Essays on International Risk Sharing

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ABSTRACT

One of the most important benefits of financial integration in theory is the international risk sharing opportunity it provides by insuring income and consumption against domestic output fluctuations. Since sharing risk among countries can yield large potential gains, it is crucial to have a deeper understanding of the channels through which risk sharing takes place at the county level. This thesis attempts to deepen the understanding of the channels of risk sharing in the existing body of knowledge.

The first empirical study examines the potentially important role of migrants' remittances in income risk sharing. Using a large sample of 86 developing countries for the period 1990−2010, the results suggest that remittance inflows serve as an effective channel through which output fluctuations are being absorbed. The diversification of migrants turns out to be the leading explanation of the cross-country differences in the extent of risk sharing: the more diverse the migration destinations of a country, the greater the amount of risk shared.

The second empirical study contributes to the literature by simultaneously examining the cross-sectional and intertemporal channels of risk sharing among states of Australia and regions of New Zealand. In doing so, it investigates the viability of a currency union between Australia and New Zealand from a risk sharing perspective. The results show that the extent of intertemporal smoothing is negligible in both countries. The study also finds a virtual absence of risk sharing when Australia and New Zealand face negative aggregate fluctuations, raising doubts about the feasibility of the union, particularly during economic downturns. From the methodological viewpoint,

the study shows that it is possible to examine both interstate risk sharing and intertemporal smoothing mechanisms in a single framework; besides, distinguishing and measuring the extent of different types of shocks.

Motivated by the concerns that the volatility of returns adversely affects the degree of risk sharing through international financial markets' channel, the third study explores the underlying factors that affect the volatility of returns on cross-border asset (equity and debt) holdings in a sample of 28 industrialized countries. Using aggregate portfolio data, it presents the first cross-country evidence on the leading determinants of the volatility of returns. The main findings are that greater portfolio concentration and an increase in asset holding in emerging markets lead to an elevation in the return volatility, whereas more financial integration and greater household share cause a reduction in the return volatility. The results indicate several possible ways to reap large potential gains from international risk sharing.

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IN THE NAME OF ALLAH, MOST GRACIOUS, MOST MERCIFUL

I am grateful to Allah almighty for giving me the strength to accomplish this long cherished desire of mine. Here I would like to express my sincere thanks to a number of people without whom this thesis would not have been possible.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

OECD	Organisation for Economic Cooperation and Development
EU	European Union
EMU	European Monetary Union
OCA	Optimum Currency Area
GDP	Gross Domestic Product
USA	United States of America
CPI	Consumer Price Index
ASB	Australian Bureau of Statistics
CRRA	Constant Relative Risk Aversion
GLS	Generalized Least Squares
OLS	Ordinary Least Squares
FDI	Foreign Direct Investment
GNI	Gross National Income
UK	United Kingdom
CAPM	Capital Asset Pricing Model
PPP	Purchasing Power Parity
CPIS	Coordinated Portfolio Investment Surveys
WDI	World Development Indicators
EME	Emerging Market Economies
OFC	Offshore Financial Centres
NBFI	Non-Bank Financial Institutions
GMM	Generalised Method of Moments
ODA	Official Development Assistance
MENA	Middle Eastern and North African Countries
NI	National Income

DNI   Disposable National Income

FGLS   Feasible Generalized Least Squares

IFS   International Financial Statistics

GBMD   Global Bilateral Migration Database

CEPII   French Research Center in International Economics

CIS   Commonwealth of Independent States

GCC   Gulf Cooperation Council

LAD   Least Absolute Deviation

AREAER   Annual Report on Exchange Arrangements and Exchange Restrictions

CHAPTER ONE

INTRODUCTION

This chapter presents an overview of the three essays contained in this thesis. In particular, it outlines the motivation and the important contribution that each provides to the existing body of knowledge on international risk sharing. The chapter concludes by outlining a structure for the remainder of the thesis.

1.1   Introduction

One of the most important benefits of financial integration in theory is the international risk sharing opportunity it provides by insuring income and consumption against domestic output fluctuations. In the absence of trade in financial assets (a closed economy scenario), consumption is totally dependent on domestic output: economic agents either consume from their income or utilize savings, which in turn are both functions of output. As a result, when domestic output falls, their consumption also declines. Whereas in an open economy, economic agents can invest in foreign assets and in doing so their income and consumption no longer solely depend on domestic output but also hinge on the output of other countries whose assets they hold. In this way, a country can delink fluctuations in consumption and output by pooling risks with other countries; since economies around the world are often not synchronized, at a given time, some countries may be expanding while others may experience recession.

The underlying theory of risk sharing suggests that under standard assumptions, a country's consumption should not respond to country-specific (idiosyncratic) output

shocks[1] — known in the literature as "consumption risk sharing" and "consumption smoothing" (Diamond 1967; Wilson 1968; Obstfeld and Rogoff 1996; Lewis 1996).[2] Although theoretical models predict complete elimination of idiosyncratic shocks, empirical studies document only a limited degree of risk sharing in the real world, which is inconsistent with the predictions of standard theory (e.g., Backus et al. 1992; Obstfeld 1994; Stockman and Tesar 1995; Baxter and Crucini 1995; Canova and Ravn 1996; Lewis 1996, 1999). This is recognized as one of the major puzzles of international macroeconomics (Obstfeld and Rogoff 2001).

This weak presence of international risk sharing seems contradictory in light of an abundant literature suggesting large potential gains from pooling risk among countries. The evidence suggests that a high degree of risk sharing, increases the level of per capita consumption and welfare, accelerates accumulation of human and physical capital, increases industrial specialization, facilitates financial deepening, enhances economic efficiency, and reduces uncertainty in the growth process (Obstfeld 1994; van Wincoop 1994; Tesar 1995; Athanasoulis and van Wincoop 2000; Kalemli-Ozcan et al. 2003; Pallage and Robe 2003; Basile and Girardi 2010; Volosovych 2013). Since sharing risk among countries can yield substantial gains, it is crucial to have a deeper understanding of the mechanisms through which (partial) risk sharing takes place in practice. Also in view of the recent global financial crisis and the apparent destabilising implications of financial integration, such as global imbalances and unstable capital flows, a comprehensive evaluation of the operative mechanisms of risk sharing is

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[1] In the literature, the difference between county-level and the world-wide variables are referred to as "country-specific" or "idiosyncratic" (Sørensen and Yosha 1998; Volosovych 2013). Subtracting the world-wide variables is important, since by definition, world output fluctuations are non-diversifiable and cannot be eliminated by sharing of risk among countries.

[2] In the literature, smoothing of consumption (income) against output shocks is referred to as "consumption (income) risk sharing", "consumption (income) smoothing" or "consumption (income) insurance". The terms "risk sharing", "smoothing" and "insurance" are synonymous and are used interchangeably throughout the thesis.

essential in formulating macroeconomic policies that would reduce a country's exposure to cross-border transmission of financial shocks.

There are several known mechanisms for sharing risk among countries, which are referred to as the "channels" of risk sharing in the literature.[3] Despite a substantial literature examining various dimensions of international risk sharing, the empirical evidence on the channels of risk sharing is inadequate at best. The central theme of this thesis which includes three self-contained essays is the notion of international risk sharing. Taken together, the studies presented in the thesis attempt to deepen the understanding of the channels of international risk sharing in the existing body of knowledge. In this vein, the essays carry out an in-depth analysis on specific channels of risk sharing by using different sets of countries for which the particular channel has its relevance.

The three essays contained in the thesis are closely related to the strand of research originated by the influential studies of Asdrubali et al. (1996) and Sørensen and Yosha (1998). To examine the channels of risk sharing, Asdrubali et al. (1996) is the first to develop a method that measures the fraction of shocks to output absorbed through different channels, namely factor income flows (capital market), international transfers (fiscal system) and savings (credit market) channels. A survey of this strand of literature indicates that the studies exploring the risk sharing channels for developing countries are relatively sparse. Since the potential welfare gains from risk sharing are presumably even greater for developing countries because of higher volatility of consumption fluctuations (Prasad et al. 2003; Imbs and Mauro 2000), understanding the

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[3] In the literature, the terms "mechanisms" and "channels" are used synonymously.

channels of risk sharing in these economies has considerable significance for macroeconomic stability.

The first essay examines the role of migrants' remittances in smoothing income against idiosyncratic output fluctuations, which is one possible channel of risk sharing for developing countries. This is motivated by the well-known properties of remittance flows to developing countries: first, these flows are the most stable source of external finance for developing economies; and second, they tend to be countercyclical with respect to the economic conditions of the recipient countries. These characteristics make them an effective channel of risk sharing for developing countries. Nevertheless, there is very little evidence on the effectiveness of this channel. This study uses a large sample of 86 developing countries for the period 1990–2010 and attempts to answer two important questions. First, to what extent are output shocks buffered through the remittance channel? Second, what factors explain cross-country differences in the extent of smoothing through remittances? With such an analysis, this essay expands the literature by documenting the major determinants of risk sharing through remittances.

Recent evidence (e.g., Asdrubali and Kim 2004, 2008a) tends to suggest a joint examination of risk sharing and intertemporal smoothing (insurance across time) channels, in order to fully assess the risk sharing capabilities of a given set of countries. This is based on the finding of a high degree of interdependence between risk sharing and intertemporal smoothing channels, thereby indicating that the two mechanisms should not be examined separately as typically carried out in the literature. The literature has also further developed a series of more extensive studies (e.g., Pierucci and Ventura 2010) that distinguish and quantify the effects of various types of shocks

— such as, positive and negative realizations of shocks — in order to assess the strength of smoothing mechanisms across business cycles. Taking these recent developments into consideration, the second essay contributes to the literature by measuring the extent of both risk sharing and intertemporal smoothing mechanisms (in a unified framework) among states and territories of Australia and regions of New Zealand.

Cross-border ownership of financial assets constitutes another important channel of sharing risk among countries (Sørensen and Yosha 1998; Lane 2001; Sørensen et al. 2007; Demyanyk et al. 2008; Balli et al. 2011, 2013; Volosovych 2013). The basic intuition behind risk sharing through cross-border asset holdings is that an internationally diversified portfolio provides stable returns, which in turn facilitates detaching income and ultimately consumption from country-specific output fluctuations. The evidence suggests that the volatility of cross-border returns adversely affects the degree of international risk sharing and the transmission of financial shocks. However, the existing literature has not examined the underlying factors that contribute to the volatility of returns at the country level. Identifying the sources of the volatility of returns is of considerable interest to help formulate adequate policy measures to reap large gains from risk sharing through international financial markets. For that reason, the third essay examines the determinants of the volatility of returns on cross-border asset holdings in a sample of 28 industrialized countries. The study investigates several possibilities. One is that the extent of financial integration may be more or less conducive to the volatility of returns. Another possibility is that the degree of concentration of cross-border investments may considerably affect the volatility of returns. Since equity and debt markets differ significantly in the way they provide risk sharing, this study makes a distinction between equity returns and debt returns.

The rest of the chapter is organized as follows. The next three sections of the chapter present an overview of each of the three essays and in particular highlight how each essay contributes to the existing body of knowledge. Section 1.5 lists research outputs from this thesis. Finally, Section 1.6 outlines the structure of the remainder of the thesis.

1.2   Essay one

The first essay in the thesis examines whether remittance inflows provide an effective channel through which risk sharing takes place in the developing world. It further attempts to explore the underlying factors that determine the magnitude of smoothing via remittances. More specifically, the essay provides evidence as to why some developing countries are able to share more risk compared to others.

Remittance flows have witnessed a tenfold increase in the past two decades and have become the second largest source of foreign capital after foreign direct investment (FDI) for developing countries (Ratha et al. 2010). Unlike FDI and private capital flows that often rise during booms and decline during economic downturns, remittances are found to be countercyclical vis-à-vis the recipient countries (Spatafora 2005; Sayan 2006; Chami et al. 2008; Frankel 2011); and relatively less volatile compared to other external flows (Ratha and Silwal 2012). Given the sheer size and stable pattern, it is imperative to examine whether remittances provide a good hedge against output fluctuations for recipient countries.

The existing literature, however, presents only few studies that assess the risk sharing role of remittances besides other well-defined channels of risk sharing (such as

savings and factor income flows). Since the main focus of these studies is to measure the relative contribution of different channels of risk sharing, they do not undertake a detailed examination of the remittance channel as such. A major limitation is that these studies only report the average estimate of risk sharing for all countries in their sample (e.g., Hadzi-Vaskov 2006; Balli and Ozer-Balli 2011; Balli et al. 2012b). In doing so, they implicitly assume that the risk sharing impact of remittances is uniform across countries. There are two obvious reasons why there might be considerable cross-country variation in the degree of smoothing via remittances. First, in practice some countries are more dependent on remittance inflows than others, and second, because of the varying patterns (procyclical and countercyclical) of remittance inflows found across countries, greater differences in the extent of smoothing are more likely to be seen. Therefore a crucial question remains as to what factors might explain the cross-country differences in the extent of risk sharing through remittances.

Given the aforementioned limitations of the existing research and the growing importance of remittance inflows to the developing countries, there is a need to undertake a comprehensive study to examine the potential stabilizing role of remittances. This essay sets out to fill that void by estimating the amount of smoothing through remittances in a large sample of 86 developing countries for the period 1990–2010. To the best of our knowledge, this is the first major research that has been undertaken to investigate whether remittance inflows stabilize income against domestic output shocks in the recipient countries.

The study measures the extent of smoothing for each country in the sample and then explores the leading determinants of smoothing by regressing the estimated extent

of risk sharing on several potential determinants. In doing so, it connects the missing link between remittances and risk sharing literatures, by identifying the factors that determine the magnitude of smoothing through remittances.

There are also other reasons why an examination of the risk sharing role of remittances contributes to the existing literature. First, this study measures the degree of income smoothing against output shocks which might be reflective of different types of economic shocks, such as, terms-of-trade shocks, policy shocks, natural disasters and production shocks (see e.g., Jeanneney and Tapsoba 2012; Volosovych 2013). Second, the empirical approach used in this study requires data on gross domestic product and remittances inflows, which is available for majority of the developing countries. Employing an income measure of risk sharing is helpful in avoiding a number of data issues, such as taste shocks and puzzles in consumption behaviour, that are common in international consumption data (Deaton and Heston 2010; Volosovych 2013). Finally, the findings from this study may provide important implications for developing countries that typically experience higher fluctuations in output and consumption. As stabilizing these fluctuations generate large welfare gains (Prasad et al. 2003; Imbs and Mauro 2007), it is important to examine the available instruments of macroeconomic stabilization for developing economies.

1.3   Essay two

One criterion for evaluating the viability of a currency (or monetary) union is whether there is an adequate risk sharing mechanism in place among the prospective member countries of the union. The second essay in the thesis examines the viability of a currency union between Australia and New Zealand based on the risk sharing criterion. Particularly, the essay measures the extent of risk sharing (insurance across

regions) and intertemporal smoothing (insurance across time) separately and jointly among states of Australia and regions of New Zealand.

Several research and policy papers have examined the suitability of a currency union between the two countries from different perspectives. The review of these studies suggests mixed evidence.[4] With the exception of Kim and Sheen (2007), no study has examined this subject from a risk sharing perspective. However, Kim and Sheen's study does not address some important issues. Firstly, they do not distinguish between risk sharing and intertemporal smoothing mechanisms. Recent research such as Asdrubali and Kim (2004, 2008a) shows that there exists a considerable interplay between risk sharing and intertemporal smoothing mechanisms, thereby suggesting that the two mechanisms should be jointly examined for a complete assessment of smoothing capabilities of an economic region. Secondly, the authors do not make a distinction between positive and negative idiosyncratic shocks, which seems essential in order to evaluate the strength of risk sharing arrangements under different phases of business cycles. In particular, a successful union between Australia and New Zealand requires that (negative) output shocks are being effectively absorbed in times of recession. Finally, the entire analysis is conducted at the aggregate (country) level, leaving aside the inherent risk sharing patterns among regions of both countries.

This essay makes several important contributions to the literature in Australia and New Zealand context. First, to the best of our knowledge, the essay expands the literature by presenting the first cross-country evidence on the extent of risk sharing

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[4] Some studies argue in favour of a currency union (Hargreaves and McDermott 1999; Crosby and Otto 2002; Grimes et al. 2000; Kim and Sheen 2007); others have suggested that the outcome of a union is either undesirable for Australia (Crosby and Otto 2002), or for New Zealand (Drew et al. 2004; Grimes 2005; Hall 2005), or for both Australia and New Zealand (Lloyd and Song 2006; McGregor 2010); nevertheless a majority of the studies avoid taking sides.

among states/regions of a given set of countries. Previous studies have only looked at the interstate risk sharing patterns within a country as in the case of the US, Germany and Canada (Asdrubali et al. 1996; Hepp and von Hagen 2013; Balli et al. 2012a). Second, following the unified model of Asdrubali and Kim (2008a), this study is the first to measure the extent of risk sharing and intertemporal smoothing simultaneously among regions of Australia and New Zealand. In this way, it also contributes to a small body of empirical research that tests the intertemporal consumption theories in the two countries. Third, the essay distinguishes between smoothing of idiosyncratic shocks and aggregate shocks, as well as between positive and negative realizations of these shocks, in order to capture their distinct impact on interstate risk sharing mechanisms. To the best of our knowledge, it is the first study that measures the extent of risk sharing under positive and negative aggregate shocks. This distinction is important since attaining a significant degree of risk sharing under both types of fluctuations is desirable for the success of the union; otherwise, a member country facing asymmetric shocks may have an incentive to leave the union.

1.4   Essay three

The third essay in the thesis explores the factors that explain the volatility of returns on cross-border asset holdings (i.e. equity and debt holdings) for 28 OECD countries for the period 2001―2009. To the best of our knowledge, this study is the first to use aggregate (country-level) data to carry out a detailed investigation on the potential determinants of the volatility of returns. From a macroeconomic perspective, returns from cross-border investments serve as a distinct mechanism that potentially contributes to consumption smoothing by stabilizing national income. Therefore, understanding the sources of the volatility of returns is crucial, if appropriate policy

responses are to be framed, especially to exploit the gains from risk sharing through cross-border asset holdings.

Cross-border ownership of financial assets constitutes one possibility of risk sharing by diversifying the sources of income, thereby partially insulating income from country-specific shocks. The empirical literature on income risk sharing (e.g., Lane 2001; Sørensen and Yosha 1998; Sørensen et al. 2007; Demyanyk et al. 2008; Balli et al. 2011, 2013; Volosovych 2013) suggests that the extent of smoothing is not only dependent on the size of foreign asset holdings but also on the patterns of their returns. In particular, cross-border asset returns need to be stable with requisite cyclical properties in order to enhance risk sharing. Although several studies (e.g., Lane 2001; Bracke and Schmitz 2011; Balli et al. 2011, 2013) have investigated the cyclical patterns of returns, the literature has so far not explored the underlying factors that affect the volatility of returns. The study fills this gap by presenting the first cross-country evidence on the determinants of the volatility of returns on cross-border asset holdings.

In particular, the study examines four important questions. First, we investigate whether more financial integration causes less volatility of asset returns or not. Second, we explore whether a higher degree of diversification (or less concentration) in investments leads to a reduction in the volatility of returns. A positive answer to this question would suggest that more diversification can further improve income stabilization, while a negative answer may suggest that the motivation to hold a diversified portfolio probably lies elsewhere. Third, we investigate whether grater foreign investments in countries belonging to a certain group, namely OECD countries,

emerging market economies (EMEs) and offshore financial centres (OFCs), cause less or more volatility of returns. Since empirical evidence reveals considerable cross-country heterogeneity in cyclical patterns of returns, it is expected that the distribution of cross-border investments into distinct group of countries may be an important determinant of the volatility of returns. Fourth, for the first time in the literature, the study explores asset holdings by different economic sectors, such as banks, non-bank financial institutions (NBFIs) and households, as a possible determinant of the volatility of returns. Since each sector has its distinct holding motives, particularly with regards to the degree of risk appetite; it would be desirable to estimate their distinct impact on the volatility of cross-border asset returns.

This essay offers several important contributions to the existing literature. To the best of our knowledge, this study is the first to present cross-country evidence on the impact of financial integration and the degree of concentration in cross-border investments, on the volatility of returns. With such an analysis, it extends the existing body of knowledge by verifying the predictions of the portfolio choice theory at the international level. Moreover, the essay makes an original contribution by estimating the effect of the geographical distribution of investments (i.e. OECD countries, EMEs and OFCs) and the share of asset holdings (i.e. banks, NBFIs and households) on the volatility of returns. Since no previous study has explored the role of these factors in the volatility of returns, the findings of this study would bring about new understanding to this issue. Finally, identifying the underlying factors that cause the volatility of returns, would facilitate in formulating macroeconomic policies that would supplement risk sharing across borders; and hence achieve macroeconomic stabilization.

1.5   Research outputs from the thesis

Essay One:

The first essay contained in this thesis is under review at the *World Development*. To date this essay has been presented at the following forums:

a) Faisal Rana (2013) "Risk Sharing through remittances: Evidence from developing countries" 54th New Zealand Association of Economists (NZAE) Conference, Wellington, July 2013.

b) Faisal Rana (2013) "Do remittance inflows provide insurance against domestic output shocks? Evidence from developing countries" 4th School of Economics and Finance (SEF) Research Symposium, Victoria University Wellington, February 2013.

c) Faisal Rana (2013) "Determinants of risk sharing through remittances: Cross-country evidence" 17th New Zealand Finance Colloquium, School of Business, University of Otago, Dunedin, February 2013.

d) Faisal Rana (2012) "Determinants of risk sharing through remittances: Cross-country evidence" 3rd MUPSA Doctoral Symposium, Massey University, Palmerston North, November 2012.

Essay Two:

The second essay is in the process of revision and resubmission to *Contemporary Economic Policy*. To date this essay has been presented at the following forum:

a) Faisal Rana and Faruk Balli (2012) "Would Australia-New Zealand be a viable currency union? Evidence from interstate risk sharing performances" 25th Australasian Finance and Banking Conference (AFBC), Sydney, December 2012.

Essay Three:

The third essay is in the process of revision and resubmission to the *Journal of International Money and Finance*. This essay has been presented at the following forum:

a) Frauk Balli, Syed Abul Basher and Faisal Rana (2012) "Why returns on cross-border asset holdings are so volatile? An examination of likely determinants" 21st European Financial Management Association (EFMA) Meetings, Barcelona, Spain, June 2012.

1.6   Structure of the thesis

The remainder of this thesis is structured as follows. The first essay which examines the impact of remittance inflows on the extent of risk sharing of developing countries is presented in Chapter 2. Chapter 3 presents the second essay which examines the channels of interstate risk sharing and intertemporal smoothing among Australian states and New Zealand regions, while Chapter 4 presents the third essay on the determinants of the volatility of returns on cross-border asset holdings. Chapter 5 outlines the key findings and implications of the three essays and the potential areas of further research.

CHAPTER TWO

ESSAY ONE

Determinants of risk sharing through remittances: cross-country evidence

The sending of remittances is a decentralised decision of migrant workers, nevertheless it has its macroeconomic implication in providing insurance against domestic output shocks in the recipient economies – a phenomenon known in the literature as risk sharing. Using a large sample of 86 developing countries for the period 1990–2010, we establish that remittance inflows serve as an important channel through which risk sharing takes place in the developing world. Although the extent of risk sharing stands at 3.3% on average, there is substantial cross-country variation found in our sample, ranging from 38% for Tajikistan and −13% for Haiti. Subsequently, we explore why the extent of risk sharing through remittances is so diverse across developing countries. The diversification of migrants turns out to be the leading explanation for the extent of risk sharing via remittances: the more diverse the migration destinations of a country, the greater the amount of risk shared. In addition, the size of the remittance flows appears to have a strong and statistically significant impact on enhancing risk sharing. We also find suggestive evidence that remittances originating from more distant countries facilitate more risk sharing compared to those originating from neighbouring or regional economies. Even after splitting the sample on the basis of country characteristics, our results remain robust.

2.1 Introduction

Remittance flows represent an important source of external financing for many developing countries. In the past two decades, remittance flows to developing economies have exhibited a tenfold increase − from US$ 31 billion in 1990 to US$ 332 billion in 2010 (Ratha et al. 2010) − constituting the second largest source of foreign capital after foreign direct investment (FDI). In addition, unlike FDI and private capital flows which declined sharply during the recent global financial crisis, remittances are found to be resilient and relatively less volatile compared to other external flows (Figure 2.1).[5] Unarguably, the sheer size and stable pattern of remittance flows make them economically vital for many countries in the developing world.

