and bank performance for a sample of 181 European banks over the period 1999-2004. They find no significant correlation between ownership structure and bank profitability but a strong correlation between ownership structure and loan quality and low risk. They find, on the one hand, that mutual banks and public banks have lower profitability than private banks, despite their lower costs. On the other hand, public banks have lower loan quality and higher insolvency risk than other types of banks, while mutual banks have better loan quality and lower asset risk than private and public banks. The authors also find that ownership concentration does not significantly affect a bank's profitability, with higher ownership concentration being associated with better loan quality, lower asset risk and lower insolvency risk.

In sum, the origin of the shareholders and the Cameroonian banking market can be a comparative advantage in the management of banking risks and the improvement of financial performance because, as mentioned above, this proximity allows for a better advice, a better analysis of credit files, a better follow-up of borrowers and a better knowledge of the socio-cultural environment (Berger and DeYoung, 2001; Freixas and Rochet, 2008). I therefore believe that the closer a bank's majority shareholders to their market, the more profitable the bank in question.

4.2.2 Bank profitability and market power

Although there seems to be a consensus on the perception of the manifestations and consequences of competition on the economy, a controversy persists on the issue of assessing and measuring competition and possibly its effect on the economy. The economic and financial literature broadly shows the importance of competition in terms of improving financing conditions, promoting financial innovation, diversifying banking products and improving the quality of financial services (Bikker et al., 2012).

The existing relationship between market power and bank's profitability is supported by two different approaches. The first approach is aligned with the structural theory

based on the Structure-Conduct-Performance (SCP) paradigm and the second, non-structural, based on the efficient structure hypothesis. The SCP paradigm concludes that there is a negative relationship between market power and bank's profitability. In other words, the higher the market power (market concentration) and thus the less competition (of financial institutions), the less profitable financial institutions are. And the efficient structure hypothesis supports a positive relationship between market power and bank's profitability. In other words, the higher the market power (market concentration) and thus the less competition (of financial institutions), the more profitable financial institutions are.

According to the SCP paradigm, the structure of a business, especially in terms of the number of players present or the concentration of activities, is determined by the behaviour of the strategies of the players in that sector and thus the level of competition that exists. For example, in a market for goods and services, a company in a monopoly position has market power and can charge higher prices. In the market for financial institutions, this is illustrated by higher lending rates in a monopoly situation than in a competitive situation (Dannon et al., 2019). Financial institutions have an incentive to make more profitable investments and placements in order to attract higher interest costs or lower interest income (Lapteacru and Nys, 2011). Following Mason (1939) and Bain (1956), the precursor of this theory, Dietsch (1992) focuses on entry and price conditions to describe the SCP paradigm. He argues that with high entry costs, the market power induced by concentration in favour of large firms leads to excessive profits, despite low efficiency¹⁸.

The SCP paradigm concludes that the fewer firms there are in an industry or sector, the more concentrated the industry or sector is and the less profitable the firms present.

¹⁸ See, *Quiet life hypothesis* of Hicks (1935) according to which a banking management unit with a large market share is less focused on efficiency because the exploitation of market power in terms of price setting automatically leads to profits. In the end, an increase in market power is accompanied by a deterioration in efficiency, making it impossible for banks to achieve higher profitability.

In contrast to the structuralist approach, Demsetz (1973) and Peltzman (1977) introduce different concepts to analyse competition: the theory of efficient structure. This is an analysis in which competition is no longer seen as a static mechanism, but as a dynamic selection process of the most efficient and profitable firms (Dannon et al., 2019).

According to the efficient structure theory, market structure is explained by the behaviour and performance of firms. Market concentration emerges from competition where firms with a low-cost structure increase their profits by reducing prices and expanding their market share (Smirlock, 1985). It is therefore through gains in market share and also because a firm is efficient that it improves its performance and increases its market share. The best profits are therefore not due to collusive activities as suggested by the SCP paradigm (Molyneux and Forbes, 1995). Under the pressure of market competition, efficient firms win the competition, grow, become larger, get a larger market share, achieve higher profits and consequently the market becomes more concentrated (Sathye, 2005)¹⁹.

Empirically, Belkhaoui et al (2012); Chortareas et al (2011); Delis and Tsionas (2009); Khan et al. (2017); Lapteacru and Nys (2011); Le and Ngo (2020); Seelanatha (2010) present results consistent with the efficient structure hypothesis. For the latter, a clear positive relationship is identified between the level of market power and the performance of financial institutions.

Delis and Tsionas (2009) conducted a study on an unbalanced panel of banks operating in the European Union over the period 1999 to 2006. They concluded that individually high market power leads to higher efficiency of banks. He is joined by Chortareas et al.

¹⁹ Firms thus have two options to maximise their profit level: either they keep their price and reduce the size of the firm or they lower the price and increase the size of the firm (Williams et al., 1994). Therefore, larger firms generate higher profits due to their higher efficiency. The main conclusion in this respect is that the extra profits generated can be considered as economic returns and not as monopoly returns (Chortareas et al., 2011; Seelanatha, 2010).

(2011) who conduct their study on the Latin American banking sector and Lapteacru and Nys (2011) on a sample of 9 Central and Eastern European countries.

While Chortareas et al. (2011) worked on a sample of over 2500 observations over the period 1997 to 2005, Lapteacru and Nys (2011) conducted their studies on a sample of 9 Central and Eastern European countries over the period 1999 to 2006. They obtain the same results. Market power positively affects banks' cost efficiency and thus their profitability. Banks with greater market power are also more efficient in reducing their costs and implicitly generate more profits.

Belkhaoui et al. (2012) also find that bank performance increases with market share, capitalization level and cost efficiency scores. On the other hand, this performance decreases with credit risk taking and the degree of diversification of the bank. Their sample consists of 293 commercial banks located in 11 emerging countries over a period of 7 successive years, from 2001 to 2007.

The work of Khan et al. (2017) and Le and Ngo (2020) takes a stand and validates the efficient structure theory. The correlation between market power and bank profitability is negative. The more banks there are in the sector, the less profitable they are. For this, Khan et al. (2017) use an unbalanced panel of 133 commercial banks from the BankScope database, i.e. 1507 observations over a period from 1999 to 2014 and Le and Ngo (2020) a sample of banks in 23 countries over a period from 2002 to 2016.

There are also studies such as Seelanatha (2010), on a sample of Sri Lankan banks from 1997 to 2005, which show that bank performance does not depend on market concentration or market power of firms but on the level of efficiency of banking units.

Given that most recent studies on performance and market power in developing countries support the efficient structure theory, we believe that for the Cameroonian banking sector, the fewer banks there are, the more concentrated the sector is, the more profitable the banks are.

4.3. Data

The data come from several sources. Financial information specific to the various banks comes from the Central African Banking Commission (COBAC)'s regulatory financial statements of banks (CERBER)²⁰. Our study period is from 2000 to 2014. I combine this data with hand-collected information on the shareholder structure and origin of banks using their webpages, complemented by information on the global ultimate owner as in Pelletier (2018) and Lepetit et al. (2012). Lastly, I merge this data with macroeconomic variables obtained from the World Development Indicators (WDI).

The sample consists of all banks that were active at some point during the 15-year sample period in Cameroon. Our sample of banks is broken down into 14 different entities. 6 banks are majority locally owned and 8 banks are in majority foreign owned (3 by African shareholders and 5 by non-African ones).

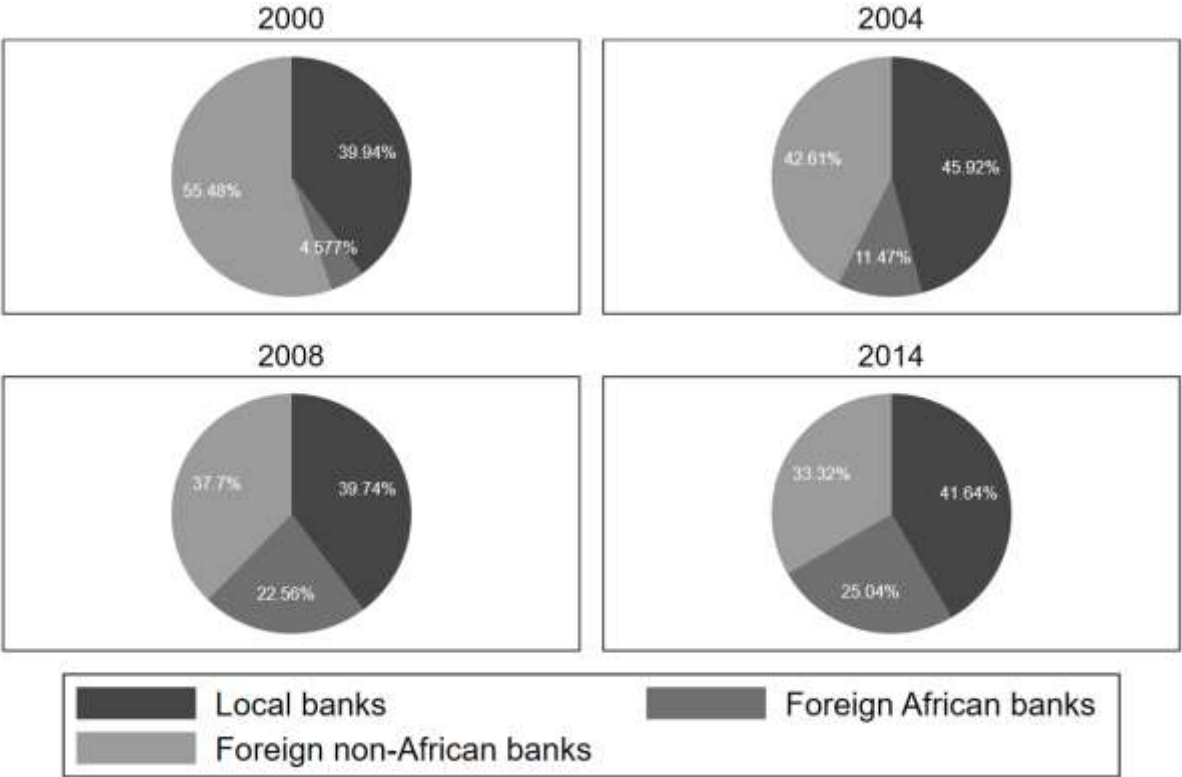
I distinguish three types of banks using dummy variables that are equal to one, when the majority shareholding owns at least 50 percent of a bank's capital originates either from Cameroon or from African countries outside Cameroon or from foreign countries outside Africa, and zero otherwise. The first category are local banks for which the majority shareholder comes from Cameroon. The second category includes foreign banks whose majority shareholding comes from Africa but outside Cameroon. And finally, the third category includes foreign banks whose majority shareholding comes from foreign countries other than those in Africa. As in most situations where several shareholders come from a specific country, I follow Pelletier (2018) and aggregate the shares of each owner from that country before assigning the bank to a particular type (local or Cameroonian, African foreign or non-African foreign).