Figure 2.1: Remittances and other external flows to developing countries
(Source: data on remittances, FDI, private debt and equity (net flows), and ODA are obtained from the World Development Indicators).

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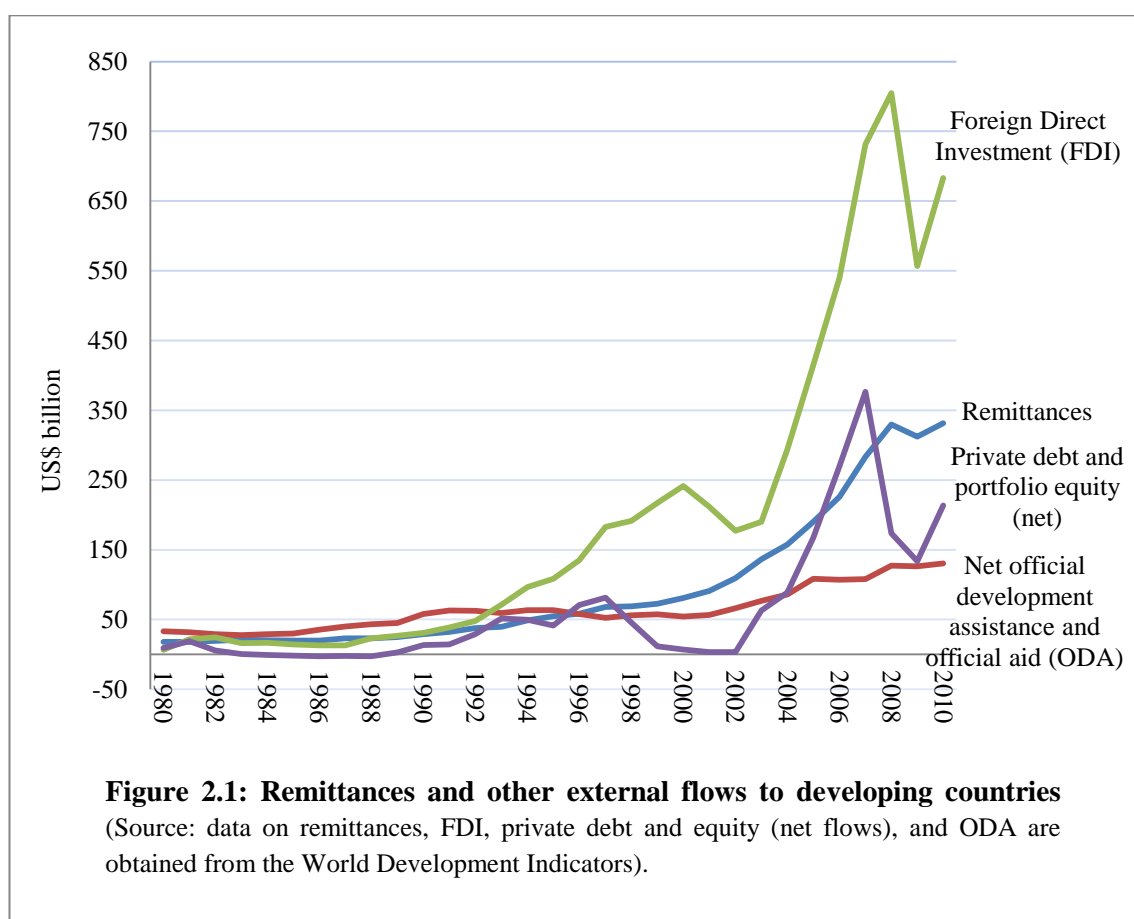
[5] Foreign direct investment (FDI) and private debt and equity flows witnessed a decline of around 40%, compared to an almost 6% drop in remittance flows to developing countries in 2009 (Ratha and Silwal 2012).

With the growing importance of remittance flows, an increasing number of researchers have examined the macroeconomic implications of remittances on recipient economies. Towards this end, recent cross-country evidence has established that remittances impact economic growth (Chami et al. 2003, 2008; World Bank 2005; Jongwanich 2007; Ramirez and Sharma 2008; Barajas et al. 2009; Catrinescu et al. 2009; Giuliano and Ruiz-Arranz 2009), output volatility (Spatafora 2005; Chami et al. 2009; Bugamelli and Paternò 2011; Ebeke and Combes 2013), the severity of poverty (Adams and Page 2005; Jongwanich 2007; Goff 2010), consumption instability (Spatafora 2005; Combes and Ebeke 2011), exchange rate movements (Amuedo-Dorantes and Pozo 2004; Lopez et al. 2007; Barajas et al. 2010), financial sector development (Giuliano and Ruiz-Arranz 2009; Mundaca 2009; Aggarwal et al. 2011), institutional quality (Catrinescu et al. 2009; Abdih et al. 2012b) and other related macroeconomic indicators of the recipient economies.

The underlying role of remittances as investigated in the aforementioned research hinges on the cyclical characteristics of these flows over the business cycle − whether remittances move procyclically or countercyclically with respect to the output of the recipient economy. Conventional wisdom suggests that remittances should move countercyclically with the output, so as to compensate for the lost income of family members owing to economic downturn back home. On the contrary, the procyclical patterns of remittances may further aggravate macroeconomic fluctuations through transmission of shocks from the host to the recipient country.[6]

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[6] For example, the 1990–91 conflict in the Middle East adversely impacted those economies that were dependent on remittances from the region, such as Pakistan and Bangladesh. In a comprehensive study of Middle Eastern, North African and Central Asian economies, Abdih et al. (2012a) conclude that shocks are generally transmitted through remittances to the fiscal balances (i.e. tax receipts) of the recipient economies.

On the specific question of cyclicality of remittances, there is a growing evidence that largely point towards the countercyclicality (or low procyclicality) of remittance flows.[7] To cite few examples: Spatafora (2005) documents a negative relationship between remittances and domestic output in a panel of 87 countries during the period 1980–2003. Frankel (2011), using a large bilateral dataset on remittances, confirms that remittances are countercyclical with respect to the receiving country and procyclical with respect to the sending country. By contrast, in a sample of 12 low and lower-middle income countries, Sayan (2006) finds procyclical as well as acyclical movements in case of some individual countries; nevertheless, the full sample exhibits a countercyclical pattern. Similarly, Chami et al. (2008) calculate a negative correlation of −0.08 between remittances and real GDP per capita for 88 countries; out of which, 38 countries show positive correlations individually, while the remaining 50 countries show negative correlations. Although recent cross-country research has shown keen interest in exploring the cyclical pattern of remittances, it largely ignores its associated implication in terms of providing insurance against domestic output shocks in the recipient economies ─ a phenomenon commonly referred in the literature as risk sharing.[8] Specifically, countercyclical remittance flows may contribute to the recipient economy by insulating its aggregate (country-level) income and eventually consumption from domestic output fluctuations.

The risk sharing hypothesis is of importance, since it is argued that excessive consumption fluctuations that are transmitted through output shocks can have adverse

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[7] While cross-country studies are few, there is an abundant research from a microeconomic perspective (wherein the basic unit of analysis is either the individual or household) that predominantly agrees that remittances positively insure individuals against shocks associated with business cycles, natural disasters and civil wars (see for example, Quartey and Blankson 2004; Azam and Gubert 2005; Adams 2006; Gubert 2002).

[8] See, Lewis (1999), Kose et al. (2007) and Islamaj (2012) for extensive surveys of the risk sharing literature. Following the literature, we use the terms (consumption/income) risk sharing, insurance and smoothing interchangeably throughout this essay.

implications for the accumulation of human and physical capital (Athanasoulis and van Wincoop 2000; Pallage and Robe 2003). Moreover, countries are found to reap large welfare gains from risk sharing which in some cases may exceed 100% permanent increase in the level of per capita consumption (Obstfeld 1994; van Wincoop 1994). Researchers have also documented that improved risk sharing enhances economic efficiency by exploiting the potential gains associated with industrial specialization and economies of scale (Kalemli-Ozcan et al. 2003). Another motivation for exploring the risk sharing potential of remittances is that if they are found to be effective in smoothing output shocks then, in view of the optimum currency area (OCA) theory (Mundell 1973), remittances may be considered as an alternative channel through which prospective member countries of a currency/monetary union can absorb their asymmetric shocks, thereby satisfying the criterion for establishing a union. Overall the remittance channel deserves a special attention as developing economies experience relatively high volatility of consumption fluctuations as compared to developed economies, thereby implying large potential gains from stabilizing these fluctuations (as documented by Prasad et al. (2003) and Imbs and Mauro (2000)).

It is therefore surprising that empirical studies have often overlooked this crucial aspect of remittance flows, resulting in the scant evidence in research concerning the impact of remittances on risk sharing.[9] For instance, amongst the few studies documenting the role of remittances in facilitation risk sharing, Balli and Ozer-Balli (2011), while examining various other risk sharing channels for Pacific Island countries,

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[9] At the household level, remittances are found to provide *ex ante* as well as *ex post* consumption smoothing (Combes and Ebeke 2011). Remittances may offer *ex ante* insurance, as found in the case of some African countries where the remittance-receiving households, instead of auctioning productive assets, utilize their cash holdings during the crisis period. Likewise, an increase in remittances to households when they are unemployed or when the recipient economy is in recession may serve as an ex post risk sharing arrangement.

show that remittances provide substantial risk sharing (absorbing 19% of domestic output shocks) during the period 2001–2007. In another paper on Middle Eastern and North African (MENA) countries, Balli et al. (2012b) find considerable role of remittances in insulating domestic output shocks, particularly in the less developed countries in their sample. Similarly, in a group of 117 developing countries, Hadzi-Vaskov (2006) estimates that countries with above-average remittance flows attain higher levels of consumption risk sharing compared to other sample countries. Apart from the limited time period of analysis (i.e. 1990–2000), this study does not endeavour to answer why the extent of risk sharing through remittances is so diverse across groups of developing countries.

Given the limited research in the area and the exceedingly important role remittances play in the overall macroeconomic stabilization of developing economies, it is imperative to explore the risk sharing potential of remittances. This study is a contribution towards this end. In a sample of 86 developing countries over the period 1990–2010, we first measure the extent of risk sharing via remittances for each country in our sample. Following the literature, our risk sharing measure represents the percentage of idiosyncratic output risk buffered through remittance inflows compared to perfect risk sharing, and ranges from zero (no risk sharing) to 100% (perfect risk sharing).[10] By employing this measure, our results suggest that there is substantial cross-country variation in the estimated degree of risk sharing, ranging from Tajikistan (38%) to Haiti (-13%). As a next logical step, we explore why some developing countries are able to share more risk through remittances compared to others.

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[10] The risk sharing estimate may take a negative value that reflects dis-smoothing of shocks.

First and foremost, we establish that diversification of emigrants is a leading explanation for the extent of risk sharing via remittances: the more diverse the migration destinations of a country, the greater the amount of risk shared. To the best of our knowledge, we are not aware of any paper that has empirically studied the role of migrant diversification. From a risk sharing perspective, more diverse destinations may ensure that remittances are coming from the regions that have less synchronized business cycles, thereby generating aggregate flows that are more countercyclical vis-à-vis the recipient economy than the ones solely originating from a particular region. Our results also support the factual position for some typical remittance-receiving countries such as the Philippines, Turkey and Haiti. The Philippines which has a well-diversified migrant population in the United States (US), the Gulf Cooperation Council (GCC) and Europe, absorb around 15% of output shocks according to our estimate, whereas Turkey, with nearly two-thirds of migrant workers employed in Germany, and Haiti, with around half of migrants in the US, exhibit negative smoothing to the magnitude of −8% and −13% respectively.

Second, we address the issue of whether or not large remittance flows (as a ratio to GDP) tend to facilitate more risk sharing. Here, we document that the size of remittance flows appears to have a strong and statistically significant impact towards enhancing risk sharing. Third, we obtain intuitive findings that remittances originating from farther countries facilitate more risk sharing compared to those originating from neighbouring countries. This is expected, since business cycles are typically more synchronized among regional and neighbouring economies, causing remittances to behave procyclicaly vis-à-vis domestic output, thereby resulting in less smoothing or even dis-smoothing of output shocks. In other words, our finding that remittance

inflows from less distant or regional countries do not enhance smoothing, is consistent with international business cycle literature, which has shown that countries which share the same border or region exhibit higher business cycle correlations, referred to as the border effect (Clark and van Wincoop 2001; Massmann and Mitchell 2004; Martincus and Molinari 2007; Montoya and de Haan 2008).

Finally, we are not able to observe any prominent role that financial openness, financial sector development or institutional quality may play in enhancing the risk sharing capabilities of the recipient economy. Employing both cross-section and panel estimations, splitting the samples and dropping the outliers, reveal that our main findings regarding the effect of diversification of migrants and the size of remittances on risk sharing remain unaffected.

The rest of this essay is organized as follows. In Section 2.2, we present the underlying theory of risk sharing that is used to specify the empirical model. Section 2.3 describes the construction of the variables and the data sources, while the estimation findings are discussed in detail in Section 2.4. Finally, Section 2.5 concludes this study.

2.2   The empirical model

2.2.1   Theory of risk sharing

The theoretical models of risk sharing suggests that under complete financial markets, the consumption of individuals with identical preferences should not respond to idiosyncratic output shocks but should strongly co-move with aggregate consumption (Diamond 1967; Wilson 1968; Cochrane 1991; Mace 1991). By the same analogy, the standard open macroeconomic models (Obstfeld and Rogoff 1996; Lewis 1996) show

that in the presence of trade in goods and financial assets, a country's consumption should be less correlated with domestic output and highly correlated with world consumption. These models predict that in a perfect risk sharing scenario (the complete markets model), a country should be able to completely detach consumption from domestic output fluctuations.

To validate these theoretical predictions, there is an abundant empirical literature that examines the perfect risk sharing conjecture (e.g., Obstfeld 1994; Stockman and Tesar 1995; Baxter and Crucini 1995; Lewis 1996). The consensus from this vast literature indicates that there is only a modest degree of risk sharing among countries, which is far from perfect and not consistent with the predictions of standard theory (Kose et al. 2007; Islamaj 2012). The leading explanations offered for this low level of risk sharing include the presence of non-traded goods, incomplete financial markets and high transactions costs.

Although perfect risk sharing is not supported by the data, it remains important to quantify the operative channels through which (partial) risk sharing takes place. In particular, there is a need to first identify the specific channels through which risk is shared and then quantify the extent of risk shared through each channel. This has not been possible until the path-breaking work of Asdrubali et al. (1996) that propose a method to quantify the relative contributions of risk sharing channels in the US. Extending the framework of Asdrubali et al. (1996) in a cross-country context, Sørensen and Yosha (1998) empirically explore the risk sharing patterns among the European Union (EU) and OECD countries. Their method builds on decomposing the cross-sectional variance of Gross Domestic Product (GDP) into various components,

representing the incremental amount of smoothing achieved through factor income flows, capital depreciation, international transfers and savings.[11] This decomposition approach is simply based on standard national account identities: Gross National Income (GNI) = Gross Domestic Product (GDP) + net factor income, National Income (NI) = Gross National Income (GNI) ─ capital depreciation, Disposable National Income (DNI) = National Income (NI) + international transfers, and, Consumption (C) = Disposable National Income (DNI) ─ savings.

A strand of research later emerges from the aforementioned influential studies, which aimed to quantify the channels of international risk sharing among selected groups of countries (e.g., Kim et al. 2006b; Kim and Sheen 2007; Demyanyk et al. 2008; Tapsoba 2010; Balli and Ozer-Balli 2011; Yehoue 2011; Jeanneney and Tapsoba 2012). Employing Sørensen and Yosha (1998)'s methodology, these studies measure the fraction of shocks to GDP absorbed through each channel, namely factor income flows, international transfers and savings channels. A survey of this literature reveals that the bulk of smoothing is typically achieved through savings and factor income flows, while international transfers remain dormant. International transfers, which mainly constitute remittances (and foreign aid) directly affect disposable income and eventually consumption.[12] Since the strand of research exploring the risk sharing channels has predominantly focussed on developed economies, the potential insurance role of remittances that are economically vital for many developing countries remains relatively unknown. It is therefore interesting to assess whether remittances serve as a potential hedge against domestic output shocks in developing countries. In the next

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[11] For full details on the methodology, see the original papers of Asdrubali et al. (1996), and Sørensen and Yosha (1998).

[12] Jeanneney and Tapsoba (2012) study the stabilizing role of aid inflows in recipient economies and estimate that about 14–19% of output shocks are smoothed out through aid inflows.

section, we outline the empirical specification to measure the extent of income smoothing through remittances.

2.2.2 Risk sharing via remittances

Remittances are able to provide insurance against domestic output shocks when a country in recession receives higher remittances from migrant workers and vice versa. In other words, countercyclical patterns of remittance inflows facilitate the smoothing of output shocks. We follow the regression model of Balli and Ozer-Balli (2011) and Balli et al. (2012b) to quantify the degree of risk sharing through remittances.[13] Their regression examines whether domestic income plus remittance inflows (which can be considered as the "total income" available before other mechanisms of risk sharing take place) varies less than one-to-one with output.[14] To put this simply, we propose a new identity ($gdprem$) which represents the sum of domestic income (gdp) and remittance inflows (wr) i.e. $gdprem = gdp + wr$. Employing this identity to measure income risk sharing via remittances, we run the following regression:

$$\widetilde{gdprem}_{it} = \text{constant} + \alpha_i \widetilde{gdp}_{it} + \varepsilon_{it}, \qquad (2.1)$$

where $\widetilde{gdp}_{it}$ represents the idiosyncratic part of output calculated as the real gdp per capita growth rate of country i in period t minus the world real per capita gdp growth.[15] Similarly, based on the $gdprem$ identity, $\widetilde{gdprem}_{it}$ represents the idiosyncratic part of output calculated as the real $gdprem$ per capita growth rate of country i in period t

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[13] Their empirical specification is based on Asdrubali et al. (1996) and Sørensen and Yosha (1998).

[14] In the literature, some studies use alternative measures of risk sharing i.e. both income and consumption measures. However, the income measure used in this study is preferred over the consumption measure, since international consumption data are known to be affected by taste shocks (Sørensen et al. 2007; Deaton and Heston 2007; Volosovych 2013).

[15] Following the empirical literature, the world real per capita gdp aggregate is calculated by the representative sample of 23 high-income OECD countries that reflect more than 80% of global output (see e.g., Volosovych 2013).

minus the world real per capita $gdprem$ growth.[16] The coefficient $\hat{\alpha}_i$ measures the average degree of comovement between country i's idiosyncratic (per capita) $gdprem$ growth with its idiosyncratic (per capita) gdp growth. The smaller the comovement (indicated by a low $\hat{\alpha}_i$), the greater the degree of smoothing. The corresponding series $100 \times (1 - \hat{\alpha}_i)$ — hereafter denoted by β_i — measures the degree of smoothing in percentage terms. Full risk sharing implies that idiosyncratic shocks to gdp and $gdprem$ are uncorrelated, accordingly β_i approaches 1. In the case when idiosyncratic $gdprem$ reacts more than one-to-one to idiosyncratic gdp, β_i may turn out to be negative, pointing towards dis-smoothing of shocks.[17]

Equation 2.1 represents individual country time series regressions. In other words, we run this model for each country's observations and derive an estimate (β_i), which is considered to be the extent of income risk sharing through remittances. Each time series regression is estimated via the Feasible Generalized Least Squares (FGLS) to adjust for the serial correlation among the error terms (Prais–Winsten estimation method).[18] Sørensen and Yosha (1998) employ somewhat similar risk sharing equations on cross-section estimations and obtain the idiosyncratic component (i.e. the deviation of a country's growth rate from the aggregate growth rate) by removing the time-fixed effect. In this study, we remove the aggregate effect by subtracting the worldwide growth rates of each identity. We deduct the aggregate component from the growth rates, as the worldwide fluctuations cannot be eliminated by the sharing of risk.

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[16] Here $\widetilde{gdprem}_{it}$ is equal to $gdprem_{it}$ minus $gdprem_{wt}$, where $gdprem_{wt}$ is the world-wide aggregate of the $gdprem$ identity.

[17] Since risk sharing takes place when remittance inflows vary less than one-to-one with output, even procyclical remittances may turn out to be stabilizing when they vary less than output. Similarly, countercyclical remittance inflows may aggravate output fluctuations when they vary more that output.

[18] The Feasible Generalized Least Squares (FGLS) approach is asymptotically more efficient than the Ordinary Least Squares (OLS) method when the autoregressive order 1 (AR(1)) exists. We use the Prais–Winsten estimation (Prais and Winsten 1954), since we have a smaller time series sample and cannot afford to lose a single observation.

After quantifying the amount of risk insured by individual countries, we further look for the determinants of the estimate of risk sharing via remittances by regressing the estimated extent of risk sharing (β_i) on several potential determinants. To begin with, we employ cross-sectional specification that enables us to empirically examine the variables that have missing information for some years and those that exhibit little time variation. As this study is at the crossroads of remittance and risk sharing research, we survey both these strands of research and shortlist some important indicators that may possibly determine the magnitude of smoothing via remittances.

To facilitate smoothing, remittances should originate from those countries that have lower business cycle synchronization with respect to the receiving country, since smoothing occurs when remittances and the recipient economy move countercyclically.[19] For this reason, the smoothing property of remittances might hinge on some relevant features of the emigrants, the remittance-sending countries and the size of remittances. Geographical dispersion of the migrants increases the probability of countercyclical remittance receipts as opposed to remittances originating from only a few destinations. The size of remittance inflows may also effectively determine the magnitude of smoothing via remittances. Furthermore, as neighbouring countries are often found to display higher business cycle synchronization, remittances from distant countries may tend to be more stabilizing. Here, we report the model and label the explanatory variables, while the underlying reasoning for employing these variables is

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[19] As mentioned earlier, in a situation where the host and recipient economies are going through recession phase at the same time, smoothing would not occur, since it would be hard for migrant workers to support family members facing similar financial conditions back home (Sayan 2006; Frankel 2011).

discussed in detail in Section 2.4.2. The following cross-section regression equation is estimated:

$$\beta_i = \gamma_0 + \gamma_1 DIV_i + \gamma_2 REM_i + \gamma_3 DIST_i + \gamma_4 CONT_i + \gamma_5 OECD_i + \gamma_6 X_i + \varepsilon_i, \quad (2.2)$$

where γ_0 is the constant and all the explanatory variables are averaged across time for each country i. DIV_i represents the migrant diversification index that captures the extent of diversification of emigrants of each country. REM_i, the proxy for the size of remittances, is measured as the ratio of remittance inflows to GDP. $DIST_i$ refers to the distantness variable, which is the proxy capturing information frictions and remoteness, and is commonly used in gravity models in the trade and international capital flows literature. $CONT_i$ reflects the share of remittances that originate from countries from the same continent as the recipient country. Similarly, $OECD_i$ is a variable that indicates the share of remittances coming from developed (OECD) economies. Finally, X_i contains control variables that include the logarithmic values of the real GDP, representing the size of the economy, and the logarithmic values of the number of migrants, indicating the stock of migrants. The construction of the aforementioned variables, along with the data sources, is discussed in detail in the next section.

Finally, in order to take advantage of both the time series and cross-sectional dimensions of the data, we follow Mélitz and Zumer (1999) and Sørensen et al. (2007) to estimate the panel equation:

$$\widetilde{gdp}_{it} - \widetilde{gdprem}_{it} = v_t + \beta_0 \widetilde{gdp}_{it} + \beta_1 \widetilde{gdp}_{it} * (DIV_{it} - \overline{DIV}_t) + \beta_2 \widetilde{gdp}_{it} *$$
$$(REM_{it} - \overline{REM}_t) + \beta_3 \widetilde{gdp}_{it} * (t - \bar{t}) + \varepsilon_{it}, \quad (2.3)$$

where v_{it} captures the time-fixed effect, while $\widetilde{gdp}_{it}$ and $\widetilde{gdprem}_{it}$ are the same as defined earlier in Equation 2.1. The coefficient $\widehat{\beta_0}$ represents the average risk sharing

via remittances for the sample period 1990–2010. The estimates of β_1 and β_2 measure the impact of the migrant diversification index and the size of remittances on the extent of risk sharing through remittances, respectively. The time trend $t - \bar{t}$ captures the trend changes in risk sharing that are not directly caused by remittances. The explanatory variables (i.e. DIV, REM and time trend) are demeaned in order to remove the cross-section effect. Accordingly, the time fixed variables (i.e. $DIST, CONT$ and $OECD$) are removed from the panel analysis.