Figure 1 below shows the evolution of the average shareholder structure by origin of shareholders. As can be seen at the beginning of our sample period, banks were

²⁰ The acronym CERBER stands for "Collecte, Exploitation et Restitution aux Banques et Etablissements Financiers des Etats Réglementaires". From the data of this system, COBAC establishes the SYSCO rating for the evaluation of CEMAC's banks.

predominately owned by foreign non-African shareholders followed by local banks. 55.48% of shareholders were of foreign origin and 39.94 of Cameroonian’s origin. At the end of our sample, in 2014, we can see that African foreign shareholders are more important and represent 25.04% of the total shareholders of the bank, while shareholders of Cameroonian origin represent 33.32% and 41.64% for shareholders of foreign origin outside Africa. It is therefore clear that foreign African banks have gained market share in Cameroon at the expense of foreign non-African banks.

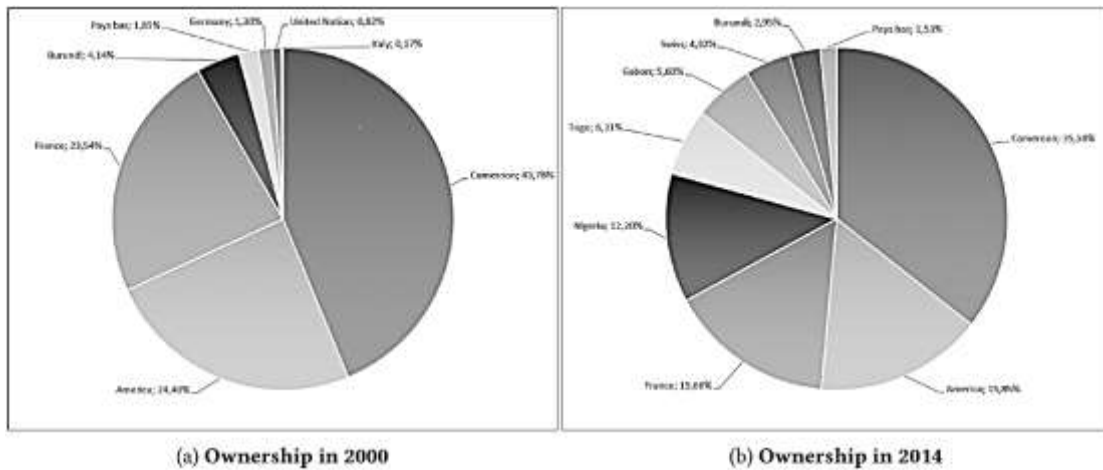
Figure 4. 1. Shareholding evolution in banks in Cameroon by origin of shareholders



Source: COBAC reports, commercial bank reports. Authors’ calculations.

Figure 2 shows the shareholder origin by country at end-2000 and end-2014, respectively. As can be seen, the shareholder origin in 2000 is dominated by three countries: Cameroon (43.78%), United States (24.40%) and France (23.54%). In 2014, the shareholder structure is dominated by four countries: Cameroon (35.58%), United States (15.85%), France (15.66%) and Nigeria (12.20%).

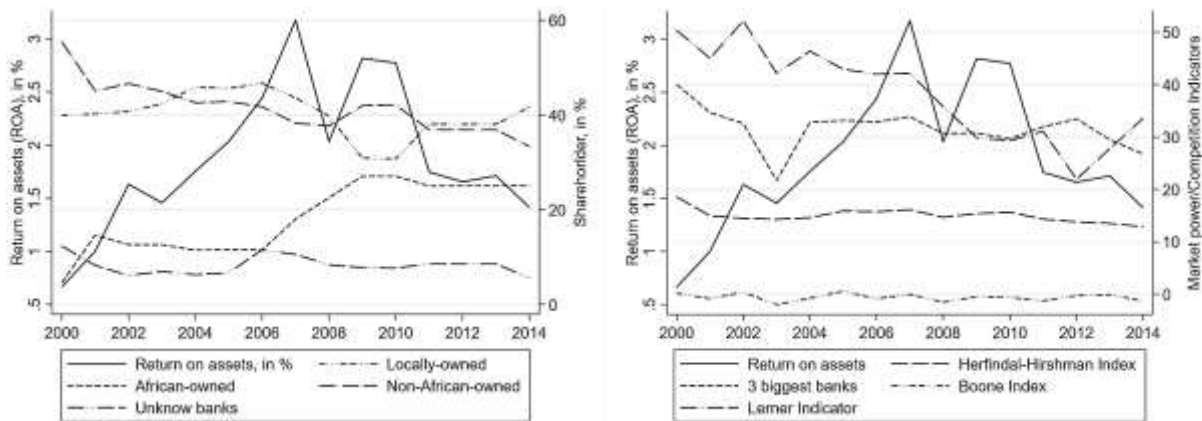
Figure 4. 2. Shareholder origin by country



Source: COBAC reports, commercial bank reports. Authors' calculations.

Next, I examine the ratio of bank profitability, shareholder and market power indicators over time and across our different types of banks. Figure 3 shows that slight variation in ROA can be observed, with an up and down evolution of ROA with a peak (superior to 30%) between 2007 and 2009.

Figure 4. 3. Ownership, bank profitability and market power indicators



Source: CERBER, COBAC reports, commercial bank reports. Authors' calculations.

Left hand graph shows the evolution of profitability indicator and the shareholder structure. While the presence of foreign shareholders is decreasing in the share capital of banks (from 55.48% in 2000 to 33.32% in 2014), the presence of African shareholders is increasing, from 4.58% in 2000 to 27.11% in 2014.

Next to this, in right hand graph, I present profitability and the competition indicators (Herfindahl-Hirschman index, 3 biggest banks concentration, Boone index and Lerner indicator).

The Herfindahl-Hirschman Index (HHI) is an index measuring market concentration, by indicating the number of firms producing a good. It is calculated by summing the square of the market shares (usually multiplied by 100) of all companies in the sector. The higher the HHI of a sector, the more production is concentrated among a small number of companies.

The concentration of 3-largest banks (3-Concentration) is the total assets of the three largest banks as a proportion of the total assets of all commercial banks. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax, discontinued operations and other assets²¹. The higher the (3-concentration) of a sector, the more production is concentrated among a small number of companies.

The Boone index is a measure of degree of competition, calculated as the elasticity of profits to marginal costs. To obtain the elasticity, the log of profits (measured by return on assets) is regressed on the log of marginal costs. The estimated coefficient (computed from the first derivative of a translog cost function) is the elasticity. The rationale behind the indicator is that higher profits are achieved by more-efficient banks. Hence, the more negative the Boone indicator, the higher the degree of competition is because the effect of reallocation is stronger²².

The Lerner index measures pricing power by examining the price mark-up over marginal cost. It is a measure of market power in the banking market. It is defined as

²¹ Raw data are from Bankscope and Orbis. The formula applied to Bankscope is $(\text{sum}(\text{data2025}) \text{ for the three largest banks in Bankscope}) / (\text{sum}(\text{data2025}) \text{ for all banks})$ and a comparable approach is applied to Orbis. Calculated from underlying bank-by-bank unconsolidated data from Bankscope and Orbis.

²² Estimations of the Boone indicator in this database follow the methodology used by Schaeck and Čihák (2010) with a modification to use marginal costs instead of average costs. Regional estimates of the Boone indicator pool the bank data by regions (for more information, Boone (2001); Griffith et al. (2005); Hay and Liu (1997)). Calculated from underlying bank-by-bank data from Bankscope, in World Database.

the difference between output prices and marginal costs (relative to prices). Prices are calculated as total bank revenue over assets, whereas marginal costs are obtained from an estimated translog cost function with respect to output. Higher values of the Lerner index indicate lower bank competition²³.

Then, in right hand graph, I show an important decrease in the levels for the Lerner indicator and the concentration of the 3 largest banks. From a value of 0.52 in 2000 to 0.22 in 2013 for the Lerner indicator and from a value of 0.40 to 0.22 for the concentration of the 3 largest banks. As for the other indicators, the HHI has kept a fluctuation in a maximum range of 0.19 and minimum of 0.13 points and on the other hand, the Boone indicator is fluctuating between -0.02 and 0.01 .

Tables 1 and 2 present the list of banks and the number of observations per bank and per year of the study. In Table 1, there are 14 commercial banks in Cameroon with 7 banks observed over the whole 15-year period. One bank is only observed until 2008 and is then bought out (AMITY bank becomes BAC-CAM bank). UBC, UBA and BGFI Cameroon were established in 2004, 2007 and 2011 respectively. I have an average of 12 observations per year. For a total of 171 observations for 14 commercial banks in Cameroon.