Following Sørensen and Yosha (1998) and Balli et al. (2011), we estimate Equation 2.3 by using a two-step Generalized Least Squares (GLS) procedure. To take into account autocorrelation in the residuals, we assume that the error terms in each equation/country follow an AR (1) process. We restrict the autocorrelation parameter to be identical across countries and equations due to the short sample period. Additionally we allow for country-specific variances of the error terms. The GLS regression involves the following steps: first, the entire panel is estimated using ordinary least squares (which is equivalent to a seemingly unrelated regression type equation, since the model contains identical regressors); second, residuals from the first step are used to estimate the variance for each country and corrected for heteroskedasticity (Balli et al. 2011).

2.3   Data and descriptive statistics

We obtain the data from various sources.[20] The remittance inflows data have been obtained from the World Development Indicators (WDI) database.[21] We use the narrow definition of remittances that best reflects remittance behaviour (Chami et al. 2008), which is categorised as *workers' remittances* in the database.[22] The WDI database provides the remittance data in US$ for a long period of time. Our sample consists of 86 developing countries, nearly all of which have a remittance to GDP ratio of 1% or more, on average.[23] The period of analysis is from 1990 to 2010, since there is a strong likelihood of negligible risk sharing (via remittances) prior to 1990, as remittance inflows to the developing world remain stagnant at low levels during this period (see Figure 2.1).[24] We obtain the GDP, consumer price index (CPI) and population data for each country from the International Monetary Fund's International Financial Statistics (IFS) database.[25] In order to convert all variables into a uniform currency, we use the annual exchange rates for the national currency to the US$ from IFS as well.

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[20] For construction of the variables and data sources, see Table A.1 in the appendix.

[21] For a few missing observations, we have extracted the data from the Migration and Remittances Unit, the World Bank and Frankel (2011). We do not use net data on remittances because, firstly, it is not available for most of the developing countries and, secondly, the data on remittance outflows is known to be less reliable than that on inflows (Hadzi-Vaskov 2006).

[22] The broad definition considers remittances as the sum of workers' remittances, compensation of employees and migrants' transfers. By definition, *workers' remittances* reflect "current transfers by migrants who are employed in new economies and considered residents there"; *compensation of employees* covers "wages, salaries, and other benefits earned by individuals — in economies other than those in which they are residents — for work performed for and paid for by residents of those economies"; and, *migrants' transfers* refer to "contra-entries to the flow of goods and changes in financial items that arise from the migration of individuals from one economy to another." (Reinke 2007, p. 2). More specifically, transfers by workers who stay less than one year are categorised under compensation of employees, while transfers by those workers who stay for a year or longer are considered residents and are categorised as workers' remittances. For a discussion of the definitions and issues related to compilation of data on remittances, see Reinke (2007) and Chami et al. (2008).

[23] However, there are few exceptions such as China, which is included as it is among the top remittance receiving countries in *nominal* terms: China has been the second highest recipient of remittances (in dollar terms) after India in recent years (Ratha and Silwal 2012). For a complete list of sample countries, see Table A.1 in the appendix.

[24] In addition, the time period is chosen owing to the unavailability of remittance data prior to 1990 for some countries in our sample.

[25] To estimate Equation 2.1, we transform gdp and $gdprem$ series into real per capita terms by dividing by population and then deflating by consumer price index (CPI).

For the purpose of quantifying the extent of the diversification of emigrants for each sample country, data on bilateral migrant stocks is extracted from the Global Bilateral Migration Database (GBMD) of the World Bank. This data is essentially based on the foreign-born definition of migrants and comprises of five census rounds between 1960 and 2000. Despite the limited period of analysis, this database contains the most comprehensive and reliable data on bilateral global migration to date.[26] Obtaining the migration data on a bilateral basis, we construct a diversification index (DIV_i), similar to the one proposed by Balli et al. (2011), as follows:

$$DIV_i = \frac{1}{\sum_{j=1}^{N}\left|\left(\theta_{ij} - \theta_{ij}^{max}\right)\right|}, \qquad\qquad (2.4)$$

where θ_{ij} is the ratio of migrants originating from country i working in country j over the total number of migrants of country i; θ_{ij}^{max} is the highest ratio among all θ_{ij} and N is the total number of countries where the emigrants of country i are distributed.[27] A higher value for the index implies greater diversification of migrants across the globe.

Following Kalemli-Ozcan et al. (2003), Alfaro et al. (2008) and Volosovych (2013), we construct a distantness variable, which is the weighted average of the distance in thousands of kilometres from the capital city of a particular country to the capital cities of other countries using the total GDP shares of the other countries as

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[26] For a detailed discussion on the Global Bilateral Migration Database (GBMD), see Özden et al. (2011).
[27] This measure is preferred over the other standard measures of diversification (or concentration), such as the Hirschman-Herfindahl index (HHI) and concentration ratio, because of a number of reasons pertaining to the purpose of this study. For instance, concentration measure is not appropriate for cross-country comparisons, since it would not take into account the relative distribution of emigrants across the globe. Similarly, Hirschman-Herfindahl index would assign larger weight to those destination countries which have greater share of migrants from a source country. This is because of the fact that the shares are squared before adding up for obtaining the HHI index values. Moreover, HHI, by construction, is highly sensitive to the entrance of small destination countries (in terms of the share of emigrants), suggesting that the results may be misleading.

weights.[28] We obtain the bilateral distance between the capital cities from the French Research Center in International Economics (CEPII). The distantness variable ($DIST_i$) is expressed as:

$$DIST_i = \frac{1}{T}\sum_{t=1}^{T}\sum_{j}\frac{d_{ij}gdp_j^t}{gdp^t},$$

(2.5)

where d_{ij} is the distance from the capital city of country i to the capital city of country j, gdp^t is the group-wide GDP and T is the total sample length.

Bilateral remittance data is required to compute the shares of remittance inflows originating from OECD countries[29] ($OECD_i$) and from countries belonging to the same continent ($CONT_i$). There is a scarcity of bilateral data which is only available for a few years for our sample countries.[30] We combine various data sources including Ratha and Shaw (2007), Jiménez-Martín et al. (2007), Lueth and Ruiz-Arranz (2008) and Frankel (2011), to obtain the maximum number of observations. In addition to these sources, we have obtained bilateral remittance data from the Migration and Remittances Unit of the World Bank and the web pages of some central banks.[31]

The descriptive statistics for the variables of main interest are presented in Table 2.1. There is a considerable variation in the estimate of risk sharing (β_i) which has a standard deviation of 8%, with a maximum value of 38% for Tajikistan and a minimum value of −13% for Haiti. The average score of the migrant diversification index is 2.96

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[28] As indicated in Alfaro et al. (2008) and Volosovych (2013), this variable is not a direct measure for distance because of using the GDP shares as weights: out of two equally distant countries, the one which has a comparatively smaller economy would display a higher value.

[29] For list of OECD countries included in this study, see Table A.1 in the appendix.

[30] Owing to data limitations, we are able to compute approximate values for these indicators. These proxies are used in cross-sectional estimations since they are expected to remain invariant over time and are averaged for the purpose of estimation.

[31] The various data sources are cross-examined to ensure that a consistent definition of remittances is followed in calculating these shares.

ranging from 7.44 for Syria and 1.09 for Nepal. While the sample countries bear an average remittance to GDP ratio of 5%, for some countries such as Lesotho this ratio is as high as 29%; for a few others such as China, it is close to 0%. Based on our distantness measure, countries belonging to East Asia and the Pacific region are found to be more distant then the rest of the sample, while countries belonging to Europe and Central Asia are generally the least remote: Tonga is the farthest in our sample with a value of 9.45, whereas Poland is least distant, with a value of 8.16.

Table 2.1: Descriptive statistics for the main variables

	Obs.	Mean	Standard Deviation	Maximum	Minimum
Risk sharing via remittance flows (β_i)	86	0.03	0.08	0.38	−0.13
Migrant diversification index	86	2.96	1.38	7.44	1.09
Remittance to GDP ratio	86	0.05	0.08	0.29	0.01
Distantness (log)	86	9.01	0.25	9.45	8.16
OECD share	86	0.55	0.31	0.94	0.00
Continent share	86	0.58	0.32	0.98	0.00
Migrant number (log)	86	12.18	1.76	15.31	7.30
GDP (log)	86	23.28	1.92	28.74	18.52
Financial openness (index)	86	−0.14	1.13	2.46	−1.86
M2 to GDP ratio	86	0.39	0.23	1.19	0.09
Bank deposit to GDP ratio	78	0.32	0.20	1.02	0.07
Private sector credit by banks to GDP ratio	78	0.26	0.20	1.10	0.03
Regulatory quality index	86	−0.32	0.57	1.02	−2.12
Government effectiveness index	86	−0.41	0.54	1.04	−1.43
Corruption perception index	86	3.01	0.93	5.86	1.44

Notes: For a detailed description of the variables, see Table A.1 in the appendix. The second column displays the number of observations (Obs.). All variables are averaged across time for each country.

As expected a large share (55%) of the remittance inflows to sample countries originate from the OECD group (fifth row of Table 2.1). Guinea-Bissau is most heavily dependent with 94% of remittances coming from developed economies. Furthermore, on average, 58% of remittances are received from those countries that belong to the

same continent as the recipient country. Latin American countries typically have a high share of remittances originating from the same continent. Nicaragua is at the top of the list with 98% of remittances originating from same continent, while the Philippines and Cambodia have a negligible share of remittances in this regard (sixth row of Table 2.1).

Prior to running regressions, we draw scatter plots (Figures 2.2–2.5) to examine the possible relationship between the dependent variable (i.e. the risk sharing estimate) and other explanatory variables. Figure 2.2 suggests that there is a positive association between the risk sharing estimate and the migrant diversification index, indicating that countries with more diverse migrants tend to share more risk via remittances. A similar positive correlation is found in the case of risk sharing estimate vis-à-vis the remittance to GDP ratio (Figure 2.3), while the other variables also display the expected behavior which we discuss in detail in the next section.

Figure 2.2: Relationship between the estimate of risk sharing via remittances and the migrant diversification index

Figure 2.3: Relationship between the estimate of risk sharing via remittances and the remittance to GDP ratio

Figure 2.4: Relationship between the estimate of risk sharing via remittances and the distantness indicator

Figure 2.5: Relationship beween the estimate of risk sharing via remittances and the share of remittance inflows from countries belonging to same continent as the recepient country

2.4 Empirical results

2.4.1 Individual countries estimates of risk sharing via remittances

Table 2.2 reports the individual regression estimations (β_i) for Equation 2.1. Out of 86 developing countries, 58 countries exhibit a positive degree of risk sharing through remittances, while 28 countries report a negative estimate as we do not impose any restriction on the sign of the α-coefficients. As reported earlier, the extent of risk sharing via remittances stands at 3.3% on average, with a range from 38% for Tajikistan to −13% for Haiti.

Table 2.2: Samples and the estimates of risk sharing via remittance inflows, β_i(%)

East Asia & Pacific	β_i(%)	Latin America & Caribbean	β_i(%)	Sub-Saharan Africa	β_i(%)
Cambodia	5*	Belize	–9*	Benin	2
China	3	Bolivia	–1	Botswana	3
Fiji	4*	Colombia	2	Burkina Faso	–1
Indonesia	1	Costa Rica	–1	Cameroon	–1
Malaysia	3	Dominica	10**	Cape Verde	4*
Myanmar	2	Dominican Republic	–7	Côte d'Ivoire	–2
Papua New Guinea	–1	Ecuador	14**	Ethiopia	–3
Philippines	15***	El Salvador	–3	Gabon	0
Samoa	4**	Guatemala	–6	Gambia	18**
Solomon Islands	–1	Guyana	11**	Ghana	4
Thailand	2	Haiti	–13**	Guinea	3
Tonga	26***	Honduras	–7	Guinea-Bissau	5
Vietnam	9**	Jamaica	–8*	Kenya	–4
Europe & Central Asia	**β_i(%)**	Nicaragua	2	Lesotho	26***
		Panama	0	Mali	6*
Albania	–6*	Paraguay	–1	Mauritania	1
Azerbaijan	21***	Peru	2	Mauritius	6*
Bosnia and Herzegovina	11**	**Middle East & North Africa**	**β_i(%)**	Mozambique	4
Bulgaria	–4	Algeria	–4	Niger	5*
Croatia	–2	Egypt, Arab Rep.	9**	Nigeria	2
Georgia	2	Jordan	0	Rwanda	–1
Kyrgyz Republic	15***	Morocco	9	São Tomé and Principe	0
Latvia	3	Syrian Arab Republic	12**	Senegal	2
Lithuania	17***	Tunisia	3	Sierra Leone	–2
Moldova	3	Yemen, Rep.	3	Sudan	–2
Poland	1	**South Asia**	**β_i(%)**	Swaziland	12**
Slovak Republic	12**	Bangladesh	–9**	Togo	2
Tajikistan	38***	India	4	Uganda	–3
Turkey	–8*	Nepal	2	Zambia	1
Ukraine	–3	Pakistan	1		
		Sri Lanka	13**		

Notes: β_i quantifies the extent of idiosyncratic output risk smoothed through remittances by each sample country and is obtained from the regression Equation 2.1 as explained in Section 2.2.2. The estimated value of β_i is reported in percentage terms in this table. The time series estimations are conducted for 86 developing countries for the period 1990–2010. Following the related literature, the coefficients are multiplied by 100 and rounded off. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

At first glance, Table 2.2 displays mixed patterns of the estimate (β_i) for countries belonging to a particular region; nonetheless, deeper examination reveals some common trends that warrant discussion. Almost all countries in the East Asia and Pacific region show positive risk sharing. This finding supports Balli and Ozer-Balli (2011), who find a significant amount of risk sharing via remittances for Pacific Island countries during recent years (2001–2007).

Among Latin America and Caribbean countries, we mostly observe dis-smoothing.[32] Since remittance inflows to the region largely originate from North America, possible explanations for negative risk sharing are the less diversification of migrant destinations and a highly correlated business cycle with the US (as documented by Ratha et al. 2010); resulting in procyclical movement of remittances with regards to recipient economies.[33] To clarify this with an example, as remittances are known to move in a procyclical fashion with the output of the host country (Sayan 2006; Frankel 2011; Chami et al. 2008), at times of economic crisis in the US, it may become challenging for a Bolivian worker employed in the US to support his/her family members facing the same economic conditions back home. This is also apparent in Figure 2.6, which shows that countries which receive relatively lesser share of remittances from North America witness higher risk sharing (e.g., Ecuador and Colombia), compared to others (e.g., El Salvador, Guatemala, Haiti and Honduras). Among other regions, MENA countries smooth on average 4.5% of domestic output

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[32] Ten out of seventeen countries belonging to Latin America and the Caribbean region show negative risk sharing, resulting in the average smoothing of around –1% for the whole region. This extent of risk sharing is considerably lower compared to the average smoothing of 3.3% for the whole sample.

[33] Among other factors, the procyclical behaviour of remittances is generally an outcome of the investment motive being dominant over the smoothing motive.

shocks through remittances, comparable to what has been estimated by Balli et al. (2012b) for a similar group of MENA countries.[34]

Figure 2.6: Risk sharing via remittances and the origin of remittances for Latin America and Caribbean countries
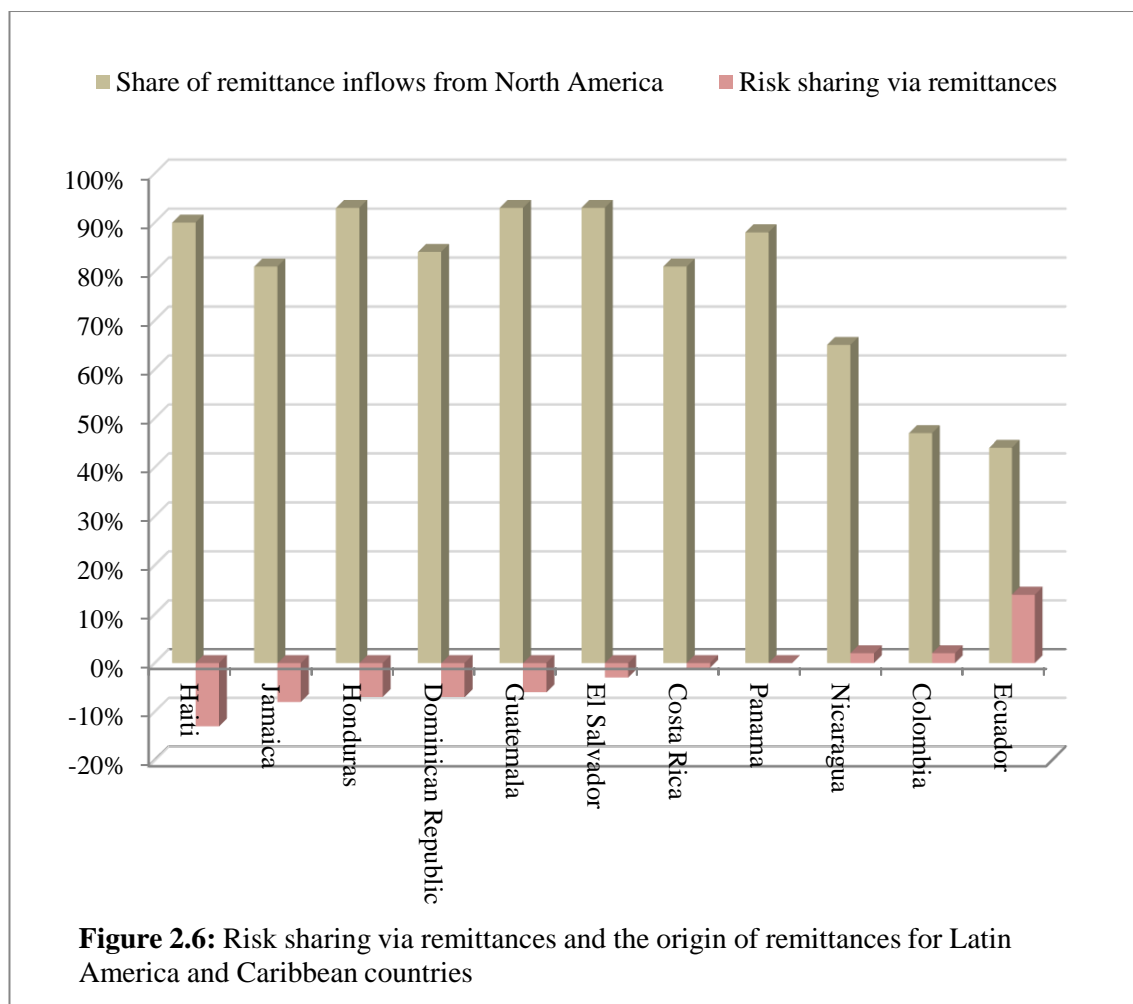
The Europe and Central Asia group mostly comprises of transition economies, some of which — particularly those that belong to Commonwealth of Independent States (CIS) — realize a substantially large estimate for smoothing. For instance, Tajikistan stands at the top of the list in our sample with 38% of the domestic output shocks being absorbed through remittances. Apart from other factors, we conjecture that

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[34] For the period 1992–2009, Balli et al. (2012b) estimate that about 6% of output shocks are buffered through remittances for a sample of non-oil MENA countries that include Egypt, Jordan, Syria, Algeria, Morocco and Tunisia.

this is possibly an outcome of the large size of remittance inflows to Tajikistan, which has had the highest remittance to GDP ratio (around 50%) in the world during the recent years (Slay and Bravi 2011).[35] Hadzi-Vaskov (2006) also finds that the extent of smoothing through remittances is strongest in transition economies in comparison to other developing countries. Most countries belonging to Sub-Saharan Africa witness positive smoothing, while for others with a negative estimate, the extent of dis-smoothing is small. This positive smoothing observed by several regional economies seems to be the outcome of the countercyclical characteristics of remittances, as comprehensively documented by Singh et al. (2009).

Except for Bangladesh, all other countries in South Asia witness positive smoothing. The sources of remittance flows to Bangladesh are heavily concentrated in the GCC countries: 65% of all remittances come from the GCC in 2009. This heavy dependence to a particular region may have resulted in the dis-smoothing of output shocks via remittances. Pakistan also has a higher share of remittance inflows (56%) from GCC economies; consequently, the extent of positive smoothing is negligible.

2.4.2 Determinants of risk sharing via remittances

The aforementioned discussion is primarily based on the findings of other studies that, at best, may partly explain the cross-country patterns of smoothing. There is a need, therefore, to systematically investigate the underlying factors that explain the large cross-country differences in the estimated degree of income smoothing via remittances. We examine these indicators under two specific categories: first, we think about whether the diversification of migrants, the size of remittances and the locational

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[35] Tajikistan has maintained a considerably high average remittance to GDP ratio of 26% in the last two decades (based on our own calculations).

characteristics of remittance-sending countries matter for risk sharing; second, we look for other potential determinants, such as the degree of financial openness, financial development and the institutional quality of the recipient economy, that may affect risk sharing to varying degrees.

2.4.2.1 Diversification, size and sources of remittances

Table 2.3 presents our main findings based on the cross-section estimations of Equation 2.2, where the dependent variable is the estimate of risk sharing via remittance flows (β_i). First and foremost, our variable of interest is the measure capturing the extent of migrant diversification for each country. From a risk sharing perspective, having more diverse migrant destinations may ensure that remittances are coming from regions that have less synchronized business cycles, thereby generating aggregate flows that are more countercyclical vis-à-vis the domestic economy than the ones solely originating from a particular region. Few researchers such as Ratha et al. (2010) also have argued in favour of well-diversified migrant destinations but for different reasons, such as bringing stability in remittance flows, particularly in times of economic downturn.[36]

In Table 2.3, we hold the diversification measure fixed, and introduce all the other explanatory variables, including the control variables, one by one, in order to check the stability of the coefficient of the diversification measure. The migrant diversification measure comes out to be positively significant in all models (Columns 1–8), implying that the more diverse the migration destinations, the greater the amount of risk shared in the recipient economy. A factual case in point here is the Philippines,

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[36] To prove their point, Ratha et al. (2010) document that remittance inflows to India witnessed a modest decline during the recent global financial crisis mainly because of well-diversified Indian immigrants to the GCC (40%), North America (20%) and other regions (40%).

whose emigrants are well-diversified globally, being present in the US, the GCC and Europe, and consequently has a substantially high risk sharing estimate (15%). On the contrary, Turkish and Haitian emigrants are concentrated in a few destinations (mostly Germany and the US, respectively)[37], and may therefore generate remittances that are unable to smooth output fluctuations (−8% and −13%, respectively). This is further supported by evidence of the procyclical behaviour of remittances sent by Turkish workers in Germany with the output in their home country (Sayan 2004, 2006; Sayan and Tekin-Koru 2007a, 2007b).[38] In other words, the remittances that Turkey receives from Germany tend to decrease when there is a slowdown in economic activity in Turkey, leading to dis-smoothing of output fluctuations. Similarly, Ratha et al. (2010) document that business cycles are highly synchronized between Haiti and US, which have resulted in procyclical remittance inflows.

Second, we address the important issue of whether or not relatively large remittance-receiving countries tend to share more risk than others. The size of remittance flows, as measured by the remittances to GDP ratio, is statistically significant at 1% level (Columns 2 and 8), suggesting that higher remittance flows lead to higher risk sharing. As another countercheck, the top recipient economies in terms of the size of remittances are found to share a substantial amount of risk through remittances. For instance, Lesotho has the highest remittance to GDP ratio (29%) in the sample and shares 26% of output shocks. Tajikistan, with a 26% remittance to GDP ratio, has absorbed 38% of output shocks through remittances. Likewise, about 11% of output shocks are being absorbed in Bosnia and Herzegovina, having remittance to GDP

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[37] It has been documented that almost two-thirds of Turkish migrant workers are employed in Germany (Sayan 2006) and half of Haitian migrant workers are employed in the US (Ratha et al. 2010).
[38] Sayan and Tekin-Koru (2007a, 2007b) further argue that remittances from Germany are less likely to have noticeable poverty-reducing effects in Turkey.

ratio of 25%, and 26% of risk is shared in Tonga with a 22% remittance to GDP ratio.

Both our proxies for migrant diversification and the size of remittances appear to be the leading determinants of risk sharing via remittances, as together they capture almost 28% of the variation in the risk sharing estimate, as indicated by a relatively high R-squared (Column 2), given the cross-section nature of our estimations.

In Columns 3–5, we use proxies representing the relevant features of the remittance-sending countries that are similar to the variables commonly used in gravity models from the trade literature. In the risk sharing context, remittances that come from distant countries may have opposite implications than the ones that originate from less remote or regional countries, owing to the degree of business cycle synchronization. Because of higher business cycle correlations among regional and neighbouring countries (known as the border effect in international business cycle literature)[39], it is expected that remittances originating from the same continent or region will be procyclical and thus fail to serve as a buffer against domestic output shocks.