While table 6 shows the definition of variables, tables 3 and 4 show the summary statistics of all the variables used. The average ROA is 1.93% and the ROE is 24.03%. The overall percentage of shares held by locals is 31.80% with 14.22% of locals in African banks and 16.9% of locals in foreign banks. A high ROA indicates a high return on assets. Similarly, the overall percentage of shares held by Africans is 75.44% with 10.97% African in local banks (in Cameroon) and none in foreign banks. Finally, the overall percentage of shares held by foreigners (outside Africa) is 78.70% with 10.25% in local banks and only 3.83% in local banks. Regarding market power and competitiveness indicators, the average HHI is 0.10, the Lerner index is 0.37 and the

²³ Lerner Index estimations follow the methodology described in Demirgüç-Kunt and Martínez Pería (2010). Calculated from underlying bank-by-bank data from Bankscope, in World Database.

concentration index is 0.31. This average indicates that the competition in Cameroonian banking sector is low. The average Boone indicator is -0.01 , this average indicates a low allocation of resources in the financial system. The average inflation rate is 2.46% and the growth rate is 4.20%. Finally, the average bank-specific indicators such as total assets to GDP is 31.01%, total equity to assets is 11.76% and the average size is 11.80.

Table 5 below provides correlation matrix of our variables. It allows us to verify the absence of multicollinearity and we can see that correlation coefficients between different variables used.

4.4. Methodological approach

Our empirical model to estimate the impact of ownership and market power on bank profitability can be summarize as follow:

$$ROA_{it} = \alpha_0 + \gamma Shareholder_{it} + \beta MarketPower_{it} + \delta X_{it} + \theta Z_t + \eta_i + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, \dots, N$ is the number of observations of the cross-section unit per individual, $t = 1, 2, \dots, T$ is the time of the cross-section unit.

ROA_{it} is our dependent variable which represents profitability of bank i at period t . The return on assets, ROA denotes the ratio of net income of a bank to its total assets. It represents bank's assets profitability that quantifies bank's performance in relation to its assets or the volatility of the bank's return on assets. This variable is used by Bouzgarrou et al. (2018); Dietrich and Wanzenried (2014); Klein and Weill (2022); Liu (2022); Pelletier (2018).

α_0 represents the constant, γ represents the parameter associated with the type of shareholder, β represents the parameter associated with the market power, δ represents the parameter associated with bank specific variables and θ the parameter associated with macroeconomics variables.

$Shareholder_{it}$ denotes ownership variables which includes nature of share of bank i at period t . $Shareholder_{it}$ is the percentage of shares held by shareholders either from Cameroon, Africa outside Cameroon or foreigners outside Africa. To be more precise, a positive coefficient of γ ($\gamma > 0$) indicates that banks of a particular type have are more profitable, relative to the omitted category (foreign non-African banks) and conditional on the control variables. The sign of this variable can be positive or negative. This vector is used by Alexakis and Samantas (2020); Claessens and Van Horen (2012); Klein and Weill (2022); Léon and Zins (2020); Pelletier (2018).

$MarketPower_{it}$ denotes market power or competition variables which includes nature of market (less concentrated or most concentrated) in which the bank i at period t operated. $MarketPower_{it}$ is the index or the ratio which represents concentration and market power variables which include one by one ρ -largest banks where $\rho = 3, 4, \dots, n$ (Léon and Zins, 2020; Weill, 1998), Boone index (Boone, 2001, 2008; Chen and Hsu, 2022), Lerner index (Alexakis and Samantas, 2020; Klein and Weill, 2022; Lapteacru, 2017; Wang et al., 2020) and Herfindahl – Hirschman Index (Azar et al., 2022; Pelletier, 2018; Wang et al., 2020; Weill, 1998). To be more precise, a positive coefficient of β ($\beta > 0$) indicates the more the market is concentrated, the higher the bank profitability.

The vector $MarketPower_{it}$ consist, one by one, according to the regression, on either concentration of 3-largest banks, the Boone indicator, the Lerner index or the Herfindahl-Hirschman index. The 3-largest banks is used by Al-Muharrami and Matthews (2009); Léon and Zins (2020), the Boone index is used by Chen and Hsu (2022); Léon and Zins (2020), the Lerner index is used by Alexakis and Samantas (2020); Claessens and Van Horen (2012, 2014); Klein and Weill (2022); Lapteacru (2017); Wang et al. (2020) and the Herfindahl-Hirschman index is used by Brei et al. (2020); Pelletier (2018); Wang et al. (2020); Weill (1998).

X_{it} represents bank specific variables. This vector includes non-performing loans, deposit, provision ratio and bank size.

The variable non-performing loans is a proxy for bank credit risk. It is the ratio of distressed loans to total loans. This variable represents the quality of the bank's assets included in each of their loan portfolios. Studies of banking crises around the world have shown that poor asset (loan) quality is a key factor in bank failures. Thus, theory suggests that higher credit risk would be associated with lower levels of bank profitability, as shown by Angbazo (1997). We therefore expect a negative sign between non-performing loans and bank profitability. This variable has been used by Alhassan et al (2016); O'Connell (2022).

The deposit to total assets ratio is a liquidity management indicator. This ratio measures the bank's exposure to liquidity risk or the bank's level of coverage against liquidity risk or the stability of funding. Funding costs have a significantly negative impact on the return on assets, as found by Dietrich and Wanzenried (2011). We know that the cost of holding deposits instead of short-term bank funding weights on overall bank profitability (Bordeleau and Graham, 2010). We expect a negative relationship between this funding ratio and overall profitability. This variable is used by O'Connell (2022).

The variable capital ratio is the provision ratio which is an indicator of financial effect. I use the ratio of provisions to total loans as a proxy for bank capital (Cardot-Martin et al., 2021; O'Connell, 2022). This variable shows the extent to which assets are financed other than by Capital ratio. It is another measure of the adequacy of capital to the bank's loan portfolio. This variable also makes it possible to assess the proportion of bad debts that have been provisioned. It is used as a control indicator and as a management tool because it gives the measure of the bank's solvency. It can also allow shareholders to arbitrate between security and profitability of invested capital. Bank capital refers to the amount of equity available to support a bank's business activities and, therefore, should serve as a safety net on which the bank can rely in adversity (Molyneux and Thornton, 1992; Athanasoglou et al., 2008). Berger (1995) noted how bank capital ratios are positively related to returns on equity, as higher bank capital can lead to higher profits through the Granger effect. Consequently, I have to consider

that our capital variable may not be exogenous, as modelled by Staikouras and Wood (2003). This variable is used by Brei et al. (2020); O'Connell (2022); Pelletier (2018); Shamshur and Weill (2022).

The variable size is a logarithm of total assets of a firm. Size is an important factor in explaining bank performance, with large banks benefiting from economies of scale and operating in different market segments from small banks, which can lead to differences in performance. Then, this variable indicates a probability of having a diversified loan portfolio and capacity of innovation, that can reduce risk and non-performing loans. A negative sign would mean that the more the larger is bank, the less the non-performing loans is associate. I expect positive or negative sign (Brei et al., 2020; Hu et al., 2004; Wang et al., 2020).

Z_t represents the vector of macroeconomic variables in period t , which includes inflation rate and GDP growth.

The variable Inflation is the consumer price index. It can affect the borrowers loan payment capacity positively; higher inflation can enhance the loan payment capacity of borrowers by reducing the real value of outstanding debt. This variable is used by Cardot-Martin et al. (2021); Klein and Weill (2022).

The variable GDP is introduced because, in times of economic expansion, the high incomes of the agents improve the capacity to repay the loan, which leads to a decrease in non-performing loans. In the opposite case, there is an increase in bad debts. In the same sense, the amount of debts is affected by the interest rate, especially in case of variable rate loan. This variable is used by Brei et al. (2020); Cardot-Martin et al. (2021); Klein and Weill (2022); Yin (2021).

ε_{it} is the error term that follows a normal distribution with zero mean and constant variance, η_i , the consideration of individual bank's fixed-effects.

4.5. Results and discussion

Table 7 presents the results of estimation of the relationship between ownership, market power and bank profitability in Cameroon. My baseline results are the one with all the variables (column 11 to 14). These results indicate that the coefficient for banks with a majority local shareholder and African shareholders are positive and significant at least at 5 percent level across all specifications. This means that the more Cameroonian and African shareholders there are in the shareholder structure of a bank located in Cameroon, the more profitable that bank is than foreign non-African banks, my reference. The coefficient in the full specification is comprised between 0.035 and 0.041 percentage point for local banks and between 0.056 and 0.066 percentage point for African banks. Both are statistically important and significant, and show that, all things being equal, a one percent increase in the number of Cameroonian shareholders in banks in Cameroon leads to an increase in the profitability of these banks of at least 0.03 percent, and at the same time a one percent increase in the number of shareholders from African countries outside Cameroon leads to an increase in the profitability of these banks of at least 0.05 percent. The higher the shared African, the higher bank profitability, and by more shared local banks. The more the shareholders are from African countries, the higher the profitability of banks in Cameroon. This impact is greater when the shareholder is from another African country than Cameroon itself.

One argument for locally-owned and African-owned being more profitable than foreign non-African owned banks is geographical proximity. The advantages conferred by local experience can be particularly salient. As banking is primarily a relationship-based business, knowledge of the local environment is crucial in the selection and monitoring of borrowers (Freixas and Rochet, 2008; Berger et al., 2001). In some countries, as is the case in Africa, information gathering and monitoring of borrowers remains difficult because they are low-transparency economies with a large informal sector and limited or no formal documentation (Beck et al., 2011). Locally-owned and

African-owned would perform better because they have an advantage in handling non-technical information and should outperform foreign non-African owned in segments where non-technical information and local knowledge are essential, such as SME lending (Pelletier, 2018).

The results indicate also that the coefficients for all the market power indicator are positive and significant at 1 percent level for HHI, 10 percent level for 3-Concentration, 5 percent level for Lerner index and non-significant for Boone indicator. This result means that higher the concentrate banking sector or the lower competition in the Cameroonian banking sector, the more profitable banks are even if the allocation of resources is not significant for this case. This seemingly counter-intuitive result can be explained by the fact that firms in a competitive situation that seek to expand their loan portfolio do not contain their costs (Nurboja and Košak, 2017). Weill (1998) demonstrates, based on a theoretical model, that an increase in the number of banks leads to a reduction in their efficiency and therefore their profitability. Indeed, when the number of banks increases, the profit of each bank is reduced for a given level of efficiency.

The coefficients of the bank-specific variables are significant only for two variables: deposit and provision ratio. The coefficient of deposit ratio is significant at 5 percent level and the coefficient of provision ratio is significant at 1 percent level.

The sign of the deposit ratio coefficient reflects the funding strategy used by the banking industry in recent history, where customer deposits are replaced by short-term assets to fund the bank's assets, resulting in higher profitability (O'Connell, 2022). Over an extended period of time, banks holding fewer deposits relative to assets, compared to other banks in the market, can expect higher levels of overall profitability due to the reduced cost of holding expensive customer deposits. Financial theory assumes an inverse relationship between liquidity and profitability; however, research has established that banks' management of liquidity has positive implications for banks'

profitability (Ibe, 2014; Khan and Ali, 2016; O'Connell, 2022). The results show that the more a bank increases its holdings of short-term liquid assets over the analysis period, the higher its overall profitability, which is consistent with many previous results. The accepted rationale for these relationships is that funding markets reward a bank for holding liquid assets, thereby reducing its liquidity risk. However, this benefit will ultimately be offset by the opportunity cost of holding comparatively low-yielding assets on the balance sheet (Bordeleau and Graham, 2010).

The coefficient of non-performing loans and bank size are not significant.

As for the coefficients of the macroeconomic variables, The GDP growth rate and inflation rate are negative and sometimes significant. This result can be explained by the fact that the additional profits of banks may be generated by weak competition in the sector, as explained above. Unfortunately, low competition in the sector, as is the case for the Cameroonian banking sector, increases barriers to business finance (Beck et al, 2004), while high competition eases credit constraints (Love and Martínez Pería, 2015; Ryan et al., 2014). Therefore, low profitability emanating from a lack of competition leads to low access to credit, high borrowing rates and thus reduced growth. Cetorelli and Gambera (2001) and Claessens and Laeven (2005) have already found the same results.

4.6. Robustness checks

Next, to test our baseline result, I performed several robustness tests using alternative method for estimate the relationship between ownership, market power and bank profitability.

In table 8, we use alternative methods to estimate our equation (1). By using panel methodology or dynamic panel, the results remain stable. The coefficient of Locally-owned and African-owned banks are still positive and significant at 1 percent level. The coefficients of the market power index are also significant and positive.

In table 9, we use alternative measures of bank profitability. Here the return on equity (Bouzgarrou et al., 2018; Pelletier, 2018), which denotes the ratio of equity of a bank to net income. It is calculated as follows:

$$ROE = Net\ Income/Total\ Equity . \quad (2)$$

$$ROE_{it} = \alpha_0 + \gamma Shareholder_{it} + \beta MarketPower_{it} + \delta X_{it} + \theta Z_t + \eta_i + \varepsilon_{it} \quad (3)$$

It represents bank's assets profitability that quantifies bank's performance in relation to its total equity. The return on equity measures the return shareholders get for their investment in the company. This ratio tells shareholders how much the company is earning for each dollar invested. A high value of ROE refers to the health of the shareholders' investments, an efficient use of their funds. Then, we used OLS estimator step by step from column 2 to column 5, we used panel fixed-effects from column 6 to column 9 and dynamic panel from column 10 to column 13. Our results remain robust to the changes.

In table 10, we use Zscore (Brei et al., 2020; Chen et al., 2017; Houston et al., 2010; Iannotta et al., 2007; Tabak et al., 2012). The Zscore is a measure of overall bank soundness and capitalization and indicates the extent to which a bank reacts positively to shocks to ensure its solvency and profitability. It is calculated as follows:

$$Zscore = \frac{\overline{ROA}_{it} + Total\ Equity_{it}}{\sigma(ROA)_{it}}. \quad (4)$$

$$Zscore_{it} = \alpha_0 + \gamma Shareholder_{it} + \beta MarketPower_{it} + \delta X_{it} + \theta Z_t + \eta_i + \varepsilon_{it} \quad (5)$$

Where ROA_{it} denotes the return on assets of bank (with the mean in the numerator), $Total\ Equity_{it}$ represents the ratio of total equity over total assets, and $\sigma(ROA)_{it}$ is the standard deviation of ROA. A higher score suggests a strong and capitalised bank (and lower probability of bank insolvency). Then, we used OLS estimator step by step from column 2 to column 5, we used panel fixed-effects from column 6 to column 9 and dynamic panel from column 10 to column 13. Our results remain robust to the changes.

Finally, in table 11, to account for endogeneity, we include lagged variables of bank specific factor. The results remain robust to these changes.

4.7. Conclusion chapter 4

The objective of this paper is to find the relationship between ownership structure, market power and bank profitability in Cameroon. Using panel data methodology on 14 commercial banks with 171 observations over 15 years spanning from 2000 to 2014, we use return on assets (ROA) as dependent variable.

Our results indicate that a more local or African shareholder structure of the banks results in higher bank profitability. We can therefore conclude that locally-owned banks and African-owned banks in Cameroon are more profitable than others. Another important finding is that competition reduces banks profitability. The more concentrated the Cameroonian banking market is, so the less competition there is, the more profitable the banks are. We performed several robustness checks, under which the results remained similar and significant. After adding control variables or using other estimator approach, the coefficients of variables locally-owned banks and African-owned banks are still positive and significant. Also, the coefficients of variable HHI, 3- Concentration and Boone Indicator are still positive and significant, except for Lerner Indicator, which is insignificant sometimes.

In sum, the policy recommendations we make are as follows. Firstly, the banking and monetary regulatory authorities in Central Africa and Cameroon in particular should encourage, stimulate and incentivise local or African investment in the share capital of banks in Cameroon through specific policies and regulations. Secondly, control the entry of new banks into this (oligopolistic) market and also control periods of growth of economic activities.

4.8. Appendix chapter 4

Table 4. 1. List of banks and number of observations per bank

Banks name	Obs.	Banks name	Obs.	Banks name	Obs.	Banks name	Obs.	Banks name	Obs.
AFRILAND	15	BGFI-CAM	4	CBC-CAM	15	NFC	14	UBA-CAM	8
AMITY	9	BICEC	15	CITI-CAM	15	SCBC	15	UBC	11
BAC-CAM	6	CA-SCB	15	ECOBANK-CAM	14	SG-CAM	15	Total	171

Note: The sample goes from 2000 to 2014. 14 commercial banks are observed during this period but there are at least 17 commercial banks in Cameroon, nowadays.

Source: COBAC; Bank reports. Authors' calculations.

Table 4. 2. Number of observations per year

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Nb. Obs.	8	10	10	10	11	11	11	12	12	12	12	13	13	13	13	171

Note: The sample goes from 2000 to 2014.

Source: COBAC; Bank reports. Authors' calculations.

Table 4. 3. Summary statistics by bank type (1)

	Obs.	Nbr.	Local	African	Foreign
Local banks	56	6	78.77	10.98	10.24
Foreign African banks	35	3	20.73	75.44	3.83
Foreign non-African banks	80	5	21.30	0.00	78.70
Mean / Total*	171*	14*	40.00	19.04	40.96
Std. Dev.			33.25	31.61	38.16
Min			0	0	0
Max			100	100	100

Note: The sample goes from 2000 to 2014. Percentages are used where appropriate. Obs. = Number of observations. Nbr. = Number of banks, Local (Local banks) are banks where the majority of share is locally-owned, African (Foreign African banks) are banks where the majority of share is African-owned and Foreign (Foreign non-African banks) are banks where the majority of share is Foreign non-African.

Sources: CERBER; WDI; COBAC and Bank reports. Authors' calculations

Table 4. 4. Summary statistics by bank type (2)

	ROA	ROE	Equity	Zscore	Size	NPL	Deposits TAssets	Capital ratio	Inflat°	GDP	HHI	3-Conc	Boone	Lerner	Assets
Local banks	1.12	18.94	14.28	5.26	11.30	18.15	4.35	2.38	2.46	4.23	15.00	31.70	-0.58	37.28	22.96
Foreign African banks	2.45	24.83	13.18	11.35	11.40	19.60	4.21	1.32	2.46	4.23	14.54	30.75	-0.58	37.28	18.24
Foreign non-African banks	2.26	27.25	9.29	10.23	12.30	11.78	4.37	0.57	2.46	4.23	14.98	31.60	-0.58	37.28	42.22
Mean	1.93	24.03	11.76	8.82	11.80	17.46	4.33	1.31	2.46	4.23	14.90	31.46	-0.58	37.28	31.01
Std. Dev.	2.17	22.66	8.01	9.69	1.07	18.25	0.37	4.23	1.50	1.24	1.24	3.63	0.69	8.59	27.31
Min	-5.39	-22.23	2.79	-32.44	8.50	0.00	0.31	0.00	0.23	2.02	12.88	21.72	-1.97	21.98	0.81
Max	8.51	80.80	44.65	44.38	13.49	94	4.91	34.15	5.34	6.78	18.59	40.06	0.59	52.19	104.64

Note: The sample goes from 2000 to 2014. Percentages are used where appropriate. ROA = Return on assets, ROE = Return on equity, Assets = Total assets, Capital ratio = Capital ratio, Size = Bank size, Inflat° = Customer price-Inflation, GDP = GDP growth, HHI = Herfindahl-Hirschmann index, 3-Conc = Concentration of 3 biggest bank. Boone = Boone indicator, Lerner = Lerner index.