The estimated coefficients, for the Distantness, the proxy capturing "remoteness" and information frictions, and Continent share (representing the share of remittances coming from countries belonging to the same continent) point towards similar outcomes. For any of these measures, we obtain intuitive findings indicating that a higher proportion of remittances coming from countries that share the same continent as the recipient country and remittances coming from less distant countries negatively affect the extent of risk shared via remittances.

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[39] See for example, Clark and van Wincoop (2001), Martincus and Molinari (2007), and Montoya and de Haan (2008).

Table 2.3: OLS estimations: exploring the determinants of risk sharing via remittance flows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: estimate of risk sharing via remittance flows (β_i)								
Migrant diversification index	0.021	0.017	0.020	0.020	0.017	0.021	0.022	0.017
	(3.02)***	(2.60)**	(3.10)***	(2.96)***	(2.24)**	(3.10)***	(3.41)***	(2.59)**
Remittance to GDP ratio		0.408						0.349
		(2.74)***						(2.71)***
Distantness (log)			0.054					0.038
			(1.69)*					(1.23)
OECD share				-0.049				-0.059
				(-1.38)				(-1.86)*
Continent share					-0.053			-0.047
					(-1.68)*			(-1.63)*
Migrant number (log)						-0.002		0.013
						(-0.54)		(1.81)*
GDP (log)							-0.008	-0.011
							(-1.93)*	(-1.74)*
R-squared	0.13	0.28	0.15	0.16	0.16	0.13	0.16	0.39
Observations	86	86	86	86	86	86	86	86

Notes: The dependent variable β_i quantifies the extent of risk sharing through remittance inflows, and is obtained from regression Equation 2.1 as explained in Section 2.2.2. This table reports cross-section estimations including a constant term and employing the OLS technique. All variables are averaged across time for each country. The standard endogeneity tests are performed to detect the endogeneity problem. White heteroscedasticity-consistent t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively. For a detailed description of the explanatory variables, see Table A.1 in the appendix.

The OECD share is employed to check whether remittance inflows from developed economies are stabilizing although the linkage is ambiguous. The coefficient is negative and significant at 10%, indicating that a higher proportion of remittance inflows from the OECD group is unfavourable for smoothing out output fluctuations.[40] The interpretation for the negative coefficient for the OECD share is not straightforward. There are some strong channels through which shocks are known to be transmitted from the OECD to developing economies, depending on the varying degree of their financial exposure. This has possibly resulted in producing business cycles that move in tandem in both developed and recipient countries, thus generating remittances from the OECD group that are procyclical to the recipient economy.

2.4.2.2 Financial openness, financial development and institutional quality indicators

Apart from the aforementioned indicators, we search for other potential determinants of smoothing based on the survey of remittance and risk sharing literatures. In this regard, we are further interested in exploring whether the degree of financial openness, financial development and institutional quality, influence the recipient country's capacity to absorb output shocks through remittances. In Table 2.4, we present the estimations by adding the relevant measures one by one, along with controls relating to the size of the economy and the stock of emigrants.

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[40] In other words, this implies that remittances originating from developing countries should enhance smoothing. Our preliminary investigation supports this conjecture (positive and significant coefficient) when developing countries' share (i.e. the non-OECD share) is included as an explanatory variable.

Table 2.4: Other potential determinants of risk sharing via remittance flows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: estimate of risk sharing via remittance flows (β_i)							
Financial openness (index)	0.001						
	(0.13)						
M2 to GDP ratio		0.000					
		(0.14)					
Bank deposit to GDP ratio			0.057				
			(1.76)*				
Private sector credit by banks to GDP ratio				0.055			
				(1.54)			
Regulatory quality index					0.000		
					(0.03)		
Government effectiveness index						0.015	
						(0.93)	
Corruption perception index							0.001
							(0.10)
Migrant number (log)	0.001	0.001	0.012	0.011	0.002	0.002	0.002
	(0.19)	(0.18)	(1.33)	(1.29)	(0.18)	(0.15)	(0.17)
GDP (log)	-0.005	-0.006	-0.000	-0.001	-0.005	-0.007	-0.006
	(-0.65)	(-0.70)	(-0.01)	(-0.08)	(-0.71)	(-0.89)	(-0.71)
R-squared	0.02	0.02	0.08	0.08	0.02	0.03	0.02
Observations	86	86	78	78	86	86	86

Notes: For an explanation of the estimation procedure, see the notes of Table 2.3. White heteroscedasticity-consistent t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively. For a detailed description of the explanatory variables, see Table A.1 in the appendix.

Our first indicator is the measure for financial openness, which appears to have an expected positive (albeit insignificant) impact on smoothing via remittances. We then examine whether financial sector development plays any role in absorbing output shocks through remittances. On the one hand, a well-developed financial sector is expected to direct remittances to projects with higher returns; on the other hand, remittances are found to provide an alternative financing channel to address liquidity constraints in countries with a less developed financial sector (e.g., Giuliano and Ruiz-Arranz 2009; Combes and Ebeke 2011).

Here we use three different measures to proxy for financial sector development, that include (1) liquid liabilities as a share of GDP (M2 to GDP ratio); (2) bank deposits, comprising demand, time and saving deposits as a share of GDP; and (3) private credit by deposit money banks as share of GDP.[41] In all of the models (Columns 2–4), financial development measures remain mostly insignificant with a positive sign. This positive sign may also be because countries with a more developed financial sector fetch a high volume of remittances (Giuliano and Ruiz-Arranz 2009), and thus enhance risk sharing. To tackle this, we also control for the size of remittance inflows, but obtain similar findings.

Finally, we investigate whether or not institutional quality matters for risk sharing via remittances. Logically, remittances can contribute more towards smoothing when there are sound institutions and policies in place that provide incentives to utilize these flows prudently. Volosovych (2013) estimates that an improvement in investor protection enhances risk sharing from cross-border factor income by fivefold.

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[41] For an extensive literature survey on financial development indicators, see Levine (1997).

Fratzscher and Imbs (2009) also obtain comparable findings. Similarly in remittance literature, Catrinescu et al. (2009) conclude that remittances enhance growth in countries having better quality institutions. By contrast, Abdih et al. (2012b) document that remittance inflows adversely impact the institutional quality of the recipient economy, primarily for the reason that the government diverts these resources to cater to its own objectives.

As in the previous case, we introduce three measures that reflect different dimensions of the institutional quality of the recipient economies, namely regulatory quality, government effectiveness and the corruption perception index. We find that all the measures for institutional quality exert a positive but statistically insignificant impact on risk sharing via remittances (Columns 5–7). Overall, we are not able to observe any prominent role that financial openness, financial sector development and institutional quality, perform to enhance the risk sharing capabilities of the recipient economy.

2.4.2.3 Sub-sample analysis and removing outliers

To investigate whether our earlier results are sample-specific, we group our sample countries on the basis of relevant country characteristics namely, high/low remittance to GDP countries, high/low emigrant to population countries, high/low financially open countries, high/low financially developed countries, and non-African/African countries. Although the distinction between high and low categories is subjective and is essentially driven by the aggregate sample size[42]; nevertheless, these groupings are fairly representative of the underlying characteristics on which they are

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[42] Considering the aggregate sample of 86 countries and retaining sufficient number of observations (in each group) for estimation purposes, the groupings turn out to be of approximately equal size.

based. For instance, high remittance to GDP countries, have remittances exceeding 9% of GDP on average, while low remittance to GDP countries have only 1% remittance to GDP ratio (on average).[43]

As can be seen from Table 2.5, the estimate for migrant diversification is strongly significant in all sub-samples, implying that higher diversification of emigrants facilitates higher smoothing through remittances. Similarly, Table 2.6 echoes our previous results that a high remittance to GDP ratio enhances risk sharing. However, it is worth noting that the estimated coefficient is insignificant in case of more financially open countries. One possible explanation could be that more open economies have other dominant mechanisms through which remittances augment smoothing. Overall, both the measures capturing migrant diversification and the size of remittances are found to be robust to splitting the samples.

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[43] Similar is the case with all other groups. For high/low remittance (to GDP) countries: all countries with remittances more than 3% of GDP are included in the high remittance to GDP group (group mean: 10%), while those with less than 3% of GDP are included in the low remittance to GDP group (group mean: 1%). For high/low emigrant (to population) countries: all countries with emigrants above 5% of the population are included in the high category (group mean: 18%), while countries with below 5% value are included in the low category (group mean: 2%). For high/low financially open countries: all countries that have Chinn–Ito index values between –0.3 to 2.5 are considered high financially open countries (group mean: 0.8), while countries with index values between –0.3 and –2.5 are included in the less open category (group mean: –1.1). For high/low financially developed countries: all countries that have M2 to GDP ratio above 30% belong to the more financially developed countries (group mean: 53%), while those with below 30% value are categorized under as less financially developed countries (group mean: 22%). For non-African and African countries: countries belonging to Sub-Saharan Africa are indicated as African countries, while all other countries mentioned in Table 2.2 are categorized as non-African countries.

Table 2.5: Sub-sample analysis: impact of the diversification of emigrants on risk sharing via remittance flows

	High remittance (to GDP) countries	Low remittance (to GDP) countries	High emigrant (to population) countries	Low emigrant (to population) countries	High financially open countries	Low financially open countries	High financially developed countries	Low financially developed countries	Non-African countries	African countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

Dependent variable: estimate of risk sharing via remittance flows (β_i)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Migrant diversification index	0.037	0.014	0.032	0.024	0.035	0.021	0.027	0.024	0.029	0.029
	(4.53)***	(2.38)**	(2.99)***	(3.59)***	(5.66)***	(2.54)**	(4.96)***	(2.18)**	(2.83)***	(5.02)***
Migrant number (log)	0.016	0.011	0.013	0.004	0.013	0.012	-0.007	0.031	0.018	0.002
	(2.11)**	(0.94)	(0.69)	(0.48)	(1.35)	(1.06)	(-0.68)	(2.49)**	(1.49)	(0.37)
GDP (log)	-0.024	-0.009	-0.018	-0.000	-0.018	-0.017	-0.005	-0.031	-0.022	-0.009
	(-2.18)**	(-0.94)	(-1.24)	(-0.01)	(-1.78)*	(-1.52)	(-0.66)	(-2.27)**	(-2.07)**	(-1.62)
R-squared	0.26	0.11	0.17	0.39	0.26	0.14	0.34	0.16	0.13	0.53
Observations	43	43	46	40	42	44	46	40	50	36

Notes: For explanation on the estimation procedure, see the notes of Table 2.3. White heteroscedasticity-consistent t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively. For a detailed description of the explanatory variables, see Table A.1 in the appendix.

Table 2.6: Sub-sample analysis: impact of the size of remittances on risk sharing via remittance flows

	High remittance (to GDP) countries	Low remittance (to GDP) countries	High emigrant (to population) countries	Low emigrant (to population) countries	High financially open countries	Low financially open countries	High financially developed countries	Low financially developed countries	Non-African countries	African countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable: estimate of risk sharing via remittance flows (β_i)										
Remittance to GDP ratio	0.470	1.771	0.553	0.454	0.332	0.516	0.376	0.911	0.73	0.361
	(3.25)***	(2.46)**	(1.69)*	(5.62)***	(1.29)	(3.83)***	(4.12)***	(2.19)**	(2.04)**	(6.94)***
Migrant number (log)	0.005	0.000	0.023	0.000	0.013	0.001	0.017	0.006	0.018	0.006
	(0.55)	(0.03)	(1.05)	(0.00)	(1.03)	(0.13)	(1.69)*	(0.62)	(1.07)	(0.90)
GDP (log)	-0.005	-0.002	-0.009	-0.004	-0.002	-0.000	0.011	-0.007	-0.012	-0.001
	(-0.42)	(-0.23)	(-0.57)	(-0.67)	(-0.24)	(-0.02)	(1.44)	(-0.77)	(-0.99)	(-0.15)
R-squared	0.27	0.16	0.15	0.56	0.07	0.37	0.29	0.31	0.17	0.43
Observations	43	43	46	40	42	44	46	40	50	36

Notes: For explanation on the estimation procedure, see the notes of Table 2.3. White heteroscedasticity-consistent t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively. For a detailed description of the explanatory variables, see Table A.1 in the appendix.

Among all subsamples, we are particularly interested to see whether our main variables behave differently with the inclusion of other explanatory variables in the case of high/low categories of financially open countries and financially developed countries. This is primarily for the reason that these country characteristics appear to be vital for an effective role of remittances in providing insurance against output shocks. Also our previous results indicate that the level of significance of the migrant diversification and the size of remittance measures differ among these subsamples.

Table 2.7 reports the results in the presence of other explanatory variables. As established earlier, the size of remittance flows does not affect the extent of smoothing in more open economies (Column 1). By contrast, in high/low financially developed countries, both our proxies for migrant diversification and the size of remittances are significant. Our findings here do not conform to those of Combes and Ebeke (2011) which suggest that remittances work better towards stabilizing consumption in less financially developed economies. The coefficients of the other explanatory variables related to the locational characteristics of the remittance-sending countries (i.e. Distantness, OECD share, and Continent share) have the expected signs but are mostly insignificant. To sum up, even after splitting the samples, our main results, by and large, remain unaffected.

Table 2.7: Sub-sample analysis: determinants of risk sharing via remittance flows

	High financially open countries	Low financially open countries	High financially developed countries	Low financially developed countries
	(1)	(2)	(3)	(4)
Dependent variable: estimate of risk sharing via remittance flows (β_i)				
Migrant diversification index	0.029	0.090	0.020	0.015
	(3.74)***	(2.04)**	(3.44)***	(2.19)**
Remittance to GDP ratio	0.208	0.385	0.295	0.890
	(0.85)	(3.09)***	(3.35)***	(3.36)***
Distantness (log)	0.026	0.028	0.066	0.026
	(1.87)*	(1.71)*	(1.99)*	(0.40)
OECD share	-0.023	-0.086	0.040	-0.113
	(-0.64)	(-1.98)*	(1.09)	(-3.70)***
Continent share	-0.034	-0.063	-0.024	-0.077
	(-0.89)	(-1.63)	(-0.72)	(-2.41)**
Migrant number (log)	0.011	0.014	0.000	0.017
	(1.00)	(1.43)	(0.04)	(1.95)*
GDP (log)	-0.013	-0.011	0.002	-0.015
	(-1.45)	(-1.26)	(0.38)	(-1.59)
R-squared	0.29	0.54	0.49	0.60
Observations	42	44	46	40

Notes: The estimation procedure is the same as mentioned in the notes of Table 2.3. White heteroscedasticity-consistent t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

As another robustness check to consider whether or not the findings are driven by outliers, Equation 2.2 is estimated by dropping the extreme values of the risk sharing estimate (β_i). The top and bottom 3.5% of the countries in terms of high and low values of β_i are removed;[44] nevertheless, the estimates of the migrant diversification index and the remittance to GDP ratio remain significant. In addition, we employ Least Absolute Deviation (LAD) estimation that gives less weight to outliers as compared to OLS estimation (Volosovych 2013). The migrant diversification index is highly significant at the 1% level, while the other explanatory variables are insignificant with a pseudo R-squared of 18%. In general, the findings remain robust to controlling for outliers.[45]

2.4.2.4 Panel regression results

Finally, to take advantage of both dimensions of the data, we estimate the panel specification in Equation 2.3 using a two-step Generalized Least Squares (GLS) regression. As can be seen in Table 2.8, the estimation results for the panel model are similar to the results obtained with the cross-section regressions. The coefficient $\widehat{\beta_0}$ reflects the average risk sharing via remittances, which is comparable to the average of the estimated extent of risk sharing obtained by individual countries as reported in Table 2.2. Further confirming the results of the cross-section estimations, both our measures for migrant diversification and the size of remittances are positive and highly significant. The coefficient of the time trend is positive (but not significant), which roughly indicates that risk sharing through remittances has improved over time.

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[44] The bottom three countries in terms of the risk sharing estimate (β_i) include Haiti (–13%), Bangladesh (–9%) and Belize (–9%), while the top three countries include Tajikistan (38%), Lesotho (26%) and Tonga (26%).

[45] Following Volosovych (2013), we also experiment by including other controls such as the financial openness, financial development and institutional quality indicators one by one into our main regression (Equation 2.2); nevertheless, the results remain somewhat similar.

Table 2.8: Panel estimations: leading determinants of risk sharing via remittance flows

	(1)	(2)	(3)
β_0	0.021	0.021	0.020
	(1.65)	(1.35)	(1.22)
Trend	0.450	0.391	0.410
	(0.21)	(0.44)	(1.03)
Migrant diversification index	1.143		2.032
	(2.94)***		(3.07)***
Remittance to GDP ratio		2.270	2.301
		(3.67)***	(3.83)***
R-squared	0.16	0.21	0.33
Observations	1624	1624	1624

Notes: This table reports the panel estimations results obtained from regression Equation 2.3 as explained in Section 2.2.2. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively. For a detailed description of the explanatory variables, see Table A.1 in the appendix.

2.5 Concluding remarks

Remittances are considered as a valuable source of foreign exchange in many developing countries, particularly in times of economic downturn. Unlike FDI and private capital flows which often rise during booms and decline during economic downturns, remittances are found to be countercyclical and relatively less volatile compared to other external flows. With the growing importance of remittance flows, an increasing number of researchers have simultaneously examined the macroeconomic implications on recipient economies. Contributing to this strand of literature, our study examines the potentially important role of migrants' remittances in providing insurance against domestic output shocks. Using a large sample of 86 developing countries over the period 1990–2010, our results suggest that remittance inflows provide an important

channel through which risk sharing might take place in the developing world. Although the extent of risk sharing via remittances stands at 3.3% on average, there is substantial cross-country variation found in our sample, ranging from 38% for Tajikistan to −13% for Haiti. We therefore thought it necessary to explore why the impact of remittances is so heterogeneous across developing countries.

Against this background, our study documents some leading determinants of risk sharing via remittances. Most importantly, we estimate that countries with well-diversified migrants globally, share more risk than others. This is further supported by evidence that those countries which are well-known for broad geographical dispersion of their migrants (such as the Philippines) are found to attain a higher degree of risk sharing, while countries whose migrants are concentrated in a few destinations (such as Turkey and Haiti) are unable to insure through remittances. In addition, a larger amount of remittance flows is likely to have a greater stabilizing impact on recipient economies. It is also observed that remittances originating from less distant countries and from countries belonging to the same continent adversely affect the extent of smoothing via remittances. In essence, this result (although not robust) reflects the same underlying behaviour: the actual degree of business cycle correlation between remittance-receiving and remittance-sending countries can help explain why the extent of smoothing through remittances varies so much. Both the cross-section and panel estimations confirm that the main findings with regard to the positive impact of the diversification of migrants and the size of remittance flows on risk sharing are robust.

From the currency/monetary union perspective, our results point out that for several developing economies that aim to be part of a prospective union, remittances

can provide an effective channel to absorb asymmetric output shocks and should therefore be considered in the discussion on the optimum currency area. In this regard, our results further support Frankel (2011, p.14), who concludes that "remittances should join trade, labor mobility, and transfers, on the list of optimum currency area criteria". Needless to mention here that the insurance role of remittances may actually turn out to be more pronounced, as a large chunk of remittance flows that are transmitted through informal channels remain unrecorded in official estimates.

Appendix:

Table A.1: Data description and sources

Variables used to obtain the estimate of risk sharing via remittance flows (β_i)

Remittance inflows	In US\$ from the World Development Indicators (WDI) database and other sources.
GDP	Source: IMF's International Financial Statistics (IFS)
CPI	Source: IMF's International Financial Statistics (IFS)
Population	Source: IMF's International Financial Statistics (IFS)
Exchange rate	Units of local currency per US\$ available from the IMF's International Financial Statistics (IFS).

Explanatory variables

Migrant diversification index	It measures the extent of diversification of migrant workers of a country across the world. The index is constructed as: $DIV_i = 1/\sum_{j=1}^{N}\left|\left(\theta_{ij} - \theta_{ij}^{max}\right)\right|$, where θ_{ij} is the ratio of migrants originating from country i working in country j over the total number of migrants from country i; θ_{ij}^{max} is the highest ratio among all θ_{ij} and N is the total number of countries where the emigrants of country i are distributed. The data on bilateral migrant stocks is extracted from the Global Bilateral Migration Database (GBMD).
Distantness	It is the weighted average of the distances in thousands of kilometres from the capital city of a particular country to the capital cities of other countries using the total GDP shares of the other countries as weights. It is calculated as: $DIST_i = \frac{1}{T}\sum_{t=1}^{T}\sum_{j}\frac{d_{ij}gdp_j^t}{gdp^t}$, where d_{ij} is the distance from the capital city of country i to the capital city of country j, gdp^t is the group-wide GDP and T is the total sample length. The bilateral distance between the capital cities is obtained from the French Research Center in International Economics (CEPII).
OECD share	It measures the share of total remittance inflows originating from OECD countries. The bilateral remittance data is obtained from Ratha and Shaw (2007), Jiménez-Martin et al. (2007), Lueth and Ruiz-Arranz (2008), Frankel (2011), the Migration and Remittances Unit (World Bank) and the web pages of several central banks.
Continent share	It is the share of total remittance inflows coming from countries belonging to the same continent as the recipient country.
Financial openness (index)	It is based on Chinn–Ito index, which measures a country's degree of capital account openness. The index is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) (Source: Chinn and Ito 2008, 2012).

Table A.1 (continued)

M2 to GDP ratio	Money and quasi-money (M2) comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings and foreign currency deposits of resident sectors other than the central government (Source: World Development Indicators (WDI)).
Bank deposit to GDP ratio	It represents demand, time and saving deposits in deposit money banks as a share of GDP (secondary source: Beck and Demirgüç-Kunt (2009); primary source: IMF's International Financial Statistics (IFS)). Updated data from other sources.
Private sector credit by banks to GDP ratio	It simply represents the private credit by deposit money banks as ratio to GDP (secondary source: Beck and Demirgüç-Kunt (2009); primary source: IMF's International Financial Statistics (IFS)). Updated data from other sources.
Regulatory quality index	It reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. The index ranges from –2.5 (weak) to 2.5 (strong) governance performance (Source: The Worldwide Governance Indicators, World Bank).
Government effectiveness index	It reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The index ranges from –2.5 (weak) to 2.5 (strong) governance performance (Source: The Worldwide Governance Indicators, World Bank).
Corruption perception index	This index is based on perceived levels of corruption in the public sector, as determined by expert assessments and opinion surveys for individual countries. It is available from Transparency International and ranges from 10 (highly clean) to 0 (highly corrupt).

List of countries

Sample countries (86)	Albania (ALB), Algeria (DZA), Azerbaijan (AZE), Bangladesh (BGD), Belize (BLZ), Benin (BEN), Bolivia (BOL), Bosnia and Herzegovina (BIH), Botswana (BWA), Bulgaria (BGR), Burkina Faso (BFA), Cambodia (KHM), Cameroon (CMR), Cape Verde (CPV), China (CHN), Colombia (COL), Costa Rica (CRI), Côte d'Ivoire (CIV), Croatia (HRV), Dominica (DMA), Dominican Republic (DOM), Ecuador (ECU), Egypt (EGY), El Salvador (SLV), Ethiopia (ETH), Fiji (FJI), Gabon (GAB), Gambia (GMB), Georgia (GEO), Ghana (GHA), Guatemala (GTM), Guinea (GIN), Guinea-Bissau (GNB), Guyana (GUY), Haiti (HTI), Honduras (HND), India (IND), Indonesia (IDN), Jamaica (JAM), Jordan (JOR), Kenya (KEN),

	Kyrgyz Republic (KGZ), Lesotho (LSO), Lithuania (LTU), Malaysia (MYS), Mali (MLI), Mauritania (MRT), Mauritius (MUS), Moldova (MDA), Morocco (MAR), Mozambique (MOZ), Myanmar (MMR), Nepal (NPL), Nicaragua (NIC), Niger (NER), Nigeria (NGA), Pakistan (PAK), Panama (PAN), Papua New Guinea (PNG), Paraguay (PRY), Peru (PER), the Philippines (PHL), Poland (POL), Rwanda (RWA), Samoa (WSM), São Tomé and Principe (STP), Senegal (SEN), Sierra Leone (SLE), Slovak Republic (SVK), Solomon Islands (SLB), Sri Lanka (LKA), Sudan (SDN), Swaziland (SWZ), Syrian Arab Republic (SYR), Tajikistan (TJK), Thailand (THA), Togo (TGO), Tonga (TON), Tunisia (TUN), Turkey (TUR), Uganda (UGA), Ukraine (UKR), Vietnam (VNM), Yemen (YEM), Zambia (ZMB).
OECD countries (23)	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

CHAPTER THREE

ESSAY TWO

Would Australia-New Zealand be a viable currency union?