Sources: CERBER; WDI; COBAC and Bank reports. Authors' calculations

Table 4. 5. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ROA (1)	1.00													
Local banks (2)	-0.47***	1.00												
African banks (3)	0.16**	-0.29***	1.00											
Foreign banks (4)	0.28***	-0.62***	-0.55***	1.00										
Non-performing loans (5)	-0.247***	0.379***	-0.188**	-0.177**	1.00									
Deposits ratio (6)	-0.04	0.05	-0.05	-0.00	0.35***	1.00								
Capital ratio (7)	-0.08	0.23***	-0.04	-0.17**	0.18**	0.09	1.00							
Size (8)	0.31***	-0.37***	-0.08	0.39***	-0.25***	0.20***	-0.12	1.00						
Inflation (9)	0.01	-0.01	0.04	-0.02	-0.01	0.01	0.04	-0.04	1.00					
GDP (10)	-0.10	0.05	-0.00	-0.03	0.08	0.12	-0.04	0.08	-0.41***	1.00				
HHI (11)	0.04	0.01	-0.13*	0.10	-0.09	-0.26***	-0.01	-0.15**	-0.05	-0.52***	1.00			
3-Conc (12)	-0.03	0.02	-0.09	0.05	-0.02	-0.18**	0.05	-0.10	0.18**	-0.20***	0.63***	1.00		
Boone (13)	0.02	0.00	-0.06	0.04	-0.01	-0.09	0.11	-0.05	-0.18**	-0.24***	0.40***	0.62***	1.00	
Lerner (14)	-0.08	0.08	-0.20***	0.09	-0.10	-0.18**	-0.07	-0.20***	-0.09	0.03	0.48***	0.29***	0.17**	1.00

Note: Where ROA = Return on assets, Local banks = locally-owned banks, African banks = African-owned banks, Foreign banks = Foreign-owned banks, Non-performing loans = Non-performing loans to total loans, Deposits ratio = Total deposits to total assets, Capital ratio = Provisions to total loans, Size = Bank size, Inflation = Customer price index, GDP = GDP growth, HHI = Herfindahl-Hirschman index, 3-Conc = Concentration of 3 biggest banks, Boone = Boone indicator, Lerner = Lerner index.

Table 4. 6. Summary statistics and definition of variables

Variable	Definition	Measure	Obs.	Mean	Std. Dev.	Min	Max
Dependent variables							
ROA	Return on asset	Net income to total assets	171	1.93	2.17	-5.39	8.51
ROE	Return on equity	Total equity to net income	171	24.03	22.66	-22.20	80.80
Z-score	Bank solvency ratio	(Average ROA + total equity)/std. deviation of ROA	171	8.82	9.69	-32.44	44.38
Shareholder variables (in % of share)							
Local banks	Local banks	% of share is majority local	171	40.00	29.26	0	100
African banks	African banks	% of share is majority African	171	19.04	31.61	0	100
Foreign banks	Foreign banks	% of share is majority Foreign	171	40.96	38.16	0	100
Concentration / Competition and Market power index							
HHI	Concentration index	Square sum of market shares	171	14.90	1.24	12.88	18.59
3-Concentration	Concentration index	sum (assets 3 big) to total assets	171	31.46	3.63	21.72	40.06
Boone	Market power index	$\delta_{\pi_{jt}} / [\delta mc_{jt} (mc_{jt} / \pi_{jt})]$	171	-0.58	0.69	-1.97	0.59
Lerner	Market power index	$(p_{it} - mc) / p_{it}$	171	37.28	8.59	21.98	52.19
Banks specifics variables							
Deposits ratio	Liquidity position	Logarithm (Deposits to total assets)	171	4.33	0.37	0.31	4.91
Capital ratio	Financial independence	Provisions to total loans	171	1.31	4.23	0	34.15
Size	Bank size	Logarithm (total assets)	171	11.79	1.07	8.50	13.50
Macroeconomics variables							
Inflation	Customer price	Customer price (annual %)	171	2.46	1.50	0.23	5.34
GDP growth	GDP growth	GDP growth (annual %)	171	4.23	1.24	2.02	6.78

Note: The sample goes from 2000 to 2014. Return on assets (ROA) and Return on equity (ROE) are our dependant variables. Shareholder is our first interest variable. It is the percentage of shares held. If majority is locally-owned. The bank is local (inside Cameroon) If the majority is African-owned. the bank is Africa (outside Cameroon but inside Africa). If the majority is Foreign-owned. the bank is Foreign (outside Africa). Our second interest variable is Market power/Concentration/Competition index. HHI is Herfindahl-Hirschman index. It is the square sum of market shares and measure the concentration of market. 3-Concentration is the 3 biggest banks concentration. It is the sum (by year) of asset of 3 biggest banks to the total assets of all the banks. Boone indicator is a measure of degree of competition based on profit-efficiency in the banking market. It is the relative ratio of marginal profit to marginal cost. In $\delta_{\pi_{jt}} / [\delta mc_{jt} (mc_{jt} / \pi_{jt})]$, π_{jt} represents the average profit of country j in period t . mc_{jt} represents the average value of marginal cost of country j in period t . Lerner represents a measure of the market power of a firm $1 - (mc/p_{it})$. Where p_{it} represents the price of bank i on period t and mc the marginal cost. Capital ratio is the financial independence (provision to total loans). Size is the natural logarithm of total assets which measures the bank size. Inflation is the annual customer price (in %) and GDP growth is the annual GDP (in %).

Sources: CERBER; WDI; COBAC and Bank reports. Authors' calculations.

Table 4. 7. Estimation results

	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
ROA, t-1	0.599*** (0.098)	0.590*** (0.096)	0.623*** (0.101)	0.638*** (0.097)	0.630*** (0.104)	0.551*** (0.092)	0.598*** (0.098)	0.613*** (0.093)	0.609*** (0.102)	0.517*** (0.080)	0.552*** (0.080)	0.567*** (0.081)	0.556*** (0.082)
Local banks	0.033 (0.020)					0.044** (0.020)	0.035* (0.020)	0.037* (0.019)	0.030 (0.019)	0.041*** (0.013)	0.039*** (0.014)	0.038*** (0.015)	0.035** (0.013)
African banks	0.046** (0.022)					0.067*** (0.023)	0.050** (0.022)	0.055** (0.022)	0.047** (0.022)	0.066*** (0.018)	0.057*** (0.019)	0.056*** (0.020)	0.057*** (0.018)
Herfindal-Hirshman Index		0.327*** (0.095)				0.406*** (0.101)				0.450*** (0.125)			
3-Concentration			0.039* (0.024)				0.048* (0.024)				0.051* (0.029)		
Boone				0.341*** (0.121)				0.389*** (0.122)				0.195 (0.138)	
Lerner					0.019 (0.013)				0.020 (0.013)				0.028** (0.013)
Non-performing loans										0.065 (0.064)	0.064 (0.061)	0.071 (0.060)	0.063 (0.064)
Deposit ratio										-2.427** (1.085)	-2.570** (1.208)	-2.482** (1.231)	-2.399** (1.123)
Capital ratio										0.082*** (0.021)	0.079*** (0.023)	0.079*** (0.022)	0.085*** (0.023)
Bank size										0.467* (0.240)	0.302 (0.235)	0.242 (0.235)	0.441 (0.266)
Inflation										-0.067 (0.062)	-0.168** (0.072)	-0.107 (0.067)	-0.129* (0.066)
GDP growth										0.016 (0.090)	-0.195** (0.076)	-0.155* (0.082)	-0.221*** (0.079)
Constant	-4.395** (1.991)	-6.196*** (1.521)	-2.449*** (0.872)	-0.973* (0.574)	-2.039*** (0.777)	-11.683*** (2.856)	-6.083*** (2.134)	-4.591** (1.877)	-4.983** (2.010)	-6.325 (5.553)	2.592 (5.420)	4.325 (5.483)	1.223 (5.080)
Observations	157	157	157	157	157	157	157	157	157	157	157	157	157
R ²	0.708	0.718	0.701	0.711	0.703	0.737	0.713	0.724	0.713	0.785	0.772	0.770	0.774
Adjusted R ²	0.674	0.688	0.670	0.680	0.671	0.705	0.678	0.690	0.678	0.748	0.732	0.730	0.735

Note: The sample goes from 2000 to 2014. The dependant variable is ROA. All the estimations are based on the OLS estimator. Estimations are made step by step in this table and are based on specification $ROA_{it} = \alpha_0 + \gamma SHARE_{it} + \beta CONC_{it} + \delta X_{it} + \theta Z_t + \eta_i + \varepsilon_{it}$. From column 2 to column 5 with estimate without macro variables and from column 6 to column 9 with estimate full model. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4. 8. Robustness tests (1) – Alternative method (Fixed-effects and Dynamic Panel)

Dependent variable=ROA	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Dynamic Panel	Dynamic Panel	Dynamic Panel	Dynamic Panel
ROA, t-1	0.517*** (0.126)	0.552*** (0.123)	0.567*** (0.122)	0.556*** (0.126)	0.631*** (0.063)	0.673*** (0.065)	0.692*** (0.066)	0.678*** (0.065)
Local banks	0.041** (0.016)	0.039* (0.018)	0.038* (0.019)	0.035* (0.017)	0.041** (0.018)	0.039** (0.018)	0.038** (0.019)	0.034* (0.018)
African banks	0.066*** (0.017)	0.057** (0.020)	0.056** (0.021)	0.057*** (0.018)	0.067*** (0.024)	0.059** (0.025)	0.058** (0.025)	0.059** (0.025)
Herfindal-Hirshman Index	0.450*** (0.133)				0.425*** (0.134)			
3-Concentration		0.051*** (0.015)				0.055* (0.033)		
Boone			0.195** (0.077)				0.218 (0.167)	
Lerner				0.028 (0.018)				0.028* (0.015)
Non-performing loans	0.065 (0.056)	0.064 (0.050)	0.071 (0.048)	0.063 (0.047)	0.079 (0.050)	0.079 (0.053)	0.085 (0.053)	0.075 (0.052)
Deposit ratio	-2.427 (1.745)	-2.570 (1.856)	-2.482 (1.847)	-2.399 (1.623)	-2.276*** (0.868)	-2.402*** (0.888)	-2.295** (0.897)	-2.203** (0.915)
Capital ratio	0.082*** (0.027)	0.079** (0.031)	0.079** (0.029)	0.085** (0.029)	0.088*** (0.025)	0.083*** (0.026)	0.083*** (0.026)	0.090*** (0.026)
Bank size	0.467 (0.343)	0.302 (0.341)	0.242 (0.330)	0.441 (0.340)	0.382* (0.227)	0.210 (0.235)	0.148 (0.237)	0.383 (0.257)
Inflation	-0.067 (0.089)	-0.168* (0.084)	-0.107 (0.085)	-0.129 (0.085)	-0.083 (0.064)	-0.184*** (0.064)	-0.115* (0.066)	-0.132** (0.062)
GDP growth	0.016 (0.121)	-0.195** (0.090)	-0.155 (0.093)	-0.221** (0.084)	0.021 (0.106)	-0.191** (0.076)	-0.153* (0.085)	-0.209*** (0.078)
Constant	-3.275 (5.814)	5.653 (7.885)	7.411 (8.004)	4.015 (5.239)				
Observations	157	157	157	157	157	157	157	157
R ²	0.575	0.548	0.545	0.553				
Adjusted R ²	0.546	0.517	0.514	0.522				