Evidence from interstate risk sharing performances

In this study, we first measure the potential welfare gains from perfect risk sharing among Australian states and New Zealand regions under a possible unification. We show that New Zealand regions reap moderate gains from perfect risk sharing when they form a union with Australia, whereas for Australian states, the gains are somewhat similar to what they have attained at the intranational level. Second, we measure the extent of interstate risk sharing and intertemporal smoothing between the two countries. Contrary to the evidence of OECD and EU countries, we are not able to observe intertemporal smoothing among Australian states and New Zealand regions, either alone or jointly, thus rejecting the permanent income hypothesis. Further, unique to the risk sharing literature, we decompose the aggregate (non-diversifiable) output shocks into positive and negative components, in order to assess the strength of risk sharing mechanisms across business cycles. The study finds a virtual absence of risk sharing when Australia and New Zealand face negative aggregate fluctuations, raising doubts about the feasibility of the union, particularly during economic downturns.

3.1 Introduction

Currency and monetary union issues have become more prominent in recent years with the rapid growth of cross-border trade in goods and financial assets and closer economic integration globally. Following the model of the European Monetary Union (EMU), several regional countries have established, while others are considering forming a currency or monetary union. The advantages of establishing a monetary union are often questioned because of the recurrent macroeconomic instability witnessed by several member countries of the EMU in recent times. The inability of a current or prospective member country to address its country-specific (asymmetric) output shocks through appropriate monetary and exchange rate policy instruments is raised as a major concern with regards to the viability of a monetary union, as in the case of EMU members (Bayoumi and Eichengreen 1992). Further, in the presence of one-size-fits-all monetary policy, member countries may experience considerable welfare losses when business cycles are unsynchronized across the union. The benchmark theory of the optimum currency area (OCA) put forward by Mundell (1961) and McKinnon (1963) also proposes that a higher degree of business cycle synchronization is an essential requirement for the feasibility of a currency union.[46] However, in the complete capital mobility setting of an OCA, Mundell (1973) counter argues that countries with asymmetric output shocks can still establish a union if they have an effective mechanism for sharing output risks through reserve pooling and portfolio diversification ― a possibility when union members are financially integrated and hold claims on each other's output. In other words, a higher degree of risk sharing can somewhat compensate for the conditionality attached with the synchronization in business cycles prior to forming a union.

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[46] The other important requirements comprise increased cross-border capital flows, greater trade connections and higher labour mobility among the prospective member countries.

This notion of sharing output risk is the same as put forward in risk sharing theory (Diamond 1967; Wilson 1968; Cochrane 1991; Mace 1991; Obstfeld and Rogoff 1996) which suggests that under standard assumptions, a country's consumption does not have to follow domestic output shocks — a phenomenon commonly referred to in academic literature as "consumption smoothing" and "consumption insurance". When risk is fully shared across national borders (better known as "perfect consumption smoothing"), domestic consumption is completely detached from all domestic output fluctuations. To test this perfect risk sharing conjecture empirically, earlier empirical work (such as Cochrane 1991; Mace 1991; Townsend 1994; Obstfeld 1994; Canova and Ravn 1996; Lewis 1996) regresses domestic consumption growth on domestic output growth and reject the extreme hypothesis of perfect risk sharing while establishing only a weak presence of risk sharing in their analysis.[47]

Although perfect risk sharing is a purely theoretical concept (since it requires an Arrow-Debreu economy with a complete set of cross-country contingent claims), quantifying the degree of risk sharing realized within a group of potential member countries that aim to form a currency or monetary union seems essential in order to assess the viability of the union. This has not been possible until the path-breaking study of Asdrubali et al. (1996) (henceforth, ASY) that develop a simple accounting methodology for quantifying the relative contributions of various channels[48] of risk sharing in the United States of America (USA), a model of a successful monetary union. Their method decomposes the cross-sectional variance of gross domestic product (GDP)

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[47] Some of this initial research confined its analysis to the micro levels (individuals and households), whereas later on, the majority of researchers investigate risk sharing patterns from a macroeconomic perspective: for example, Townsend (1994) estimates risk sharing among individuals in a village in India; Cochrane (1991), Mace (1991) and Hayashi et al. (1996) test risk sharing among households; while, Obstfeld (1994), Canova and Ravn (1996), Lewis (1996) and others, examine risk sharing among a set of developing and developed countries.

[48] In the literature, the terms "channels" and "mechanisms" are synonymous and are used interchangeably throughout this study.

into various components, representing the market (capital and credit markets) and non-market (fiscal system) channels of risk sharing. Applying ASY's methodology in a cross-country context, several studies later on quantify the channels of risk sharing among specific groups of countries, particularly European Union (EU) and OECD countries. A survey of this strand of literature suggests that the current state of risk sharing at the international level is considerably lower than it is at the intranational level. For instance, unsmoothed output shocks amount to only 25% among the states of the USA (Asdrubali et al. 1996), 10% among the states and territories of Australia (Kim and Sheen 2007) and 30% among Canadian provinces (Balli et al. 2012a): these figures are much lower when compared to almost 70% of output shocks remaining unabsorbed in OECD and European countries (Sørensen and Yosha 1998) and 80% in the case of East Asian countries (Kim et al. 2006b).

These aforementioned findings point towards the fact that states or provinces within a federal system such as in the USA and Canada are more financially integrated and closer to an OCA, than other regional countries that have either formed a currency union or aim to have one. Like these regional blocs, there has been a long-standing debate on the possibility of a currency union between Australia and New Zealand; that is, how feasible might a currency union between Australia and New Zealand be?[49] At an academic level, several research and policy papers, such as Lloyd (1990), Hargreaves and McDermott (1999), Coleman (1999, 2001), Grimes (2000, 2005), Grimes et al. (2000), McCaw and McDermott (2000), Scrimgeour (2001), Crosby and Otto (2002), Cohen (2003), Björksten et al. (2004), Drew et al. (2004), Hall (2005), Hunt (2005),

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[49] Three major proposals for the currency arrangements between Australia and New Zealand are generally discussed: first, pegging New Zealand dollar to the Australian dollar; second, unilateral adoption of Australian dollar as New Zealand's currency; and third, adopting a new common currency, generally referred to as the ANZAC dollar.

Lloyd and Song (2006), Kim and Sheen (2007), and McGregor (2010), have discussed the viability of a possible currency union between the two countries from different angles. The review of these studies, by and large, suggests that the outcome of this debate has been inconclusive at best.[50]

However, with the exception of Kim and Sheen (2007), no study (to our knowledge) has tackled this issue from a risk sharing perspective. Utilizing the technique of ASY, Kim and Sheen (2007) examine the feasibility of the union by quantifying the channels of risk sharing between the two countries.[51] However, this study is unable to answer several important questions because of the inherent limitations of the methodology used (discussed later on). This is the task the present study has endeavoured to take up. Most importantly, the analysis of Kim and Sheen (2007) is based on the aggregate (country) data and does not take into account the risk sharing arrangements among states/regions of both countries.[52] Our study therefore aims to measure the extent of interstate risk sharing between Australia and New Zealand. In doing so, it offers the first cross-country evidence of the extent of risk sharing among regions of a given set of countries; previous studies have only examined interstate risk

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[50] For instance, some researchers argue in favour of a currency union documenting different reasons, such as the two countries being similar structurally and cyclically (Hargreaves and McDermott 1999; Crosby and Otto 2002), the associated costs of establishing a union being smaller (Grimes et al. 2000) and better risk sharing opportunities being prevalent between the two countries (Kim and Sheen 2007). On the contrary, some studies have suggested that the outcome of a union is either undesirable for Australia (Crosby and Otto 2002), or for New Zealand (Drew et al. 2004; Grimes 2005; Hall 2005), or for both Australia and New Zealand (Lloyd and Song 2006; McGregor 2010). Nevertheless, the majority of the studies avoid taking sides.

[51] Kim and Sheen (2007) estimate that almost 28% of shocks are smoothed by credit markets and 6% of shocks are absorbed by capital markets, while the rest 66% of shocks remain unsmoothed during the period 1960-2003. Based on the risk sharing criterion, they conclude that Australia and New Zealand are better-off forming a currency union than compared with members of the EMU.

[52] Some researchers emphasize using state-level data, as these provide a wealth of information for important issues in consumption smoothing. For instance, Ostergaard et al. (2002, p. 635) argues that "regional data at the subnational level are much underutilized for the study of consumer behavior. Such data are sufficiently aggregated to be regarded as macroeconomic data yet exhibit considerable cross-sectional variation that can be exploited in empirical analysis. Endogeneity of state-specific income is not likely to be a major problem, and measurement error is less serious than in micro data."

sharing patterns from a single country's perspective (as in the case of the USA (Asdrubali et al. 1996), Germany (Hepp and von Hagen 2013) and Canada (Balli et al. 2012a)). Specifically, we are interested in exploring whether the states and territories of Australia, and the regions of New Zealand would gain from risk sharing if they formed a currency union.[53] In addition, we aim to assess who would gain the most from perfect risk sharing and whether these states and regions would be able to absorb various types of shocks effectively in a union setting.

With this objective, we explore a suitable empirical strategy for examining the interstate risk sharing patterns across Australia and New Zealand. One of the main drawbacks of using ASY's methodology[54] is that it fails to distinguish clearly between risk sharing (insurance across states) and intertemporal smoothing (insurance across time) mechanisms.[55] This distinction is of importance, since researchers (e.g., Asdrubali and Kim 2004) have found a substantial degree of interplay between risk sharing and intertemporal smoothing channels, thereby arguing a case in favour of jointly examining the two mechanisms in a single framework. Therefore a complete assessment of consumption smoothing patterns requires a joint examination of risk sharing and intertemporal smoothing hypotheses, which is relevant in comparing states/regions within a country and also the member countries of a union. For instance, a monetary union may enhance risk sharing through integration of the financial markets, while it may also bring about a high correlation of inflation and interest rates across time, which

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[53] For convenience, we refer to the "states and territories" of Australia as "states" only.

[54] ASY's approach primarily measures the contribution of various smoothing channels, wherein smoothing through the capital markets channel typically occurs prior to shocks, whereas credit market smoothing takes place after shocks; however, smoothing through the fiscal transfers channel may occur ex ante as well as ex post — progressive taxation is ex ante while fiscal transfers as a result of natural disasters are ex post.

[55] Intertemporal macroeconomic theory suggests that under standard assumptions, countries (like individuals) smooth their consumption across time against output fluctuations. Intertemporal smoothing is typically done through domestic saving and dissaving in a closed economy, and through foreign borrowing and lending in an open economy setup (Asdrubali and Kim 2008a, 2008b).

in turn, facilitates intertemporal smoothing. Furthermore, ASY's method is incapable of distinguishing and quantifying the effects of different types of shocks such as idiosyncratic and aggregate shocks, and positive and negative realizations of these shocks.

From the methodological viewpoint, we contribute to the literature in the context of Australia and New Zealand in several ways. First, to overcome the aforementioned limitations of ASY's approach, we follow Asdrubali and Kim (2008a), who make a brilliant contribution by presenting a unified framework to measure the extent of risk sharing and intertemporal smoothing concurrently. We argue that the estimates of earlier research that have explored these two smoothing mechanisms separately may raise doubts, since in the presence of evidence supporting incomplete risk sharing, there is a need to gauge the extent of intertemporal smoothing simultaneously to fully assess the insurance capabilities of a given set of economic regions.[56]

Second, following Pierucci and Ventura (2010), we split the idiosyncratic output shocks into positive and negative components. As a result, we are able to distinguish consumption smoothing opportunities among Australian states and New Zealand regions in periods of economic expansion and recession. Third, to the best of our knowledge, for the first time in the risk sharing literature, we measure the degree of risk sharing under positive and negative aggregate output shocks. The distinction between positive and negative realizations of aggregate shocks is of paramount importance in

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[56] In previous empirical research, the tests for risk sharing and intertemporal smoothing at the aggregate level have been examined separately. While several studies have explored perfect risk sharing tests at the aggregate level (e.g., Lewis 1996; Canova and Ravn 1996); for estimating intertemporal smoothing, researchers have typically based their analysis on testing the life-cycle/permanent income hypothesis employing aggregate country-level data (e.g., Campbell and Mankiw 1987; Crucini 1999). With regards to empirical findings, studies have usually found intranational risk sharing to be around 70% and international risk sharing to be around 10%, while intertemporal smoothing is roughly almost 50% (Sørensen and Yosha 1998; Asdrubali and Kim 2008a, 2008b & 2009).

order to assess the strengths and limitations of risk sharing arrangements across business cycles. In particular, attaining a significant degree of risk sharing under negative output shocks is highly desirable for the viability of a union during economic downturns.

Prior to undertaking the aforementioned econometric analysis, in the first place, we are interested in quantifying, whether or not there are any unexploited welfare gains from perfect risk sharing between the two countries. For this, we employ the methodology developed by Kalemli-Ozcan et al. (2001), for estimating the potential gains to individual states of Australia and regions of New Zealand if they attain full risk sharing. We find that Australian states would gain little or nothing from sharing risk with each other, whereas New Zealand regions would exhibit relatively larger gains than their Australian counterparts. Similarly, in the possible union exercise, we show that New Zealand regions witness higher gains from complete risk sharing than being alone, whereas for Australian states, the gains are somewhat similar to what they have achieved at the intranational level.

Our initial estimation results indicate the presence of partial consumption smoothing, as about 70% of idiosyncratic shocks are absorbed across Australia and New Zealand. This finding justifies the need for a joint examination of the risk sharing and intertemporal smoothing models as suggested by Asdrubali and Kim (2008a). Contrary to the evidence of OECD and EU countries, the intertemporal smoothing is found to be non-existent in both countries (alone or jointly), as permanent income changes are not reflected in consumption considerations. The degree of risk sharing is also quite low as domestic consumption growth is not dependent on aggregate output growth:

consumption growth follows only 2% (New Zealand), 4% (Australia) and 4% (Australia and New Zealand) of the changes in aggregate output growth. When a distinction is made between positive and negative aggregate shocks, there is a complete lack of risk sharing in an Australia–New Zealand union under negative aggregate shocks, which raises concerns about the feasibility of the union particularly during economic downturns.

3.2   Data and descriptive statistics

Consumption and output information for New Zealand regions have become available recently. The household consumption and output (GDP) levels and population on regional basis are obtained from Statistics New Zealand and Infometrics Ltd. for the years 1998 to 2008.[57] Again, regional level consumer price index (CPI) data have been obtained from Infometrics as well. For Australia, the state level national accounts data are published by the Reserve Bank of Australia. National accounts data are also obtained from the Australian Bureau of Statistics catalogue 5220.0. Both the state level consumption and GDP are divided by population and then deflated by their own CPI, thereby transforming the series into real consumption and GDP per capita terms. We also use logs and first differences of the variables to minimize heteroskedasticity and autocorrelation issues.[58] In addition, we perform the necessary tests to diagnose any remaining problems of heteroskedasticity and autocorrelation. The data have been log differenced to eliminate any possible unit root issues.

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[57] For the details on the regional data compiled by Infometrics Ltd., please see http://www.infometrics.co.nz/regional.asp.

[58] The analysis is conducted in per capita terms, which is helpful in addressing region or country-size bias. Jeanneney and Tapsoba (2012) argue that the use of first differences removes country-fixed effects and also ensures that variables are covariance stationary.

Table 3.1 contains the descriptive statistics for the output (GDP) and consumption (CON) variables for Australian states and New Zealand regions for the period 1998–2008.[59] The first two columns report the mean and standard deviation, while the third and fourth columns report the kurtosis and skewness of real GDP per capita and real consumption per capita growth rates. The average growth rates of GDP and consumption per capita are similar in both countries — approximately 4% for New Zealand regions and 5% for Australian states. The standard deviation of real consumption per capita is much higher than that of the real GDP per capita for New Zealand. Overall, the average growth rates (standard deviation) in output and consumption per capita are relatively higher (lower) in Australia than in New Zealand. If we aggregate Australia and New Zealand together, the growth rates of output and consumption per capita are found to be higher for New Zealand and lower for Australia when compared with their growth rates without a union. The kurtosis and skewness of our data are on the normal standards for performing the regressions. Additionally, Figure 3.1 and Figure 3.2 display the patterns of growth rates of consumption and GDP per capita for the selected New Zealand regions and Australian states. At first glance, these figures show greater scope for risk sharing, because of the divergent patterns (pro-cyclical and counter-cyclical) of consumption and output found at the intranational level in both countries.

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[59] For descriptive statistics of the individual states of Australia and regions of New Zealand, refer to Table B.1 of the appendix.

Table 3.1: Descriptive statistics for New Zealand (NZ), Australia (AUS) and an Australia-New Zealand union (ANZ)

	Mean	Standard Deviation	Kurtosis	Skewness
New Zealand (NZ)				
ΔGDP	0.042	0.031	2.059	0.100
ΔCON	0.046	0.065	7.504	0.085
Australia (AUS)				
ΔGDP	0.059	0.027	2.853	1.272
ΔCON	0.053	0.022	4.106	1.123
Australia-New Zealand union (ANZ)				
ΔGDP	0.048	0.031	2.289	0.266
ΔCON	0.048	0.055	11.013	0.023

Notes: Sample: 1998–2008. The statistics are computed using logarithms of per capita variables, wherein ΔGDP and ΔCON are the logarithm of real GDP per capita and the logarithm of real (final) consumption per capita, respectively.

Figure 3.1: Output (GDP) and consumption (CON) patterns across selected regions of New Zealand

Figure 3.2: Output (GDP) and consumption (CON) patterns across selected states of Australia
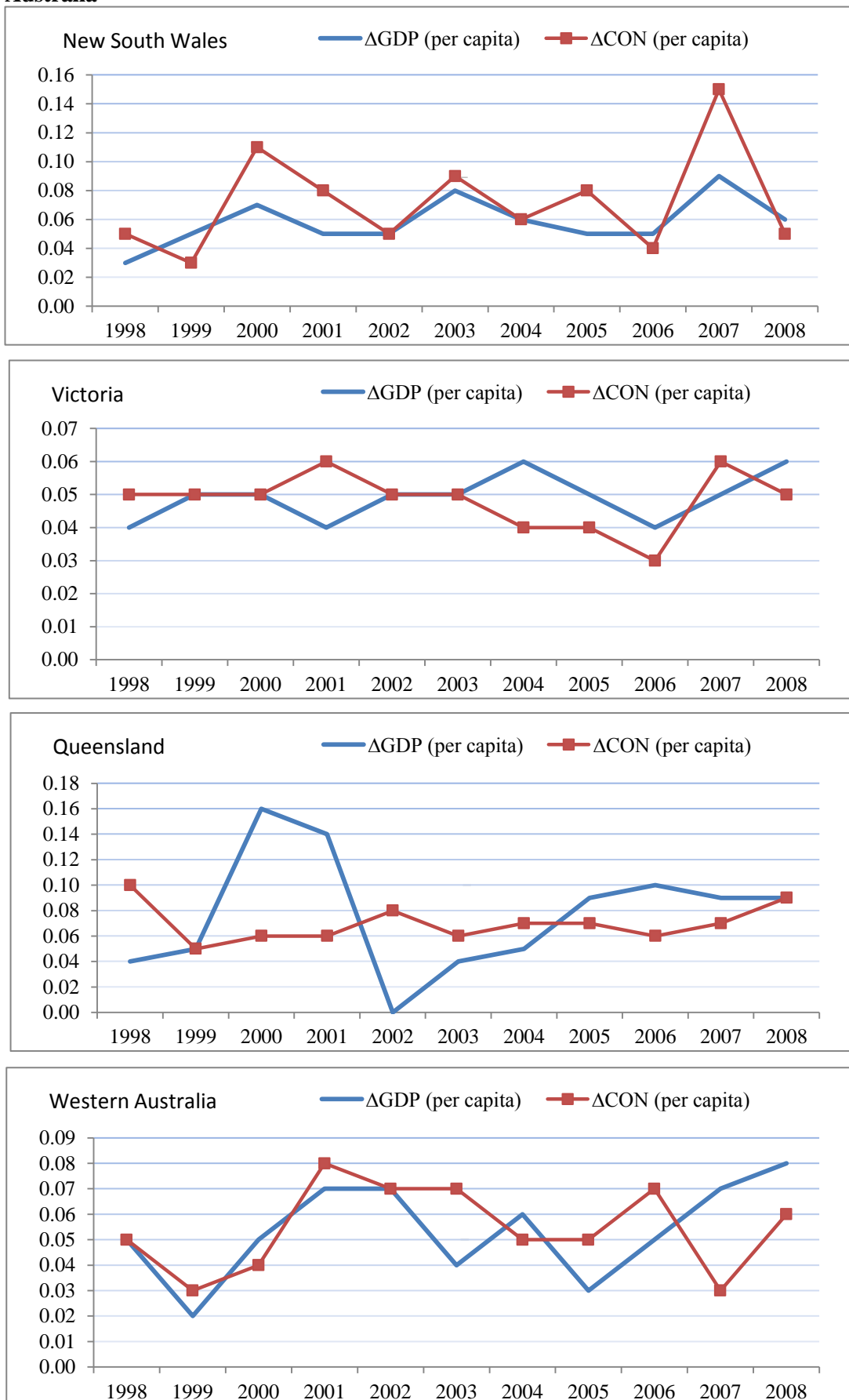
3.3   Theory of risk sharing

In the literature, the earliest works on the theoretical model of risk sharing by Diamond (1967) and Wilson (1968), and relatively recent papers by Cochrane (1991), Mace (1991) and Obstfeld and Rogoff (1996), document that under standard assumptions of iso-elastic preferences and complete markets, an individual's consumption should not respond to country-specific output shocks. This is referred in literature as "consumption risk sharing", which is the degree to which the consumption growth rate is delinked from the growth rate of domestic output. This risk sharing proposition is generally considered to be the cross-sectional counterpart of the permanent income hypothesis (Friedman 1957) and the life cycle model (Modigliani and Brumberg 1954) of consumption. While the theory of risk sharing is concerned with consumption smoothing among countries (or states within a country) at a point in time, benchmark consumption theories discuss consumption behaviour over longer time horizons.

Theoretically, economic agents can completely detach their consumption from domestic output fluctuations if they purchase claims on foreign countries' output, while, in turn foreigners hold claims on domestic output.[60] In this way risk can be fully shared, better known as "perfect consumption risk sharing". In a perfect risk sharing scenario, "the global supply of consumption goods will be allocated to each country according to its share in global wealth" (Tesar 1995, p. 100). Since each country has a similar consumption portfolio of assets, this has an empirical implication of similar growth rates in consumption across countries. While theoretically sound, it has not been empirically validated as several studies, notably Backus et al. (1992), Stockman and

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[60] In theory, these claims are represented by Arrow-Debreu securities, which include all production possibility outcomes in a complete market model.

Tesar (1995), Tesar (1995), Baxter and Crucini (1995), Obstfeld and Rogoff (1996) and Lewis (1996) have found that cross-country correlation in consumption growth rates is not close to unity and, in fact, consumption is even much less correlated than output[61], a phenomenon commonly referred to in the literature as the international consumption correlation puzzle.[62]

In earlier empirical work on risk sharing, Cochrane (1991) and Mace (1991) utilize consumer-level data to investigate the degree of risk sharing between individual and aggregate consumption. Later on, researchers generally regress idiosyncratic (domestic minus world) consumption growth rates (Δc_t^i) on idiosyncratic (domestic minus world) output growth rates (Δy_t^i) to empirically explore the risk sharing conjecture — that is, $\Delta c_t^i = \alpha + b\Delta y_t^i + \varepsilon_t$. In a perfectly risk sharing scenario, b will be equal to zero, implying that idiosyncratic consumption is uncorrelated with idiosyncratic output. Similar to earlier findings, consumption is found to be strongly correlated with output, rejecting the extreme hypothesis of perfect risk sharing; for instance, Lewis (1996) finds b to be around 0.93 on average for each country in her set of 47 countries, comprising both industrialized and developing countries. In another study, Lewis (1999) estimates b to be 0.65 for the USA, 0.92 for Germany and 0.97 for a sample of 72 countries during the period 1950–92. Similarly, Obstfeld (1994) estimates the relationship between the consumption growth rates of each of the G7

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[61] For example, Tesar (1995) obtains 0.32 as the average correlation between the global consumption growth rate and consumption growth rates in industrialised countries, while it is 0.10 for developing countries during the period 1973-88. Obstfeld and Rogoff (1996) document the correlation between an individual country's consumption (output) with world consumption (output) for the period 1973-92 and conclude that consumption correlations are lower than output correlations — that is 0.52 (0.68) for the USA, 0.63 (0.62) for the UK, O.38 (0.46) for Japan, 0.63 (0.70) for Germany and 0.43 (0.52) for OECD countries. Similarly, Pakko (1998) presents comparable findings of higher output correlations compared to consumption correlations, using two different datasets: OECD and Penn World Tables.