Note: The sample goes from 2000 to 2014. The dependant variable is ROA. Estimations from column 2 to column 5 are based on fixed effects panel methodology and from column 6 to column 9, estimations are based on dynamic panel method. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4. 9. Robustness tests (2) – Alternative measure of profitability (ROE)

Dependent variable=ROE	OLS	OLS	OLS	OLS	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Dynamic Panel	Dynamic Panel	Dynamic Panel	Dynamic Panel
ROE, t-1	0.528*** (0.084)	0.553*** (0.086)	0.564*** (0.088)	0.557*** (0.087)	0.528*** (0.134)	0.553*** (0.126)	0.564*** (0.126)	0.557*** (0.131)	0.677*** (0.068)	0.700*** (0.070)	0.714*** (0.070)	0.707*** (0.068)
Local banks	0.482** (0.225)	0.472* (0.240)	0.465* (0.243)	0.412* (0.224)	0.482** (0.186)	0.472** (0.211)	0.465* (0.216)	0.412** (0.181)	0.485** (0.216)	0.474** (0.218)	0.464** (0.218)	0.411* (0.214)
African banks	0.650*** (0.245)	0.561** (0.257)	0.544** (0.258)	0.560** (0.240)	0.650*** (0.195)	0.561** (0.218)	0.544** (0.224)	0.560** (0.188)	0.672** (0.297)	0.586** (0.295)	0.571* (0.293)	0.585** (0.292)
Herfindal-Hirshman Index	5.019*** (1.522)				5.019** (1.866)				5.014*** (1.621)			
3-Concentration		0.684* (0.412)				0.684* (0.346)				0.712* (0.379)		
Boone			2.423 (1.770)				2.423 (1.431)				2.591 (1.890)	
Lerner				0.399** (0.158)				0.399 (0.243)				0.393** (0.181)
Non-performing loans	0.875 (0.732)	0.825 (0.706)	0.892 (0.703)	0.789 (0.712)	0.875 (0.610)	0.825 (0.480)	0.892* (0.461)	0.789* (0.419)	0.905 (0.615)	0.851 (0.620)	0.913 (0.617)	0.795 (0.610)
Deposit ratio	9.199 (12.041)	6.770 (13.179)	7.298 (13.104)	9.131 (12.038)	9.199 (15.495)	6.770 (17.221)	7.298 (17.129)	9.131 (14.015)	11.274 (10.544)	8.757 (10.424)	9.433 (10.445)	11.592 (10.701)
Capital ratio	0.690*** (0.171)	0.629*** (0.190)	0.627*** (0.194)	0.709*** (0.185)	0.690*** (0.198)	0.629*** (0.204)	0.627*** (0.174)	0.709*** (0.208)	0.746** (0.307)	0.676** (0.300)	0.676** (0.303)	0.769** (0.304)
Bank size	3.691 (2.785)	2.157 (2.784)	1.470 (2.774)	4.264 (2.992)	3.691 (3.343)	2.157 (3.314)	1.470 (3.211)	4.264 (3.517)	2.736 (2.715)	1.165 (2.737)	0.495 (2.739)	3.651 (2.998)
Inflation	-0.465 (0.730)	-1.650** (0.765)	-0.856 (0.810)	-1.124 (0.730)	-0.465 (0.931)	-1.650** (0.727)	-0.856 (0.926)	-1.124 (0.810)	-0.544 (0.778)	-1.772** (0.746)	-0.908 (0.761)	-1.112 (0.729)
GDP growth	0.024 (1.218)	-2.368** (0.990)	-1.889* (1.082)	-2.756*** (1.010)	0.024 (1.934)	-2.368 (1.362)	-1.889 (1.533)	-2.756** (1.265)	0.049 (1.268)	-2.420*** (0.859)	-1.971** (0.948)	-2.664*** (0.883)
Constant	-209.090*** (61.850)	-113.470* (58.641)	-89.046 (59.661)	-135.849** (57.956)	-174.838** (66.603)	-78.872 (82.039)	-53.888 (83.628)	-105.140* (57.075)				
Observations	157	157	157	157	157	157	157	157	157	157	157	157
R ²	0.733	0.720	0.717	0.726	0.453	0.427	0.420	0.439				
Adjusted R ²	0.687	0.672	0.668	0.678	0.415	0.387	0.380	0.400				

Note: The sample goes from 2000 to 2014. The dependant variable is ROE. Estimations from column 2 to column 5 are based on OLS estimator, from column 6 to column 9 on panel fixed effects and from column 10 to column 138, estimations are based on dynamic panel method. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4. 10. Robustness tests (3) – Alternative measure of profitability (Zscore)

Dependent variable=Zscore	OLS	OLS	OLS	OLS	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Dynamic Panel	Dynamic Panel	Dynamic Panel	Dynamic Panel
Zscore, t-1	0.525*** (0.103)	0.559*** (0.103)	0.574*** (0.106)	0.563*** (0.107)	0.525*** (0.154)	0.559*** (0.153)	0.574*** (0.153)	0.563*** (0.157)	0.635*** (0.062)	0.677*** (0.064)	0.696*** (0.065)	0.682*** (0.064)
Local banks	0.175*** (0.055)	0.169*** (0.060)	0.166*** (0.061)	0.150** (0.058)	0.175** (0.076)	0.169* (0.086)	0.166* (0.089)	0.150* (0.081)	0.175** (0.079)	0.169** (0.083)	0.166* (0.085)	0.149* (0.082)
African banks	0.293*** (0.077)	0.254*** (0.084)	0.248*** (0.085)	0.250*** (0.080)	0.293*** (0.079)	0.254** (0.095)	0.248** (0.099)	0.250** (0.087)	0.295*** (0.108)	0.263** (0.113)	0.258** (0.114)	0.257** (0.112)
Herfindal-Hirshman Index	1.992*** (0.560)				1.992*** (0.605)				1.869*** (0.604)			
3-Concentration		0.246* (0.130)				0.246*** (0.072)				0.262* (0.148)		
Boone			0.892 (0.610)				0.892** (0.308)				1.002 (0.759)	
Lerner				0.112* (0.057)				0.112 (0.073)				0.111 (0.070)
Non-performing loans	0.317 (0.291)	0.312 (0.275)	0.342 (0.272)	0.311 (0.289)	0.317 (0.264)	0.312 (0.239)	0.342 (0.227)	0.311 (0.216)	0.385* (0.228)	0.382 (0.239)	0.411* (0.241)	0.372 (0.234)
Deposit ratio	-12.556** (5.126)	-13.186** (5.650)	-12.812** (5.741)	-12.542** (5.391)	-12.556 (8.363)	-13.186 (8.804)	-12.812 (8.775)	-12.542 (7.923)	-11.933*** (3.885)	-12.481*** (3.988)	-12.020*** (4.040)	-11.714*** (4.114)
Capital ratio	0.357*** (0.091)	0.338*** (0.102)	0.339*** (0.095)	0.365*** (0.098)	0.357*** (0.111)	0.338** (0.130)	0.339** (0.121)	0.365** (0.123)	0.380*** (0.113)	0.357*** (0.116)	0.357*** (0.119)	0.387*** (0.119)
Bank size	2.067* (1.134)	1.369 (1.114)	1.090 (1.107)	1.895 (1.224)	2.067 (1.546)	1.369 (1.536)	1.090 (1.484)	1.895 (1.463)	1.723* (1.011)	0.999 (1.050)	0.714 (1.057)	1.673 (1.158)
Inflation	-0.318 (0.280)	-0.777** (0.329)	-0.492 (0.306)	-0.594** (0.300)	-0.318 (0.406)	-0.777* (0.396)	-0.492 (0.391)	-0.594 (0.393)	-0.395 (0.288)	-0.855*** (0.289)	-0.527* (0.297)	-0.611** (0.281)
GDP growth	0.066 (0.401)	-0.872** (0.343)	-0.690* (0.369)	-0.977*** (0.353)	0.066 (0.529)	-0.872** (0.402)	-0.690 (0.414)	-0.977** (0.381)	0.090 (0.476)	-0.851** (0.344)	-0.677* (0.384)	-0.918*** (0.354)
Constant	-18.480 (26.377)	19.991 (25.551)	28.369 (26.042)	16.230 (25.174)	-6.167 (30.068)	32.355 (38.835)	40.875 (39.866)	27.554 (29.150)				
Observations	157	157	157	157	157	157	157	157	157	157	157	157
R ²	0.777	0.764	0.762	0.765	0.581	0.557	0.553	0.557				
Adjusted R ²	0.738	0.723	0.721	0.724	0.552	0.526	0.522	0.527				

Note: The sample goes from 2000 to 2014. The dependant variable is Zscore. Estimations from column 2 to column 5 are based on OLS estimator, from column 6 to column 9 on panel fixed effects and from column 10 to column 138, estimations are based on dynamic panel method. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4. 11. Robustness tests (5) – OLS with lagged value

Dependent variable=ROA	OLS	OLS	OLS	OLS	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Panel Fixed-effects	Dynamic Panel	Dynamic Panel	Dynamic Panel	Dynamic Panel
ROA, t-1	0.658*** (0.084)	0.687*** (0.085)	0.699*** (0.084)	0.687*** (0.085)	0.658*** (0.089)	0.687*** (0.089)	0.699*** (0.089)	0.687*** (0.091)	0.791*** (0.064)	0.822*** (0.066)	0.836*** (0.065)	0.825*** (0.064)
Local banks	0.040* (0.023)	0.039* (0.023)	0.039* (0.023)	0.035 (0.023)	0.040** (0.017)	0.039* (0.018)	0.039* (0.020)	0.035* (0.019)	0.039* (0.020)	0.038* (0.020)	0.037* (0.020)	0.034 (0.021)
African banks	0.062*** (0.023)	0.057** (0.023)	0.057** (0.022)	0.054** (0.022)	0.062*** (0.012)	0.057*** (0.013)	0.057*** (0.015)	0.054*** (0.013)	0.061*** (0.021)	0.057*** (0.021)	0.056*** (0.021)	0.053** (0.021)
Herfindal-Hirshman Index	0.306** (0.128)				0.306** (0.115)				0.287** (0.135)			
3-Concentration		0.049* (0.026)				0.049*** (0.014)				0.051 (0.036)		
Boone			0.258** (0.124)				0.258* (0.121)				0.272* (0.159)	
Lerner				0.009 (0.014)				0.009 (0.013)				0.009 (0.013)
Non-performing loans, t-1	0.019 (0.061)	0.019 (0.059)	0.010 (0.059)	0.018 (0.060)	0.019 (0.072)	0.019 (0.067)	0.010 (0.070)	0.018 (0.068)	0.029 (0.051)	0.028 (0.052)	0.019 (0.051)	0.027 (0.052)
Deposit ratio, t-1	0.430 (0.649)	0.362 (0.654)	0.302 (0.646)	0.298 (0.648)	0.430 (0.568)	0.362 (0.556)	0.302 (0.567)	0.298 (0.612)	0.405 (0.569)	0.357 (0.572)	0.312 (0.573)	0.316 (0.577)
Capital ratio, t-1	-0.007 (0.028)	-0.005 (0.029)	-0.008 (0.030)	-0.003 (0.029)	-0.007 (0.020)	-0.005 (0.023)	-0.008 (0.026)	-0.003 (0.024)	-0.003 (0.029)	-0.002 (0.029)	-0.005 (0.029)	0.002 (0.030)
Bank size, t-1	-0.469** (0.210)	-0.600*** (0.204)	-0.601*** (0.212)	-0.563** (0.244)	-0.469* (0.249)	-0.600* (0.281)	-0.601* (0.279)	-0.563** (0.219)	-0.540** (0.214)	-0.673*** (0.210)	-0.675*** (0.209)	-0.615*** (0.224)
Inflation	-0.055 (0.066)	-0.138* (0.075)	-0.068 (0.068)	-0.102 (0.069)	-0.055 (0.085)	-0.138 (0.082)	-0.068 (0.083)	-0.102 (0.083)	-0.061 (0.077)	-0.145* (0.078)	-0.070 (0.077)	-0.099 (0.074)
GDP growth	-0.026 (0.099)	-0.172** (0.076)	-0.118 (0.083)	-0.179** (0.078)	-0.026 (0.126)	-0.172* (0.092)	-0.118 (0.100)	-0.179* (0.088)	-0.026 (0.112)	-0.170** (0.080)	-0.118 (0.085)	-0.168** (0.080)
Constant	-6.229 (5.482)	-0.487 (4.502)	1.109 (4.397)	0.825 (4.754)	-2.584 (4.338)	3.126 (4.445)	4.649 (4.564)	4.309 (4.420)				
Observations	156	156	156	156	156	156	156	156	156	156	156	156
R ²	0.770	0.766	0.768	0.762	0.542	0.535	0.538	0.528				
Adjusted R ²	0.730	0.726	0.727	0.721	0.511	0.503	0.506	0.495				

Note: The sample goes from 2000 to 2014. The dependant variable is Zscore. Estimations from column 2 to column 5 are based on OLS estimator, from column 6 to column 9 on panel fixed effects and from column 10 to column 138, estimations are based on dynamic panel method. Standard errors are shown in brackets. (***, **, *) indicate significance at the 1%, 5%, and 10% level, respectively.

General conclusion

L'objectif de cette thèse était d'analyser les facteurs explicatifs de la rentabilité, de l'efficacité et des créances en souffrance dans le portefeuille des institutions financières à partir de plusieurs échantillons et méthodologies.

Nous avons mis en relief dans le premier chapitre l'importance de la segmentation du marché dans l'efficacité des institutions de microfinance. Nous nous sommes particulièrement intéressés à l'importance de femmes emprunteuses car l'objectif principal est la promotion des exclus de la finance et du marché traditionnel des banques, l'accès aux pauvres et particulièrement des femmes aux services financiers. Pour mesurer le risque dans ce chapitre, nous avons utilisé le portefeuille à risque à 30 jours et il s'avère que plus le pourcentage de femmes emprunteuses est élevé dans le portefeuille de prêts de l'institution, moins le portefeuille à risque est élevé. L'analyse nous montre également que le pourcentage de femmes emprunteuses tend à diminuer et ce paradoxe apparent s'explique par l'augmentation de la taille des institutions de microfinance : les femmes réduisant l'exposition au risque, les institutions dans lesquelles elles sont plus présentes grossissent plus vite, et sont obligées de réduire la part des femmes, au risque d'augmenter leur exposition au risque. Pour conforter ces résultats nous avons utilisé des variables alternatives de mesure du risque telles que le portefeuille à risque à 90 jours, le ratio des provisions pour dépréciation des prêts, le ratio de couverture contre le risque. Les résultats restent stables et significatifs. De même, nous avons utilisé des méthodes d'analyse alternatives telles les méthodes des panels, les GMM et les panels dynamiques. Les résultats restent également stables et significatifs. Nous avons testé la relation entre la taille et le pourcentage de femmes emprunteuses en régressant le taux de variation ou le taux d'accroissement de la taille de l'institution respectivement sur le taux de variation ou le taux d'accroissement du pourcentage de femmes emprunteuses. Nous trouvons une relation négative : une augmentation de la taille moyenne des institutions s'accompagne d'une diminution du

pourcentage de femmes emprunteuses. Nous avons à l'issue de ce chapitre formulé quelques recommandations de politique économique. Premièrement, il est nécessaire de maintenir l'objectif social des IMF's en développant davantage des programmes de valorisation des emprunteuses féminines. Deuxièmement, les IMF's doivent gérer en amont les crédits à problème afin de réduire les provisions pour dépréciation des prêts à travers la mise en place d'une politique efficace de contrôle des dossiers de crédit et de suivi de tous les emprunteurs. Troisièmement renforcer les politiques sur la détention de la liquidité afin de permettre à l'IMF de faire face aux éventuels chocs externes. Enfin, les IMF's devraient renforcer les politiques d'octroi de crédit pendant les périodes d'euphorie et particulièrement en période de crise.

Dans le deuxième chapitre de la thèse, nous avons analysé l'impact de l'origine des actionnaires sur le niveau de risque des institutions financières dans la Communauté Economique et Monétaire d'Afrique Centrale. Dans ce chapitre, nous avons mesuré le niveau de risque pris par l'institution à partir des créances en souffrance. Nous avons constaté que l'origine des actionnaires est un déterminant très important dans cette sous-région. Les résultats nous révèlent que les banques détenues par les actionnaires locaux (venant de la sous-région) opèrent avec des ratios de créances en souffrance plus élevés que leurs homologues détenues par l'Etat ou par des étrangers. Cette constatation peut être liée à des pratiques de gestion, à une sélection des crédits et à une technologie de suivi plus faibles, mais aussi au fait que les banques détenues localement servent une clientèle plus risquée et plus pauvre, avec moins d'antécédents de crédit et un accès autrement limité à l'intermédiation financière. Nous avons également fait des interactions entre les banques locales et l'origine des actionnaires. Les résultats montrent que le deuxième actionnaire majoritaire joue un rôle important sur la prise de risque. Lorsque le deuxième plus gros actionnaire est l'Etat (local) ou les sociétés ou entreprises publiques, celui-ci contribue à des risques plus élevés dans la banque locale. Lorsque le deuxième plus gros actionnaire est plutôt de type étranger, celui-ci contribue à une diminution du risque surtout si ce dernier est un étranger

originaires de la zone Afrique. L'impact négatif des seconds actionnaires publics pourrait être lié à des conflits d'intérêts accrus et à d'autres problèmes de gouvernance (les gouvernements ne sont pas en première ligne et sont donc moins responsables), tandis que l'impact positif des seconds actionnaires étrangers pourrait être lié à des améliorations technologiques mais aussi managériales. Nous avons effectué plusieurs tests de robustesse. Premièrement, nous avons utilisé des mesures alternatives du risque telles que le Z-score qui décrit la solidité de l'institution financière car la littérature montre que les banques solides sont les moins risquées. Nous avons utilisé ensuite le ratio des provisions qui décrit la qualité du management qui peut expliquer le degré de prise de risque (croissance des créances et concentration des créances en souffrance). Les résultats restent stables et significatifs : les banques dont l'origine des actionnaires est locale opèrent avec un niveau de créances en souffrance plus élevé. Les résultats de cette analyse suggèrent que la structure spécifique de l'actionnariat des banques justifie une attention supplémentaire en matière de supervision.