[62] In theory, another likely outcome of the presence of international risk sharing is that domestic savings do not need to be strongly connected to domestic investment. However, contrary to these expectations, in an influential study, Feldstein and Horioka (1980) observe that savings and investments are highly correlated across countries — a phenomenon known as the Feldstein-Horioka puzzle in literature.

countries and the global consumption growth rate $\left(\text{i.e. } \Delta \log c_t^i = \delta^i + \alpha^i \Delta \log c_t^j + \varepsilon_t^i + \eta_t^i\right)$ and finds only a weak presence of risk sharing in his sample countries.

The consensus from the risk sharing literature so far is that firstly, cross-country consumption correlations are far short of unity; secondly, cross-country consumption correlations are lower than output correlations; and thirdly, the correlation between domestic consumption and domestic output is generally higher than that between domestic consumption and world output. Overall, these findings point towards the presence of lower levels of risk sharing across countries, primarily because of incomplete financial integration worldwide. Thus the theoretical notion of perfect risk sharing seems a far-fetched goal; nevertheless quantifying the degree of risk sharing realized within countries such as Australia and New Zealand is important, since the welfare costs of output fluctuations are far larger if they are transmitted to consumption.

3.4   Potential welfare gains from risk sharing

The general picture that emerges from the survey of empirical literature is that risk sharing across borders is incomplete at best, pointing towards a large scope of obtaining potential welfare gains from perfect risk sharing — when consumption is completely detached from domestic output fluctuations. Thus before examining whether Australia and New Zealand can constitute an optimum currency union based on the current state of risk sharing arrangements, first and foremost, we need to quantify the potential gains that could be attained with perfect risk sharing between the two countries. More precisely, we need to assess how large the potential welfare gains to individual states of Australia and regions of New Zealand would be when they achieve full risk sharing with each other.

The underlying framework used by empirical studies that attempt to measure the extent of potential gains from perfect risk sharing[63] typically computes the level of welfare gains from an incomplete market economy to an economy with full insurance arrangements (a complete market economy). Here we use the methodology developed by Kalemli-Ozcan et al. (2001) (henceforth, KSY) for the estimation of unexploited gains from perfect risk sharing.[64] In a simple general equilibrium framework under standard assumptions[65], the KSY methodology measures the increase in per capita discounted expected utility that a country would attain as it moves from financial autarky to perfect risk sharing. More specifically, for each country, the potential gains are measured as the difference between the expected utility of consuming its own per capita output (an autarky situation) and that of consuming a country-specific fraction of the aggregate output (perfect risk sharing). Intuitively, the final outcome represents the permanent percentage change (increase/decrease) in the level of consumption of each country as it moves from autarky to perfect risk sharing.

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[63] Empirical studies measuring welfare gains have provided inconclusive findings so far. Some studies show minimal gains from risk sharing, (e.g., Lucas 1987; Backus et al. 1992; Cole and Obstfeld 1991; Tesar 1995) that are insufficient to cover even small transaction and information related costs. Other empirical studies point towards substantial gains from risk sharing that in some cases exceed 100% of permanent consumption (Obstfeld 1994; van Wincoop 1994). These varied findings are mainly attributed to the sensitivity of the underlying assumptions of the models used in these studies.

[64] Another widely used approach to measure welfare gains is developed by van Wincoop (1994). Although both the approaches of KSY and van Wincoop (1994) are based on a similar framework, we prefer KSY's methodology for two main reasons. Firstly, we argue that the KSY method employs output data only, which are more suitable for measuring asymmetric output shocks, whereas van Wincoop (1994) uses consumption data rather than output data. Secondly, van Wincoop (1994) assumes that countries are of similar size and thus consume identical portions of the aggregate output, while KSY considers a more realistic assumption, where each country consumes a fixed fraction of aggregate output which is accrued to it under full risk sharing equilibrium.

[65] These assumptions include an Arrow-Debreu exchange economy with complete securities markets, symmetric information, no transaction costs, identical CRRA utility function, the same realization of uncertainty and a similar rate of time preference for all countries.

KSY employ the Constant Relative Risk Aversion (CRRA) utility function[66] in order to derive the potential welfare (utility) gains from risk sharing[67]:

$$G_i = 100 \times \frac{1}{\delta}\left(\frac{1}{2}\sigma^2 + \frac{1}{2}\sigma_i^2 - cov_i\right), \qquad (3.1)$$

where G_i is a measure of fluctuations asymmetry, representing utility gains for each country i; δ is the intertemporal discount rate; σ^2 and σ_i^2 represent the variance of the union-wide per capita GDP growth rate and the variance of country i's per capita GDP growth rate, respectively; and cov_i is the covariance of the country i's per capita GDP with union-wide per capita GDP. The aforementioned equation puts forward some logical outcomes in a risk sharing arrangement. For instance, a country experiencing asymmetric output growth (represented by a lower covariance, cov_i) will obtain higher welfare gains as compensation for providing insurance to other member countries by stabilizing aggregate output growth. In essence, this notion is based on Kenen (1969) and Mundell (1973), who argue that in the presence of risk sharing arrangements, countries with asymmetric output fluctuations lead to less volatility in aggregate output, as asymmetric shocks tend to offset each other in a union setting. Thus, a country with higher fluctuations in output growth (represented by a higher variance, σ_i^2) is associated with higher estimated risk sharing gains. Also, in the case of higher variability in aggregate output (represented by a higher variance, σ^2), the existing member countries will be willing to provide higher incentives to a joining country, since it enables additional insurance opportunities for all union members.[68]

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[66] The CRRA utility function is generally expressed as $U(c) = \frac{c^{1-\gamma}}{(1-\gamma)}, (\gamma \neq 1)$, where γ is the coefficient of relative risk aversion.

[67] For a complete derivation of this formula, see appendix A on pages 130–135 of Kalemli-Ozcan et al. (2001).

[68] Logically the variability in aggregate output growth (σ^2) is a function of the change in each member country's output growth (σ_i^2); nevertheless, Kalemli-Ozcan et al. (2001) make distributional assumptions

Table 3.2 reveals the potential welfare gains for individual states and territories of Australia and regions of New Zealand in the presence of complete risk sharing between the two countries. As the first step, we measure the gains that New Zealand regions and Australian states would accrue as a result of perfect risk sharing at the *intranational* level. Overall, the (average) interstate level of welfare gains for New Zealand and Australia are lower than those found across fifty US states by Kalemli-Ozcan et al. (2001);[69] nevertheless, the potential gains for New Zealand regions are relatively larger than those for Australian ones. On average, the estimated gain for each region in New Zealand is around 0.64% of the permanent increase in consumption. It appears that smaller regions (Taranaki, West Coast, Tasman and Marlborough) reap relatively large welfare gains as compensation towards stabilizing aggregate output, primarily because of their higher volatility (counter-cyclicality) in output. These findings are consistent with the earlier studies of Kalemli-Ozcan et al. (2001), Demyanyk and Volosovych (2008) and Balli and Ozer-Balli (2011) who report that smaller US states, EU countries and Pacific Island countries display relatively high welfare gains, because of the counter-cyclical patterns of their output.[70] Further, when Australian states move towards a complete risk sharing arrangement with each other, the welfare gains are found to be of a small magnitude — on average, a state gains by 0.45% of permanent consumption. Particularly, the three largest states, New South Wales, Victoria and Queensland, which contribute more than 70% of Australia's output show only a minimal increase (0.1%) in permanent consumption. We argue that these states show similar patterns because of strong economic ties and well-connected

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regarding aggregate output which has enabled the authors to treat σ^2 as a parameter that can be calculated from aggregate output data.

[69] The average gain from complete insurance across US states stands at 1.27% (for log-utility) and 1.55% (for CRRA utility).

[70] These small US states include Alaska, North Dakota and Wyoming (Kalemli-Ozcan et al. 2001); smaller EU countries that joined later in 2004 comprise Latvia, Hungary, Slovakia and Poland (Demyanyk and Volosovych 2008); and smaller Pacific Island countries include Kiribati, Palau, French Polynesia, New Caledonia and Vanuatu (Balli and Ozer-Balli 2011).

financial institutions, which have resulted in high correlations in output and consumption among themselves.[71]

Table 3.2: Potential welfare gains from risk sharing among states and territories of Australia and regions of New Zealand

	Welfare Gains from Interstate Risk Sharing			
	Country Basis	Union Basis	Country Basis	Union Basis
New Zealand Regions				
Northland	0.4	0.4		
Auckland	0.1	0.2		
Waikato	0.5	0.6		
Bay of Plenty	0.3	0.3		
Gisborne	0.5	1.1		
Hawke's Bay	0.5	0.5		
Taranaki	2.6	2.7		
Manawatu–Wanganui	0.2	0.8		
Wellington	0.2	0.3		
West Coast	1.2	2.0		
Canterbury	0.1	0.4		
Otago	0.3	0.6		
Southland	0.6	1.2		
Tasman	1.1	0.9		
Nelson	0.6	0.6		
Marlborough	1.0	1.2		
North Island			0.2	1.0
South Island			0.6	2.5
Average	0.64	0.86	0.4	1.75
Australian States				
Australian Capital Territory	0.2	0.2		
New South Wales	0.1	0.1		
Northern Territory	1.9	1.8		
Queensland	0.2	0.2		
South Australia	0.1	0.2		
Tasmania	0.3	0.4		
Victoria	0.1	0.1		
Western Australia	0.7	0.9		
Average	0.45	0.48		

Notes: Sample: 1998–2008. The table represents welfare gains in utility when each country moves from financial autarky (each member consumes its own GDP) to perfect risk sharing (where the consumption is completely detached from GDP fluctuations). The gain can be interpreted as a permanent percentage increase in the country's per capita consumption relative to its initial consumption under autarky.

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[71] This has also been corroborated by Kim and Sheen (2007). See Figures B.1 and B.2 of the appendix for output and consumption patterns across (small) regions of New Zealand and (large) states of Australia.

On the possible union between the two countries, New Zealand regions seem to benefit more than Australian states when compared with the welfare gains they achieve at the intranational level. The average increase in welfare gains to Australian states as they move from perfect risk sharing with each other to a union with New Zealand regions is merely 0.03% (i.e. from 0.45% to 0.48%). Comparable to our earlier observation, the states of New South Wales, Victoria and Queensland display similar results: they fail to exhibit any gain in permanent consumption in the case of a union. In contrast, while New Zealand regions display an increase in welfare gains by 0.22% on average (i.e. from 0.64% to 0.86%), the majority of regions, particularly the economically vital ones such as Auckland, Wellington, Waikato and Canterbury, gain as a result of enlargement.[72] Overall, the average gain for individual states of Australia and regions of New Zealand from full risk sharing with each other is somewhat comparable to average gain of around 0.69% for EU members (Demyanyk and Volosovych 2008) and 0.67% for OECD countries (Kalemli-Ozcan et al. 2001).

In general, our findings indicate that regions of New Zealand would gain relatively more than states of Australia which exhibit similar welfare gains in a union framework than without it. These findings from interstate risk sharing are also comparable with the country-level results obtained by Kim and Sheen (2007), who estimate moderate welfare gains for New Zealand but negligible (zero) gains for Australia.[73] The authors empirically establish that most of the potential gains between Australia and New Zealand have been exploited as a result of the structural reforms of the early 1980s, when the two countries deregulated their financial sectors, adopted

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[72] Specifically, eleven out of sixteen regions show an increase in welfare gains in a perfect risk sharing with Australian states vis-à-vis the intranational level, while four regions (Northland, Bay of Plenty, Hawke's Bay and Nelson) witness no change and only one region (Tasman) exhibits a minor welfare loss.
[73] Kim and Sheen (2007) estimate that for the period 1984–2000, the increase in permanent consumption amounts to 0.2% for New Zealand after 10 years and 0.7% after 50 years.

floating exchange rate regimes and established the Closer Economic Relations (CER) trade agreements. Moreover, Balli and Ozer-Balli (2011) also report similar results, where the welfare gains for New Zealand (1.31%) from complete risk sharing with other Pacific Island countries, are found to be relatively larger than those for Australia (0.51%). In the next section, we present our estimation strategy to examine interstate risk sharing in Australia and New Zealand.

3.5   Empirical findings

To begin with, we are interested in detecting the presence of risk sharing and intertemporal smoothing opportunities among the states of Australia (AUS), among the regions of New Zealand (NZ), and in a possible union of the Australian states and New Zealand regions (ANZ). For this purpose, we quantify the comovement of the consumption growth $(\Delta C_{i,t})$ of state/region i in year t with the idiosyncratic (domestic) output growth $(\Delta GDP_{i,t}^{id})$ of state/region i in year t via the following equation:

$$\Delta C_{i,t} = \beta \Delta GDP_{i,t}^{id} + v_{i,t}, \qquad (3.2)$$

where the β-coefficient captures the weighted averages of the year-by-year cross-sectional regressions.[74] Allowing for state-specific variances for the error terms, we estimate the panel equations by a two-step Generalized Least Squares (GLS) technique.[75] First, we use least squares and then use the residuals to estimate the

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[74] As explained in Section 3.3, the idiosyncratic consumption (or output) growth rate in standard risk sharing estimations is computed as the difference between the national (or state/region) and aggregate component of each variable (see Asdrubali et al. (1996), Sørensen and Yosha (1998) and Sørensen et al. (2007) for complete details). Following Asdrubali and Kim (2008a), we simply refer to the current domestic output growth of a state/region as the idiosyncratic output growth. The coefficient (β) attached to idiosyncratic output growth measures the consumption smoothing opportunities (i.e. risk sharing and intertemporal smoothing) among our sample countries, as it captures the average degree of comovement between (per capita) consumption growth and idiosyncratic (per capita) output growth. The error term ($v_{i,t}$) is generally assumed to follow a stationary process and captures errors in measuring consumption (Obstfeld 1994).

[75] The simple ordinary least squares (OLS) approach is not appropriate for estimating Equations 3.2–3.5 because of the potential autocorrelation and heteroskedasticity in the data. The generalised least squares

weights. Second, weighted least squares is performed using the estimated weights. The Prais-Winsten transformation is used to take care of serial correlation of the variables (see, Prais and Winsten 1954; Sørensen and Yosha 1998; Balli and Ozer-Balli 2011). We use differenced data at annual frequency.

The first row in Table 3.3 displays the results of the estimation of Equation 3.2, wherein the estimated coefficient of β represents the percentage of idiosyncratic output shocks that remain unabsorbed.[76] In other words, it represents a measure of the joint failure of the risk sharing and intertemporal smoothing hypotheses. For the regions of New Zealand, the coefficient attached to idiosyncratic output growth is 0.33, implying that 67% of idiosyncratic shocks are smoothed through standard channels of risk sharing and intertemporal smoothing (i.e. capital markets, credit markets and the fiscal system). Among the states of Australia, the amount of idiosyncratic output shocks that remain unabsorbed is 26%, while the other 74% of the shocks are buffered. At first glance, these findings suggest that consumption smoothing channels seem to play a relatively efficient role in insulating idiosyncratic output shocks within Australia, compared to New Zealand. We also estimate the amount of unabsorbed shocks taking place among Australian states and New Zealand regions together and find that 24% of idiosyncratic shocks are left unsmoothed, whereas a considerably large fraction of shocks (76%) are insured. Comparing the aforementioned results suggest that the degree of smoothing of idiosyncratic shocks among Australian states and New Zealand regions

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(GLS) approach is more appropriate since it applies a clustering technique to correct heteroskedasticity and uses the Cochrane–Orcutt procedure to correct the potential autocorrelation of the error terms. In so doing, it is assumed that the error terms in each state/country follow an AR(1) process (Sørensen and Yosha 1998; Jeanneney and Tapsoba 2012).

[76] Following the standard literature, the coefficients and the standard errors are multiplied by 100 in order to compare the estimates to the related literature. The smaller the extent of the comovement of consumption growth with domestic output growth (which is indicated by a low estimated coefficient of β), the greater the degree of smoothing through risk sharing and intertemporal smoothing channels. The corresponding series $100 \times (1 - \beta)$ is often used to discuss the degree of smoothing in percentage terms.

is larger than at the intranational level, implying that Australia and New Zealand would be better-off forming a union based on the consumption smoothing criterion.

In general, the aforementioned findings indicate the presence of partial consumption smoothing opportunities across Australia and New Zealand. This suggests the need for a joint examination of risk sharing and intertemporal smoothing for a complete assessment of the smoothing capabilities of both countries.[77] Asdrubali and Kim (2008a) employ the statistical properties of panel data to measure the degrees of risk sharing and intertemporal smoothing in a group of OECD countries. Their methodology involve time- and cross-section- fixed effects for the purpose of quantifying risk sharing and intertemporal smoothing amounts, by using the cross-sectional and time-series variations of panel data.[78] Time fixed effects correspond to the degree of interstate/regional risk sharing (or simply risk sharing), whereas cross-section fixed effects correspond to the degree of intertemporal smoothing.

Employing Asdrubali and Kim (2008a)'s unified approach,[79] we estimate the following panel equation to jointly test the extent of both risk sharing and intertemporal smoothing:

$$\Delta C_{i,t} = \alpha \Delta GDP_i^{pr} + \delta \Delta GDP_t^{ag} + \beta \Delta GDP_{i,t}^{id} + v_{i,t}, \qquad (3.3)$$

where α measures the degree of intertemporal smoothing by quantifying the comovement of a state's/region's consumption growth with permanent (average) output

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[77] Asdrubali and Kim (2008a, p. 375) argues that "when risk sharing is not complete, intertemporal consumption does not necessarily ensue, and thus a separate test is warranted in order to assess the full range of smoothing capabilities of the economy".

[78] Asdrubali and Kim (2008a) note that panel data estimation also reduces the potential problems of multicollinearity, omitted variable bias and selectivity bias.

[79] For complete derivation of the econometric model, see Asdrubali and Kim (2008a).

growth (ΔGDP_i^{pr})[80]; likewise, δ measures the degree of risk sharing, as it quantifies the comovement of a state's/region's consumption growth with aggregate output growth (ΔGDP_t^{ag}).[81] As previously mentioned, β is a measure of the joint rejection of both the risk sharing and intertemporal smoothing hypotheses, as it quantifies the degree of comovement of a state's/region's consumption growth with idiosyncratic output growth $(\Delta GDP_{i,t}^{id})$. An inherent feature of this model is that the time and country effects are independently and identically distributed, and are uncorrelated with the regressors. Asdrubali and Kim (2008a) emphasize that their model orthogonalizes the effects of risk sharing and intertemporal smoothing on consumption, while at the same time, it allows the direct estimation of the coefficients of aggregate and average output growth.

The second row in Table 3.3 reports the estimation results for Equation 3.3. The coefficient α attached to permanent output growth, a direct measure of the degree of intertemporal smoothing, is negative and statistically significant for New Zealand; implying that there is dis-smoothing of permanent output shocks among New Zealand regions. Performing the regression equation for the states of Australia, α is nil which indicates the absence of intertemporal smoothing within Australia. These results point out that in contradiction with the permanent income hypothesis, economic agents in New Zealand and Australia do not consider permanent income in their current consumption decisions. When Australia and New Zealand are combined together, the coefficient α is negative and statistically significant — a confirmation of the lack of

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[80] The econometric model of Asdrubali and Kim (2008a) replaces permanent output growth with average output growth, by arguing that the two measures are same under the assumption that output follows a linear stochastic process.

[81] General risk sharing regressions are based on panel estimations with time-fixed effects, so that we are able to measure the response of idiosyncratic consumption growth of state/country *i* in year *t*, deviated from the aggregate consumption growth, to the idiosyncratic output growth of state/country *i* in year *t*, again deviated from the aggregate output growth. We employ the aggregate output growth as the measure of risk sharing and this variable captures the time-fixed effect as well.

intertemporal smoothing within the two countries observed earlier.[82] These findings are in contrast to a significant amount of intertemporal smoothing (26%) found among OECD countries by Asdrubali and Kim (2008a).[83]

The coefficient δ captures the degree of risk sharing, as it measures the extent to which consumption growth follows aggregate (non-diversifiable) output shocks.[84] The degree of interstate risk sharing within New Zealand and within Australia appears to be quite low, as consumption growth follows only 2% and 4% of aggregate output shocks, respectively. Similarly, in case of a union between Australia and New Zealand, consumption growth follows only 4% of aggregate output shocks. This finding suggests that Australia and New Zealand may not constitute a viable union based on the prevalent risk sharing arrangements. Lastly, our estimate for β, a measure of the failure of both risk sharing and intertemporal smoothing models, suggests that consumption growth follows around 26% of the idiosyncratic shocks in output within New Zealand, while 13% of idiosyncratic disturbances dictate consumption growth within Australia. Between Australia and New Zealand, almost 18% of the idiosyncratic shocks are not insulated, which is considerably less than the amount of shocks (i.e. 61%) that are found to be unabsorbed among OECD countries (Asdrubali and Kim 2008a). Nevertheless, these estimates differ with the corresponding estimates of Equation 3.2, which is

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[82] The rejection of the intertemporal smoothing hypothesis reflects the inability of domestic and international credit markets in smoothing consumption: common explanations are tight liquidity conditions, borrowing constraints and prevailing social security benefits in the two economies both at the aggregate and state level (Leong 2002; Coleman 2006; Kim et al. 2006a; Rao and Sharma 2007; Asdrubali and Kim 2008b; Wang 2011). Nevertheless, our work does not directly address these issues and focuses on measuring the extent of interstate risk sharing and intertemporal smoothing.

[83] Our empirical results here do not support the argument of Ostergaard et al. (2002) that borrowing and lending activities are easier for individual states than for the country as a whole. Ostergaard et al. (2002) document that individual US states and Canadian provinces can more easily borrow and lend among themselves than the aggregate economy.

[84] According to the theory of risk sharing (Obstfeld and Rogoff 1996), consumption should not respond to idiosyncratic output shocks but should be highly correlated with aggregate output shocks. Thus, aggregate shocks are non-diversifiable and cannot be eliminated by sharing of risk among economic regions.

primarily an outcome of incorporating intertemporal smoothing and risk sharing hypotheses concurrently in a single model. Contrary to the literature, we find that the extent of risk sharing and intertemporal smoothing within a country is not larger than across countries.[85]

Table 3.3: Estimates of risk sharing among regions of New Zealand (NZ), states and territories of Australia (AUS), and between Australia and New Zealand (ANZ)

$\Delta C_{i,t} = \beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ	AUS	ANZ
	33	26	24
	(13)	(6)	(5)

$\Delta C_{i,t} = \alpha \Delta GDP_i^{pr} +$ $\delta \Delta GDP_t^{ag} +$ $\beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ			AUS			ANZ		
	α	δ	β	α	δ	β	α	δ	β
	-8	2	26	0	4	13	-3	4	18
	(4)	(1)	(13)	(1)	(1)	(6)	(1)	(1)	(5)

$\Delta C_{i,t} = \beta^+ \Delta GDP_{i,t}^{id+}$ $+ \beta^- \Delta GDP_{i,t}^{id-} + v_{i,t}$	NZ		AUS		ANZ	
	β^+	β^-	β^+	β^-	β^+	β^-
	29	14	25	16	16	12
	(16)	(10)	(12)	(8)	(10)	(9)

$\Delta C_{i,t} =$ $\delta^+ \Delta GDP_t^{ag+} +$ $\delta^- \Delta GDP_t^{ag-} +$ $\beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ			AUS			ANZ		
	δ^+	δ^-	β	δ^+	δ^-	β	δ^+	δ^-	β
	11	8	31	5	-1	10	7	0	18
	(5)	(5)	(19)	(3)	(4)	(6)	(3)	(4)	(6)

Notes: NZ stands for regions of New Zealand, AUS stands for states and territories of Australia, and ANZ represents an Australia-New Zealand union. The coefficients represent the following: α quantifies the extent of intertemporal smoothing by measuring the comovement of a state's/region's consumption growth with permanent (average) output growth (ΔGDP_i^{pr}); δ represents the extent of risk sharing by measuring the comovement of consumption growth with aggregate output growth (ΔGDP_t^{ag}); β measures the degree of comovement of consumption growth with idiosyncratic output growth ($\Delta GDP_{i,t}^{id}$). In addition, the coefficients β^+ and β^- quantify (partial) risk sharing and (partial) intertemporal smoothing opportunities under positive and negative idiosyncratic output shocks; similarly, the coefficients δ^+ and δ^- quantify the degree of risk sharing under positive and negative aggregate shocks, respectively. Following the related literature, the coefficients and the standard errors are multiplied by 100 and rounded off.

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[85] For example, Asdurabali and Kim (2008b) estimate that the degrees of risk sharing and intertemporal smoothing are higher in US states than in OECD and EU countries. Kim and Sheen (2007) obtain similar findings for Australia.

3.5.1 Decomposing idiosyncratic and aggregate output shocks

The aforementioned analyses do not take into account the distinction between positive and negative output shocks, which may potentially bias the coefficients attached to output thereby generating misleading results. Pierucci and Ventura (2010, p.711) argue that decomposing the idiosyncratic shocks into positive and negative components may also capture some of the permanent and transitory features of output shocks. For the purpose of understanding, they further point out that when an economy is on a positive growth trajectory, it is likely to experience permanent positive shocks that prevail over the negative ones, resulting in a relatively larger absolute value of the coefficient attached to positive shocks. If the economy has an effective insurance mechanism in place to counter (transitory) negative shocks, not differentiating positive and negative disturbances may fail to fully capture the inherent insurance arrangements within the system.

To guard against this possibility, following Pierucci and Ventura (2010), we augment our regressions by arguing a clear distinction between positive and negative idiosyncratic shocks:

$$\Delta C_{i,t} = \beta^+ \Delta GDP_{i,t}^{id+} + \beta^- \Delta GDP_{i,t}^{id-} + v_{i,t}, \tag{3.4}$$

where the coefficients β^+ and β^- are the estimates of the degree to which consumption growth follows positive and negative idiosyncratic output growth ($\Delta GDP_{i,t}^{id+}$ and $\Delta GDP_{i,t}^{id-}$). In order to split up output shocks into positive and negative components, following Pierucci and Ventura (2010), we employ an output gap process that measures the output trend through linear and quadratic filtering approach: this approach primarily

extracts the time-varying trend (output trend) from the output data.[86] Here, positive output shocks represent a situation where the actual output is higher than the trend output (positive output gap), whereas negative output shocks represent a situation where actual output is lower than the trend output (negative output gap).

The third row in Table 3.3 displays the estimated coefficients of idiosyncratic output shocks when they are decomposed into positive and negative components. The coefficients of positive and negative idiosyncratic output growth turn out to be statistically insignificant for New Zealand, while these coefficients are significant for Australia. When Australia and New Zealand are considered jointly, the coefficients (i.e. β^+ and β^-) remain statistically insignificant. In general, all these estimates are somewhat different than the ones reported in the first row, suggesting that disintegrating the nature of idiosyncratic shocks changes our results considerably. In other words, the earlier model that does not split up the nature of idiosyncratic fluctuations seems to inappropriately measure the insurance capabilities that are prevalent among our sample countries.

Similar to the exercise conducted in case of idiosyncratic output growth, as the next step, we are interested in exploring whether the nature (positive vs. negative) of aggregate (non-diversifiable) output shocks makes any noticeable change to our earlier findings that point towards a low degree of risk sharing being present among Australian states and New Zealand regions. In particular, we argue that a higher degree of

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[86] For comparison purposes, we also use the standard filtering methods (such as, Hodrick and Prescott (1997) and Baxter and King (1999)), however, the results may not be reliable given that these methods are considered poor for estimating short samples. The results using Hodrick and Prescott (1997) filtering approach are reported in Table B.2 and Table B.3 of the appendix.

smoothing consumption against negative shocks is highly desirable to gauge the efficacy of the risk sharing mechanisms during economic downturns. Here, unique to the risk sharing literature, we make a distinction between positive and negative aggregate output shocks by utilizing the methodologies of Asdrubali and Kim (2008a) and Pierucci and Ventura (2010). Accordingly we estimate the following equation:

$$\Delta C_{i,t} = \delta^+ \Delta GDP_t^{ag+} + \delta^- \Delta GDP_t^{ag-} + \beta \Delta GDP_{i,t}^{id} + v_{i,t}, \qquad (3.5)$$

where ΔGDP_t^{ag+} and ΔGDP_t^{ag-} represent positive and negative aggregate output growth respectively.[87] The coefficients δ^+ and δ^- are the estimates of the degree to which consumption growth follows positive and negative aggregate output growth. As explained earlier, we use the output gap notion by employing the linear and quadratic filtering method, in order to recognize positive and negative aggregate output disturbances.

The last row of Table 3.3 reports the estimation results for Equation 3.5. Similar to the previous results, the coefficient attached to positive aggregate output growth has a low value: consumption growth follows only 11% (NZ), 5% (AUS) and 7% (ANZ) of the movements in positive aggregate growth, implying a low degree of interstate and regional risk sharing under positive aggregate shocks. The coefficient attached to negative aggregate output growth is statistically insignificant with a low value, that reflects the virtual absence of interstate as well as regional risk sharing when both countries face negative fluctuations. Overall, this implies that in a union setting, either there will be a low degree of risk sharing when the region experiences a boom (i.e. positive aggregate shocks), or a complete lack of risk sharing when the region

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[87] Since the coefficient attached to average output growth is insignificant in all cases, it is not included in Equation 3.5. The results do not differ much whether or not we use average output growth.

experiences a recession (i.e. negative aggregate shocks). In contrast to earlier findings, it can be argued that a clear recognition of the positive and negative aggregate output shocks is needed to fully assess the extent of risk sharing across business cycles.

Since New Zealand regions are very small compared to their Australian counterparts, to have a better comparison between the two, we aggregate the sixteen regions of New Zealand into two larger categories based on their location, i.e. North Island and South Island.[88] Here our objective is to see whether or not this aggregation makes any difference to our earlier findings. With this purpose, Table 3.4 reports the estimates of risk sharing across the two islands of New Zealand (NZ) and in a union between Australian states and New Zealand islands (ANZ) for the system of equations.[89] The overall results are similar to what has been obtained previously.

Across the North and South Islands, 55% of idiosyncratic output shocks remain unsmoothed, while 33% of idiosyncratic shocks are absorbed among the regions of New Zealand. When New Zealand islands and Australian states are combined together, the coefficient attached to idiosyncratic output growth amounts to 0.29, implying that 71% of idiosyncratic shocks are absorbed. Estimating the unified model of Asdrubali and Kim (2008a), intertemporal smoothing is found to be absent, thereby rejecting the permanent income hypothesis within New Zealand, and between Australia and New Zealand (row two). Contrary to the earlier results, the degree of risk sharing improves substantially within New Zealand: consumption growth follows 50% of aggregate output growth. Nevertheless, in a union between Australia and New Zealand, the extent

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[88] North Island comprises Auckland, Waikato, Northland, Bay of Plenty, Gisborne, Hawke's Bay, Taranaki, Manawatu and Wellington; the South Island comprises the West Coast, Canterbury, Otago, Southland, Tasman, Nelson and Marlborough.

[89] For brevity, we occasionally refer to the North Island and South Island of New Zealand as the "islands".

of risk sharing remains quite low (6%). Interestingly, only positive idiosyncratic output shocks are insured across the islands of New Zealand and jointly with Australian states, while the coefficient attached to negative idiosyncratic output growth is insignificant as estimated previously (row three). Finally, as established earlier, an Australia–New Zealand union is unable to share risk when the region experiences negative fluctuations.

Table 3.4: Estimates of risk sharing among the North Island and South Island of New Zealand (NZ), and between Australia and New Zealand (ANZ)

$\Delta C_{i,t} = \beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ	ANZ				
	55	29				
	(14)	(6)				

$\Delta C_{i,t} = \alpha \Delta GDP_i^{pr} + \delta \Delta GDP_t^{ag}$ $+ \beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ			ANZ		
	α	δ	β	α	δ	β
	-6	50	11	1	6	26
	(14)	(14)	(10)	(1)	(1)	(7)

$\Delta C_{i,t} = \beta^+ \Delta GDP_{i,t}^{id+} + \beta^- \Delta GDP_{i,t}^{id-}$ $+ v_{i,t}$	NZ		ANZ			
	β^+	β^-	β^+	β^-		
	30	28	28	17		
	(11)	(18)	(12)	(10)		

$\Delta C_{i,t} = \delta^+ \Delta GDP_t^{ag+} + \delta^- \Delta GDP_t^{ag-}$ $+ \beta \Delta GDP_{i,t}^{id} + v_{i,t}$	NZ			ANZ		
	δ^+	δ^-	β	δ^+	δ^-	β
	48	4	4	5	-4	28
	(12)	(7)	(16)	(2)	(4)	(7)

Notes: NZ represents the North Island and South Island of New Zealand; and ANZ represents an Australia-New Zealand union. The estimates of risk sharing and intertemporal smoothing among states and territories of Australia (AUS) are not mentioned since they are similar to the ones reported in Table 3.3. The coefficients represent the following: α quantifies the extent of intertemporal smoothing by measuring the comovement of a state's/region's consumption growth with permanent (average) output growth (ΔGDP_i^{pr}); δ represents the extent of risk sharing by measuring the comovement of consumption growth with aggregate output growth (ΔGDP_t^{ag}); β measures the degree of comovement of consumption growth with idiosyncratic output growth ($\Delta GDP_{i,t}^{id}$). In addition, the coefficients β^+ and β^- quantify (partial) risk sharing and (partial) intertemporal smoothing opportunities under positive and negative idiosyncratic output shocks; similarly the coefficients δ^+ and δ^- quantify the degree of risk sharing under positive and negative aggregate shocks, respectively. Following the related literature, the coefficients and the standard errors are multiplied by 100 and rounded off.

In general, our results are consistent in both cases (islands vis-à-vis regions of New Zealand), displaying a substantial amount of insurance against idiosyncratic output shocks, a lack of intertemporal smoothing and negligible risk sharing in a union setting.

3.6   Conclusions

The aim of this study is to examine the viability of a union between Australia and New Zealand based on the interstate risk sharing mechanisms between the two countries. We apply appropriate methodological techniques to explore the degrees of both risk sharing and intertemporal smoothing taking place separately and jointly among Australian states and New Zealand regions for the period 1998–2008. Further, we distinguish and quantify between smoothing of idiosyncratic shocks and aggregate (non-diversifiable) shocks, as well as between positive and negative realizations of these disturbances, so as to capture their distinct effects on smoothing mechanisms.

In the context of a possible unification, we obtain several interesting findings. To begin with, we show that the potential welfare gains from perfect risk sharing for New Zealand regions are relatively higher than those for Australian states, which obtain somewhat similar gains in a union framework than without it. Although initial estimation results indicate the presence of partial risk sharing and partial intertemporal smoothing opportunities in our sample, further examination by distinguishing and quantifying the effects of different types of shocks unfolds a different story. Firstly, contrary to the evidence for OECD and EU countries, we are not able to observe intertemporal smoothing among Australian states and New Zealand regions, whether alone or jointly. It appears that economic agents here do not consider permanent income when undertaking consumption decisions. Secondly, the degree of risk sharing is found to be negligible since there is only a weak dependence of consumption growth on

aggregate output growth: consumption growth follows only 4% of movements in aggregate output growth in a union between Australia and New Zealand. Decomposing aggregate shocks into positive and negative components, we find a virtual absence of risk sharing when both countries face negative fluctuations. This lack of risk sharing under negative aggregate shocks should be a concern for policy makers, since it has a greater potential for causing breakdown of the union, particularly in times of economic crisis. In general, our findings are not consistent with the evidence of Kim and Sheen (2007), which appears to be an outcome of a joint examination of risk sharing and intertemporal smoothing mechanisms in a single approach.

Overall, the intuition underlying our results is that a union between Australia and New Zealand should be cautiously pursued based on the current state of risk sharing and intertemporal smoothing arrangements, as market institutions appear to provide an inadequate mechanism to pool and diversify output risks. From a policy point of view, there is greater scope for enhanced macroeconomic coordination and integration of financial and goods markets between the two countries, which may, in turn, facilitate economic agents in insulating consumption against adverse output fluctuations. Alternatively, establishing a currency union may itself enhance economic integration and risk sharing opportunities across the two countries (Mundell 1973; Frankel and Rose 1998).

Appendix:

Table B.1: Descriptive statistics for regions of New Zealand and states and territories of Australia

	ΔGDP (per capita)		ΔCON (per capita)	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
New Zealand Regions				
Northland	0.046	0.023	0.039	0.052
Auckland	0.040	0.015	0.031	0.026
Waikato	0.035	0.019	0.045	0.039
Bay of Plenty	0.044	0.025	0.036	0.037
Gisborne	0.044	0.035	0.049	0.048
Hawke's Bay	0.049	0.025	0.051	0.051
Taranaki	0.045	0.059	0.023	0.065
Manawatu–Wanganui	0.038	0.028	0.057	0.044
Wellington	0.040	0.020	0.039	0.016
Tasman	0.035	0.047	0.050	0.049
Nelson	0.040	0.022	0.040	0.026
Marlborough	0.042	0.030	0.065	0.054
West Coast	0.046	0.036	0.045	0.056
Canterbury	0.051	0.035	0.075	0.123
Otago	0.035	0.020	0.022	0.156
Southland	0.046	0.038	0.072	0.065
Average	0.042	0.030	0.046	0.057
Australian States				
New South Wales	0.058	0.017	0.072	0.035
Victoria	0.049	0.007	0.048	0.009
Queensland	0.077	0.047	0.070	0.015
South Australia	0.057	0.021	0.028	0.017
Western Australia	0.054	0.019	0.055	0.017
Tasmania	0.057	0.025	0.050	0.017
Northern Territory	0.048	0.010	0.047	0.008
Australian Capital Territory	0.074	0.037	0.051	0.014
Average	0.059	0.023	0.053	0.016

Notes: Sample: 1998–2008. The statistics are computed using logarithms of per capita variables, wherein ΔGDP (per capita) and ΔCON (per capita) are the logarithm of real GDP per capita and the logarithm of real (final) consumption per capita, respectively. For information on the data sources and the construction of variables, see Section 3.2.

Figure B.1: Output (GDP) and consumption (CON) patterns across small regions of New Zealand

New Zealand regions: ΔGDP (per capita)

Marlborough — Tasman — Taranaki — West Coast

New Zealand regions: ΔCON (per capita)

Marlborough — Tasman — Taranaki — West Coast
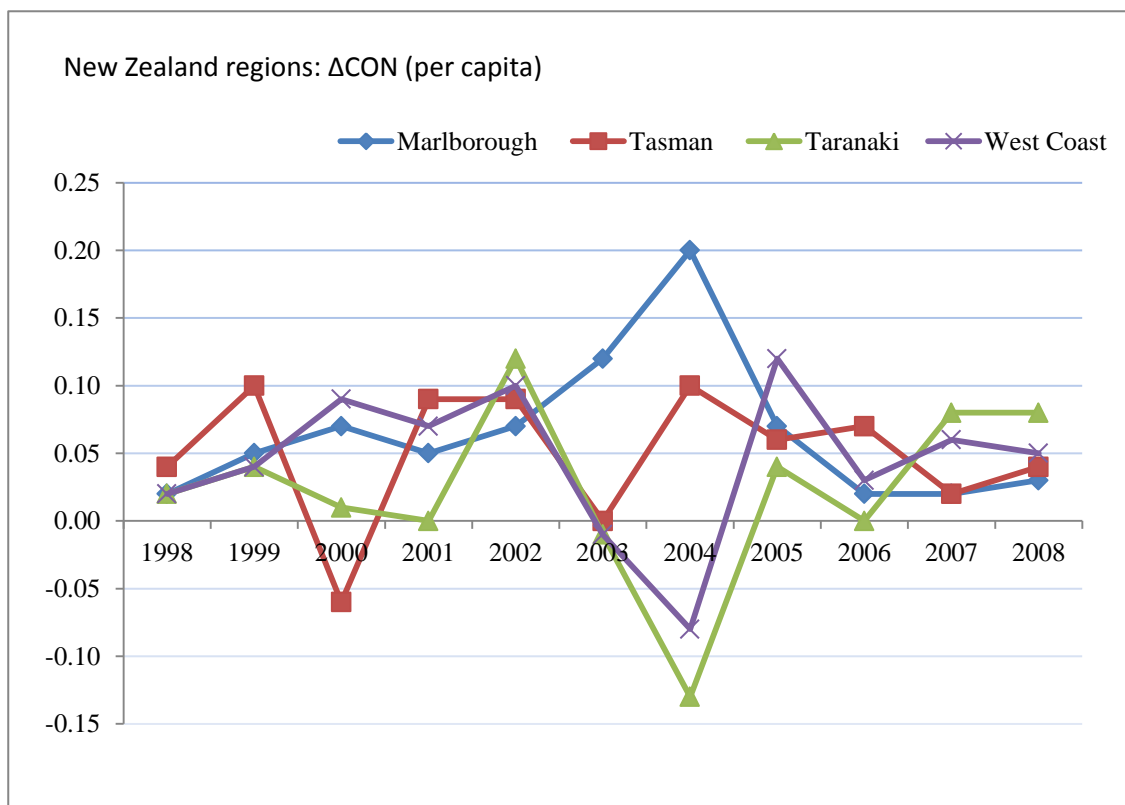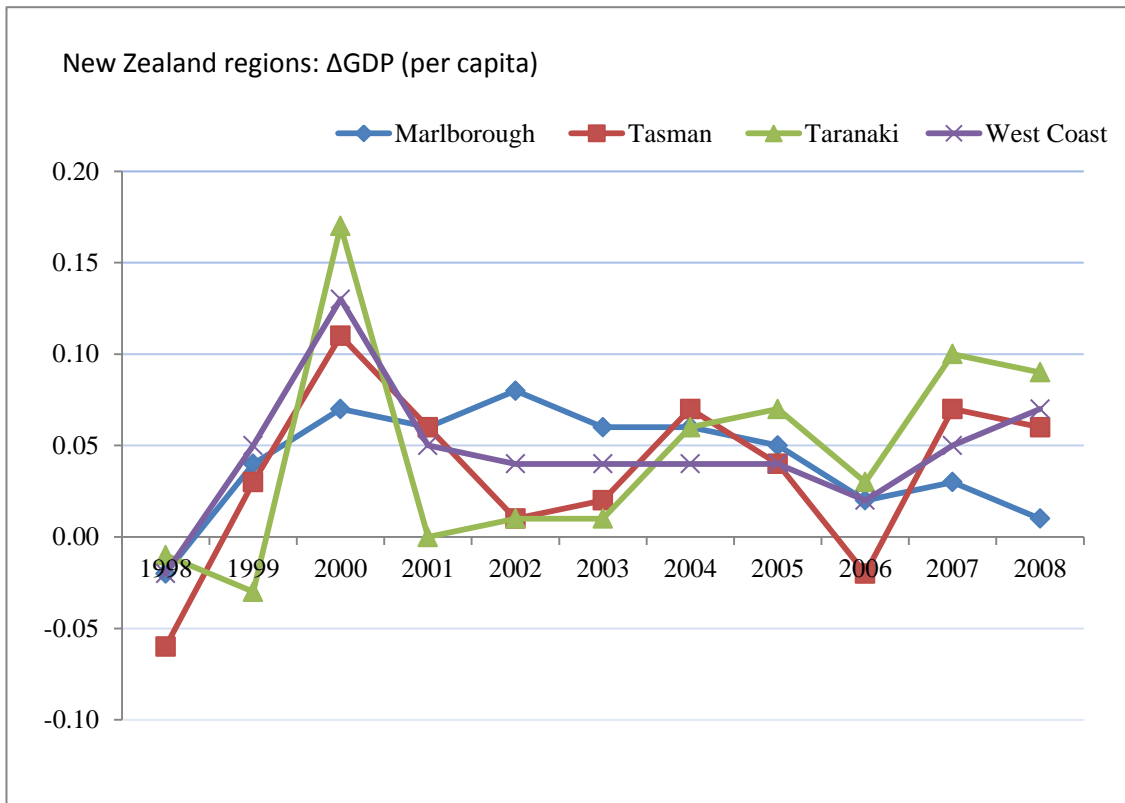
Figure B.2: Output (GDP) and consumption (CON) patterns across large states of Australia

Australian states: ΔGDP (per capita)

— New South Wales — Victoria — Queensland — Western Australia

Australian states: ΔCON (per capita)

— New South Wales — Victoria — Queensland — Western Australia
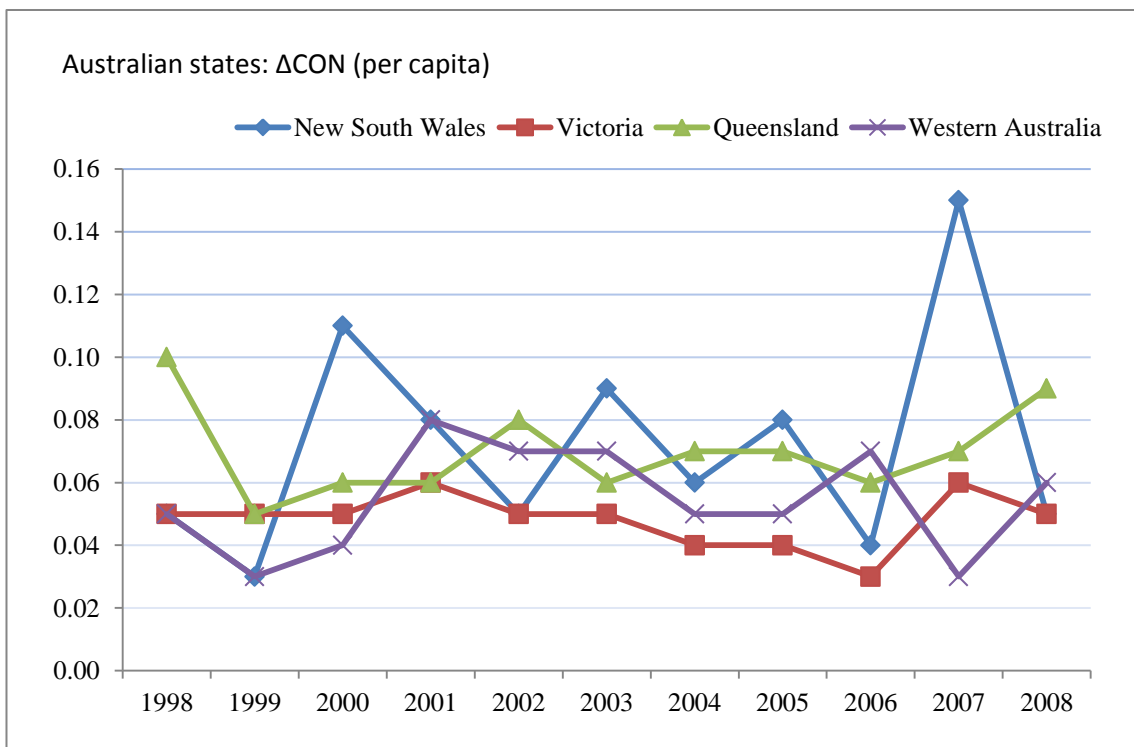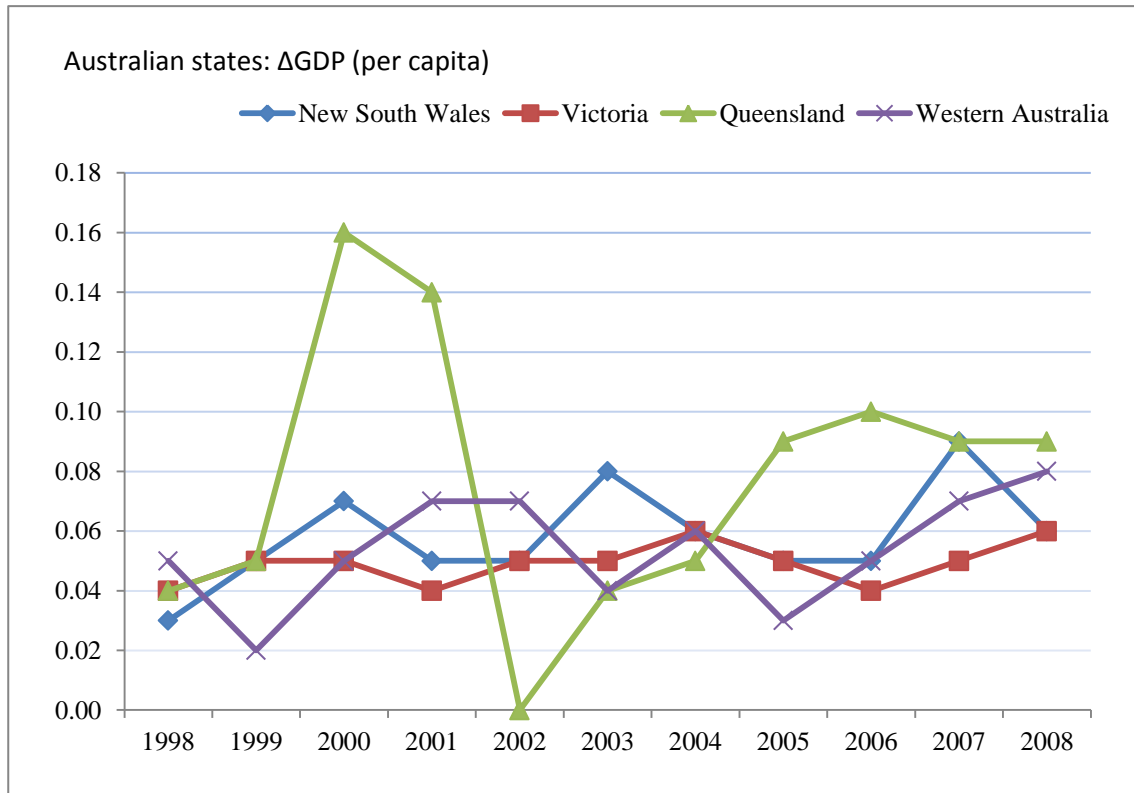
Table B.2: Estimates of risk sharing among regions of New Zealand (NZ), states and territories of Australia (AUS), and between Australia and New Zealand (ANZ)