Le troisième chapitre de cette thèse analyse les déterminants de l'inefficacité des institutions de microfinance dans les pays de la Communauté Economique et Monétaire d'Afrique Centrale et de l'Union Economique et Monétaire Ouest-Africaine. Nous avons utilisé dans ce chapitre la méthodologie développée par Wang et Ho pour estimer la technologie de production et les déterminants de l'inefficacité en prenant en compte l'hétérogénéité de chaque institution. Nous avons utilisé une approche par les frontières stochastiques et estimé une fonction de coût *translog*. Les résultats nous montrent que les facteurs explicatifs de l'inefficacité des institutions de microfinance dans ces deux zones sont le pourcentage de femmes emprunteuses, la concentration mesurée par (l'Indice Herfindhal-Hirschman) et l'âge de la microfinance. Dans ces sous-régions, plus l'institution de microfinance est ancienne, moins elle est efficace, et les institutions de microfinance qui se spécialisent dans les prêts aux femmes sont également moins efficaces. L'indicateur de concurrence montre un résultat contre-intuitif aux politiques de dérégulation du secteur bancaire dans la plupart des économies car la concurrence

détériorer a priori l'efficacité des institutions de microfinance dans ces deux sous-régions. Après l'ajout des variables de contrôle, les résultats sont stables et toujours significatifs. L'amélioration de l'efficacité des institutions de microfinance dans la Communauté Economique et Monétaire d'Afrique Centrale et de l'Union Economique et Monétaire Ouest-Africaine passe nécessairement par l'amélioration et le contrôle de la réglementation. Les institutions de microfinance les plus anciennes doivent être mieux supervisées, et le suivi de la libéralisation reste indispensable dans le secteur financier. Ensuite, les institutions de microfinance doivent diversifier leurs portefeuilles sans se spécialiser dans des segments de clientèle particuliers, notamment les femmes.

Enfin dans le quatrième chapitre de la thèse nous nous sommes intéressés à un échantillon plus restreint de banques commerciales. L'objectif ici était d'analyser la relation entre la structure de propriété, le pouvoir de marché et la rentabilité des banques au Cameroun. Les résultats obtenus montrent qu'une structure actionnariale plus locale ou africaine entraîne une rentabilité plus élevée des banques commerciales et, comme pour le secteur de la microfinance, la concurrence réduit la rentabilité de ces banques. Nous avons effectué plusieurs tests de robustesse et nos résultats restent stables et significatifs. Nous avons par exemple ajouté des variables de contrôle ou utilisé d'autres approches d'estimation. Les coefficients des variables spécifiques aux banques dont les actionnaires sont originaires du Cameroun et de l'Afrique restent toujours positifs et significatifs. De même, les coefficients de nos variables de pouvoir de marché, dont l'indicateur de Herfindhal-Hirschman, la concentration des trois plus grosses banques et l'indicateur de Boone sont toujours positifs et significatifs, à l'exception de l'indicateur de Lerner, qui est parfois non significatif. A l'issue de ce dernier chapitre, nous avons également formulé quelques recommandations. Premièrement, les autorités de régulation bancaire et monétaire en Afrique centrale et au Cameroun en particulier devraient encourager, stimuler et inciter l'investissement local ou africain dans le capital social des banques à travers des politiques et réglementations spécifiques. Deuxièmement, il faudrait contrôler l'entrée de nouvelles banques sur ce marché

(oligopolistique) et également contrôler les périodes de croissance des activités économiques.

Cette thèse nous a donc permis d'identifier les facteurs explicatifs de la rentabilité, de la performance et des créances douteuses dans le portefeuille des institutions financières. Nous avons utilisé dans cette thèse pour une première fois (à notre connaissance) la méthodologie de Wang et Ho qui n'a pas encore été implémentée dans la mesure de l'efficacité des institutions financières. Nous avons également décomposé les dépenses opérationnelles en dépenses administratives, de personnels, financières et d'amortissement et de provision pour voir l'impact de chaque composant dans la mesure de l'efficacité de l'institution de microfinance dans les pays de la CEMAC et dans l'UEMOA. Nous avons également dans cette thèse montré l'importance de l'origine des actionnaires en général et en particulier l'effet de l'origine du second actionnaire majoritaire dans la prise de risque dans les banques commerciales de la Communauté Economique et Monétaire d'Afrique Centrale. Nous avons vérifié que le pourcentage de femmes emprunteuses diminue le portefeuille à risque mais tend à diminuer à mesure que la taille de la banque augmente. Enfin nous avons aligné le marché bancaire camerounais sur la théorie de l'efficience des marchés, car la concentration améliore l'efficacité des institutions financières et la rentabilité des banques.

Ce travail présente malheureusement quelques limites. La première limite est liée à la taille de l'échantillon dans certaines études comme celle sur les banques commerciales au Cameroun qui ne comporte que 171 observations ou celle sur les institutions de microfinances dans la Communauté Economique et Monétaire d'Afrique Centrale et dans l'Union des Etats Ouest Africaines qui ne comporte que 530 observations. La deuxième limite est liée à la base de données *Mix Market* qui comporte des biais de sélection de l'échantillon car Le MIX est une base de données autodéclarée, et les IMF divulguent volontairement des informations. Aussi, il est à noter que les données du MIX sont de qualité inégale. Le MIX classe les IMF en fonction de leur niveau de transparence et de fiabilité. Enfin, la dernière limite liée à cette base de données est la taille de la base

par rapport à la réalité. En réalité, le secteur de la microfinance comprend des centaines de milliers d'institutions dans le monde entier, dont la grande majorité ne rapporte pas de données financières au MIX. Parfois, cela est simplement dû au fait que de nombreuses institutions de microfinance sont très petites et ont des systèmes d'information peu fiables.

Dans les travaux futurs, premièrement, nous pensons modéliser le comportement atypique des actionnaires dans les pays en développement pour mieux étayer la prise de risque plus importante par rapport aux banques dont les actionnaires sont d'origine étrangère. Deuxièmement, il serait intéressant de comprendre le mécanisme de la réduction de risque lorsque nous observons le comportement du second actionnaire majoritaire dans les banques locales. Montrer à partir de quel seuil les actionnaires d'origine étrangère ont un impact sur la prise de risque et étendre l'étude sur les autres types de banques dont la majorité actionnariale est d'origine étrangère, africaine et non africaine. Troisièmement, une étude plus approfondie doit être menée sur le paradoxe de l'accroissement du pourcentage de femmes emprunteuses dans le portefeuille de prêts pour gérer le risque et de la taille de l'institution. On pourrait se retrouver à long terme avec des effets en U, et, alors une attention particulière des autorités de surveillance devrait être accordée à l'analyse de la croissance des IMFs.

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Abstract

The main objective of our thesis is to analyse the explanatory factors of profitability, efficiency and non-performing loans in the portfolio of financial institutions. The thesis consists of four chapters. The first chapter proposes to study the importance of customer segmentation on the risk level of the financial institution. To this end, we examine the relationship between the percentage of female borrowers and the risk level of microfinance institutions. We find a negative relationship between the percentage of female borrowers and the portfolio at risk, even though the share of women in the clientele of microfinance institutions tends to decrease. The second chapter analyses the impact of shareholder origin on the risk level of commercial banks. We examine the relationship between shareholder origin and risk in the Economic and Monetary Community of Central Africa. We find that locally owned banks operated with significantly higher non-performing loan ratios than their state-owned or foreign-owned counterparts. The third chapter analyses the determinants of inefficiency of microfinance institutions in the countries of the Central African Economic and Monetary Community and the West African Economic and Monetary Union. The results show that microfinance institutions less specialized in lending to women and younger microfinance institutions are more efficient and that competition worsens the efficiency of microfinance institutions in these countries. Finally, the fourth chapter examines the relationship between shareholder origin, market power and bank profitability. We find that locally owned banks and African owned banks are more profitable than other banks and that competition (market power) worsens (improves) their profitability.

Keywords: Profitability, Efficacy, Risk, Bank, Microfinance.

Résumé

L'objectif principal de notre thèse est d'analyser les facteurs explicatifs de la rentabilité, de l'efficacité et des crédits à problèmes dans le portefeuille des institutions financières. La thèse est constituée de quatre chapitres. Le premier chapitre propose d'étudier l'importance de la segmentation de la clientèle sur le niveau de risque de l'institution financière. Pour cela, nous examinons la relation entre le pourcentage de femmes emprunteuses et le niveau de risque des institutions de microfinance. Nous trouvons une relation négative entre le pourcentage de femmes emprunteuses et le portefeuille à risque, bien que la part des femmes dans la clientèle des institutions de microfinance tend à diminuer. Le deuxième chapitre analyse l'impact de l'origine des actionnaires sur le niveau de risque dans les banques commerciales. Pour cela nous examinons la relation entre l'origine des actionnaires et le risque dans la Communauté Economique et Monétaire d'Afrique Centrale. Nous trouvons que les banques détenues localement ont opéré avec des ratios de prêts non performants significativement plus élevés que leurs homologues détenus par l'État ou par des étrangers. Le troisième chapitre analyse les déterminants de l'inefficacité des institutions de microfinance dans les pays de la Communauté Economique et Monétaire d'Afrique Centrale et de l'Union Economique et Monétaire Ouest-Africaine. Les résultats mettent en évidence le fait que les institutions de microfinance moins spécialisées dans les prêts aux femmes et les institutions de microfinance plus jeunes sont plus efficaces et que la concurrence détériore l'efficacité des institutions de microfinance dans ces pays. Enfin, le quatrième chapitre examine la relation entre l'origine de l'actionnaire, le pouvoir de marché et la rentabilité des banques. Nous trouvons que les banques détenues localement et les banques détenues par des africains sont plus rentables que les autres banques et que la concurrence (pouvoir de marché) détériore (améliore) leur rentabilité.

Mots clés : Rentabilité, Efficacité, Risque, Banque, Microfinance.