$\Delta C_{i,t} = \beta \Delta GDP^{id}_{i,t} + v_{i,t}$

	NZ	AUS	ANZ
	33	26	24
	(13)	(6)	(5)

$\Delta C_{i,t} = \alpha \Delta GDP^{pr}_i + \delta \Delta GDP^{ag}_t + \beta \Delta GDP^{id}_{i,t} + v_{i,t}$

NZ			AUS			ANZ		
α	δ	β	α	δ	β	α	δ	β
-8	2	26	0	4	13	-3	4	18
(4)	(1)	(13)	(1)	(1)	(6)	(1)	(1)	(5)

$\Delta C_{i,t} = \beta^+ \Delta GDP^{id+}_{i,t} + \beta^- \Delta GDP^{id-}_{i,t} + v_{i,t}$

NZ		AUS		ANZ	
β^+	β^-	β^+	β^-	β^+	β^-
32	26	23	29	17	23
(20)	(11)	(8)	(10)	(7)	(10)

$\Delta C_{i,t} = \delta^+ \Delta GDP^{ag+}_t + \delta^- \Delta GDP^{ag-}_t + \beta \Delta GDP^{id}_{i,t} + v_{i,t}$

NZ			AUS			ANZ		
δ^+	δ^-	β	δ^+	δ^-	β	δ^+	δ^-	β
6	7	30	4	9	9	8	-2	17
(3)	(3)	(20)	(2)	(2)	(9)	(2)	(3)	(7)

Notes: NZ stands for regions of New Zealand, AUS stands for states and territories of Australia, and ANZ represents an Australia-New Zealand union. The coefficients represent the following: α quantifies the extent of intertemporal smoothing by measuring the comovement of a state's/region's consumption growth with permanent (average) output growth (ΔGDP^{pr}_i); δ represents the extent of risk sharing by measuring the comovement of consumption growth with aggregate output growth (ΔGDP^{ag}_t); β measures the degree of comovement of consumption growth with idiosyncratic output growth ($\Delta GDP^{id}_{i,t}$). In addition, the coefficients β^+ and β^- quantify (partial) risk sharing and (partial) intertemporal smoothing opportunities under positive and negative idiosyncratic output shocks; similarly, the coefficients δ^+ and δ^- quantify the degree of risk sharing under positive and negative aggregate shocks, respectively. Following the related literature, the coefficients and the standard errors are multiplied by 100 and rounded off.

Table B.3: Estimates of risk sharing among the North Island and South Island of New Zealand (NZ), and between Australia and New Zealand (ANZ)

$$\Delta C_{i,t} = \beta \Delta GDP_{i,t}^{id} + v_{i,t}$$

	NZ	ANZ
	55	29
	(14)	(6)

$$\Delta C_{i,t} = \alpha \Delta GDP_i^{pr} + \delta \Delta GDP_t^{ag} + \beta \Delta GDP_{i,t}^{id} + v_{i,t}$$

	NZ			ANZ		
	α	δ	β	α	δ	β
	-6	50	11	1	6	26
	(14)	(14)	(10)	(1)	(1)	(7)

$$\Delta C_{i,t} = \beta^+ \Delta GDP_{i,t}^{id+} + \beta^- \Delta GDP_{i,t}^{id-} + v_{i,t}$$

	NZ		ANZ	
	β^+	β^-	β^+	β^-
	34	50	33	28
	(13)	(12)	(14)	(6)

$$\Delta C_{i,t} = \delta^+ \Delta GDP_t^{ag+} + \delta^- \Delta GDP_t^{ag-} + \beta \Delta GDP_{i,t}^{id} + v_{i,t}$$

	NZ			ANZ		
	δ^+	δ^-	β	δ^+	δ^-	β
	65	13	4	4	-5	27
	(21)	(5)	(15)	(1)	(6)	(5)

Notes: NZ represents the North Island and South Island of New Zealand; and ANZ represents an Australia-New Zealand union. The estimates of risk sharing and intertemporal smoothing among states and territories of Australia (AUS) are not mentioned since they are similar to the ones reported in Table B.2. The coefficients represent the following: α quantifies the extent of intertemporal smoothing by measuring the comovement of a state's/region's consumption growth with permanent (average) output growth (ΔGDP_i^{pr}); δ represents the extent of risk sharing by measuring the comovement of consumption growth with aggregate output growth (ΔGDP_t^{ag}); β measures the degree of comovement of consumption growth with idiosyncratic output growth ($\Delta GDP_{i,t}^{id}$). In addition, the coefficients β^+ and β^- quantify (partial) risk sharing and (partial) intertemporal smoothing opportunities under positive and negative idiosyncratic output shocks; similarly, the coefficients δ^+ and δ^- quantify the degree of risk sharing under positive and negative aggregate shocks, respectively. Following the related literature, the coefficients and the standard errors are multiplied by 100 and rounded off.

CHAPTER FOUR

ESSAY THREE

The determinants of the volatility of returns on

cross-border asset holdings

Using both panel and cross-sectional models for 28 industrialized countries observed from 2001 to 2009, we report a number of findings regarding the determinants of the volatility of returns on cross-border asset holdings (i.e., equity and debt). Greater portfolio concentration and an increase in asset holding in emerging markets lead to an elevation in earning volatility, whereas more financial integration and greater share by Organization for Economic Cooperation and Development (OECD) countries and household sector cause a reduction in the return volatility. Greater asset holdings by offshore financial corporations and non-bank financial institutions cause higher market volatility, although they affect the volatility in equity and bond markets in the opposite way. Overall, both panel and cross-sectional estimations provide very similar results (albeit of different magnitude), and are robust to the endogeneity problem.

4.1   Introduction

After growing in tandem with gross domestic product (GDP) for most of the first eight decades of the 20th century, (global) financial assets grew at a more rapid pace after 1980 as companies and financial institutions turned increasingly to capital markets for financing. Although a spate of currency and financial crises in the late 1980s and early 1990s interrupted the process, advances in information and communication technology, financial market liberalization and, in particular, the creation of the European Monetary Union (EMU) have contributed to a dramatic surge in global capital flows in recent years. According to Deutsche Bundesbank (2009), total cross-border assets and liabilities documented worldwide amounted to some US\$ 192 trillion at the end of 2007 – reflecting an almost four-fold increase compared with 1999.[90] However, the upheaval in financial markets in late 2008 abruptly halted this decade-long expansion of the global capital market, resulting in an 8% drop in the value of world's financial assets by the end of 2008, the largest decline compared with the previous economic and financial turmoil seen in 1990-91, 1997-98 and 2000-02 (McKinsey Global Institute 2009).

The surge in cross-border capital flows[91] in the first decade of the new millennium has stimulated numerous empirical investigations that can be roughly divided into two strands of literature. The first strand of the literature concentrates on the determinants of bilateral asset holdings covering[92] the role of geography, culture and information costs (Ahearne et al. 2004; Chan et al. 2005; Portes and Rey 2005); trade

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[90] As a result, financial depth (the ratio of a country's financial assets to GDP) has been increasing consistently across all countries. For example, from 1990-2006, the number of countries whose financial assets' value exceeded that of their respective GDPs increased from 33% to 72% (Farrell et al. 2008).

[91] This includes foreign direct investment (FDI), purchases and sales of foreign equities and debt securities, and cross-border lending and deposits.

[92] This collection of studies is originally compiled by Coeurdacier and Guibaud (2011, p. 291).

(Aviat and Coeurdacier 2007; Lane and Milesi-Ferretti 2008); exchange rate risk and currency unions (Lane 2006; Coeurdacier and Martin 2009; De Santis and Gerard 2006; Fidora et al. 2007); institutions (Vlachos 2004; Wei and Gelos 2005; Daude and Fratzscher 2008) and corporate governance (Dahlquist et al. 2003) as important determinants of cross-border asset holdings. Controlling for many of these determinants of international portfolios, Coeurdacier and Guibaud (2011) find that investors tend to tilt their foreign holdings towards countries that offer better diversification opportunities. The second strand of the literature looks at the diverse patterns of foreign capital flows, including topics such as the changing nature of a country's (gross) external positions and the associated composition of international portfolios (Lane and Milesi-Ferretti 2007), cross-border portfolio investments as a channel of international risk sharing (Sørensen et al. 2007; Demyanyk et al. 2008; Kose et al. 2009; Bracke and Schmitz 2011; Balli et al. 2011) and the impact of the recent financial crisis on international diversification (Vermeulen 2013, Balli et al. 2013).[93]

However, all the aforementioned studies have one shortcoming in common: they have remained silent on the underlying risk affecting cross-border portfolio returns. Risk, captured by the volatility in returns, is one of the two pillars of investors' risk-return profiles underlying their investment decisions. From a macroeconomic perspective, understanding the (major) sources of earning volatility is crucial, if appropriate policy responses are to be framed, especially to exploit the gains from risk sharing through cross-border asset holdings. The basic intuition behind risk sharing through cross-border asset holdings is that a country would be better placed to sever connections between its income and output fluctuations when it is involved in

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[93] In fact, studies on international capital flows have burgeoned so rapidly in recent years that they are collectively referred to today as a completely new branch of literature, namely "Open Economy Financial Macroeconomics" (Coeurdacier and Rey 2011).

substantial cross-border investments globally. Through stable returns from cross-border investments, risk is diversified across national borders, and national income is stabilized against country-specific output fluctuations ─ a phenomenon known in the literature as "income risk sharing" or "income smoothing" (Obstfeld and Rogoff 1996; Sørensen and Yosha 1998).

A review of the empirical literature (e.g., Lane 2001; Sørensen and Yosha 1998; Sørensen et al. 2007; Demyanyk et al. 2008; Balli et al. 2011, 2013; Volosovych 2013) suggests that the extent of income smoothing is not only dependent on the size of foreign asset holdings but also on the patterns of their returns.[94] For instance, Sørensen et al. (2007) find a positive association between foreign asset holdings and income risk sharing among OECD countries, implying that more financial integration will possibly lead to greater income smoothing. Studying the role of returns in facilitating income risk sharing, Lane (2001) concludes that neither returns on foreign assets show countercyclical patterns nor returns on foreign liabilities behave procyclically to insulate income from domestic output fluctuations. In contrast, Balli et al. (2011) find that returns on foreign liabilities tend to facilitate income risk sharing whereas foreign asset returns have an insignificant effect. Bracke and Schmitz (2011) show that capital gains tend to be countercyclical vis-à-vis domestic economy and thus present a relatively effective channel than investment income returns, in detaching consumption from

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[94] Since cross-border asset holdings are well-represented in net factor income flows (i.e. difference between Gross National Income (GNI) and Gross Domestic Product (GDP)), empirical studies decompose the components of net factor income into various sub-channels through which output shocks can be absorbed (e.g., Sørensen and Yosha 1998; Lane 2001; Sørensen et al. 2007; Demyanyk et al. 2008; Balli et al. 2011, 2013; Volosovych 2013). Specifically, income smoothing via net factor income flows takes place through two mechanisms: one mechanism is through returns on factor income flows (i.e. via asset side), while the other mechanism is through payments on foreign owned domestic assets (i.e. via liabilities side). Among other factors, the extent of smoothing is dependent on the degree of association between cross-border asset returns and domestic output.

domestic output shocks. Similarly, Balli et al. (2012c) present evidence of a relatively stable risk sharing through capital gains when compared to investment income returns.

Overall the aforementioned studies indicate that the cross-border asset returns need to be stable with requisite cyclical properties in order to enhance risk sharing. It is also argued that any excessive volatility in cross-border asset returns adversely affects the degree of international risk sharing and the transmission of financial shocks (Lane 2005). Although several studies have investigated the cyclical patterns of returns, the literature has so far not explored the underlying factors that affect the volatility of returns. The study fills this gap by presenting the first cross-country evidence on the determinants of the volatility of returns on cross-border asset holdings. Since equity and debt markets differ significantly in the way they provide risk sharing, we make a distinction between equity returns and debt returns for investigation purposes.

Although wider swings in the performance of various asset classes create increased profit opportunities for strategies such as macro and convertible arbitrage, these short-term gains should not be traded off for a country's overall financial stability. When investment earnings are unpredictable and volatile, so is growth. Across the board, the equity loss from the 2008 stock market crash was so damaging that at the 2008 savings rate, it would take 18 consecutive years for the world's households to amass the lost $28.8 trillion of global wealth (McKinsey Global Institute 2009).

Before progressing to the main analysis of our study, it is instructive to take a quick detour to examine the recent performance of the United States (US) stock market from a historical perspective. The US remains the world's largest foreign investor,

followed by the United Kingdom (UK) and Germany. Figure 4.1, adopted from McKinsey Global Institute (2011a), plots the distribution of rolling 10-year annualized equity returns over the 1881-2010 period. As this shows, the periods ending in 2008, 2009 and 2010 are among the worst for equity returns ever recorded. But also notice the earning volatility during 2000s and how its distribution shifted from above the median return of 7% in the early part of 2000s to two standard deviations away from the median in more recent periods. An almost similar picture was evident in the UK in the past decade (McKinsey Global Institute 2011a). Due to greater financial integration and the resulting increased stock market comovements, the phenomena of higher volatility is likely to be present in other developed and emerging markets. Employing a range of indicators, we examine the extent and potential determinants of earning volatility across 28 industrialized countries over the past decade.
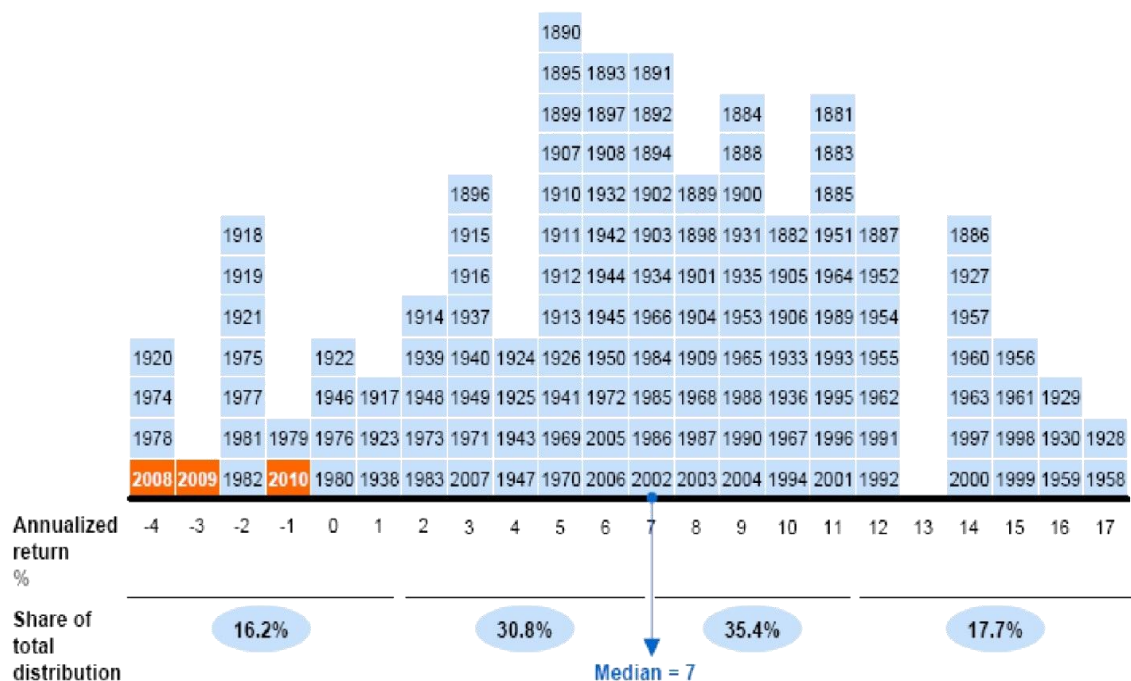
Figure 4.1: Annualized total real returns to share-holders (each block represents the endpoint of a 10-year period) — Source (McKinsey Global Institute 2011a).

The plan of this study is as follows: Section 4.2 discusses the theory, choice and construction of the variables, as well as specification of our empirical models. Section 4.3 presents our preliminary and main empirical results, while Section 4.4 presents robustness checks. Section 4.5 concludes this study.

4.2 Theoretical and empirical model specification

4.2.1 Theory

Our empirical model is based on a standard multi-factor international capital asset pricing model (CAPM), which rests on global market integration and requires that investors from different countries or sectors have access to a common set of assets that receive the same price across countries. Implicit to this hypothesis is that the purchasing power parity (PPP) holds, such that the validity of market integration hypothesis is not currency sensitive. Throughout the study, we denominate the asset returns and country-specific components in the US dollars.[95]

Suppose there are L countries, where country i has N_i assets, $i = 1, 2, 3,...., L.$ [96] The dollar denominated return vector for country i is denoted R_i. Let $N = \sum_{i=1}^{L} N_i$ and $R = [R_1', R_2', ..., R_L']'$ be the $N \times 1$ return vector for all assets in the world. The market integration hypothesis postulates that there exists a set, M_{t+1}, of correct global pricing kernels m_{t+1}, which can price every asset return $R_{j,t+1}$ in the world market. The specification of the unconditional model can be expressed as:

$$E(m_{t+1} R_{j,t+1}) = p_j, \forall t > 0, \forall j = 1, ..., N \text{ and } \forall m_{t+1} \in M_{t+1} \qquad (4.1)$$

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[95] When there are deviations from PPP, exchange rate risk constitutes an additional source of risk in influencing the changes in asset prices (Adler and Dumas 1993). However, in our empirical analysis the inclusion of exchange rate volatility measure does not yield statistically significant results.

[96] We follow the notations in Zhang (2006).

where p_j is the price for return $R_{j,t+1}$ at time t. Since m_{t+1} are not observable, the international asset pricing models generally use a pricing proxy, y_{t+1}, for m_{t+1}. The linear pricing proxy y_{t+1} can be written as:

$$y_{t+1} = b'F_{t+1} = b_0 + b'_1 f_{t+1} \tag{4.2}$$

where $F_{t+1} = [1, f_{t+1}]'$ is the $(K+1) \times 1$ global factor vector, and $b = [b_0, b'_1]'$ is the $(K+1) \times 1$ global factor price vector. According to this specification, only global factors, F, are priced for assets in the world market, such that these global factors receive the same prices, b, across different countries.

Our main departure from the above international standard CAPM model is that the factors (or determinants) that are used to examine the variations in stock returns are not the traditional Fama and French (1993) global factors (i.e., excess market return, size, book-to-market equity factor). Rather, as detailed below, our factors are characterized by country-specific components of market integration, financial concentration and investment shares in financial centers and across economic sectors. Furthermore, the ICAPM literature considers volatility innovations as a risk factor priced in the cross-section of asset returns, as done by, for instance, Ang et al. (2006). This motivates our approach to investigate factors that mimic the market volatility. As a final remark, it must be mentioned that the y_{t+1} variable in equation (4.2) is not an indicator of market volatility, as defined in equations (4.3) and (4.4). Rather, the model presented above is only a simple representation of the ICAPM where market volatility emerges as a relevant risk factor (Campbell 1993).

4.2.2 Data

Since our aim in this study is to examine the likely determinants of the volatility of returns on cross-border asset holdings, we rely on regression analysis to underpin the determinants empirically. Our annual data cover the years 2001-2009 for a sample of 28 industrialized countries for which we are able to obtain consistent information. See Table C.1 of the appendix for a list of the countries included in our sample. The endpoint is chosen based on the availability of data at the time when we undertook this research. The main sources of our data are the International Monetary Fund's Coordinated Portfolio Investment Surveys (CPIS) database and the Organization for Economic Cooperation and Development (OECD) Annual National Accounts Detailed Tables (Volume II). The CPIS data provides geographical details of cross-border equity and debt holdings based on the residence of the issuer of the securities. The OECD data contains information on the returns on foreign assets (debt and equity). The portfolio returns are simply calculated by summing up equity and debt returns.

4.2.3 Choice of variables

Our dependent variable is the volatility of cross-border equity/bond returns.[97] Since our empirical analysis involves both panel and cross-section models, we have computed separate dependent variables for each model. For the panel model, the dependent variable is computed by taking the absolute value of the change in foreign receipts scaled by total foreign investment, i.e.,

$$VOL_{it} = \frac{RECEIPT_{it}}{TOTAL\ FOREIGN\ INVESTMENT_{it}} - \frac{RCEIPT_{it-1}}{TOTAL\ FOREIGN\ INVESTMENT_{it-1}} \qquad (4.3)$$

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[97] In the OECD's Annual National Accounts Detailed Tables (Volume II), country-level returns from international equity holdings are reported as distributed income of corporations which predominantly include dividend payments (distributed income of corporations also include withdrawals from income of quasi-corporations); whereas country-level returns on debt holdings include interest payments received on foreign debt investments.

This variable is capable of capturing variations in returns over time, while scaling with total foreign investment control for cross-country heterogeneity among the industrialized countries that constitute our sample. For the cross-section model, the dependent variable refers to the standard deviation (σ) of foreign receipts scaled by total foreign investment, i.e.,

$$VOL_i \; = \; \frac{\sigma RECEIPT_i}{TOTAL\ FOREIGN\ INVESTMENT_i} \tag{4.4}$$

Our independent variables include financial integration, portfolio concentration and a set of control variables encompassing geographic regions as financial centres and economic sectors. First, we employ a conventional measure of financial integration, specifically the sum of portfolio assets and liabilities, scaled by a country's GDP, i.e.,

$$FI_{it} \; = \; \frac{FA_{it} + FL_{it}}{GDP_{it}} \tag{4.5}$$

where *FA* (*FL*) denotes the stock of external assets (liabilities).[98] Financial integration is a commonly used indicator in the related literature, mainly to capture the substantial changes in cross-border asset trade by industrial and emerging countries observed in the previous decade. Second, we expect that the concentration (or the degree of diversification) in investments may be an important determinant of the volatility of cross-border asset returns. Typically, securities in a concentrated portfolio are believed to be more "active" and provide better returns to investors. The CPIS data provides sufficient information that can be used to compute standard concentration measures such as the concentration ratio. In general, the *n*-concentration ratio is the percentage of portfolio allocations in a number (*n*) of the largest countries and is computed at time *t*

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[98] See, Lane and Milesi-Ferretti (2007). The data for GDP is taken from World Bank's World Development Indicators (WDI) database.

as,

$$CR_{it} = \frac{\sum_{j=1}^{n} \theta_{ij}}{TFH_i} \tag{4.6}$$

where θ_{ij} is the amount of investment by country i in country j, and TFH_i is the total foreign holdings of country i. We have computed concentration ratios for the top one, three, five and ten largest destination countries. Concentration ratios range from 0 to 1, with small values of this ratio indicating less concentration, and vice versa.

Third, the distribution of cross-border investments into distinct groups of countries may affect the volatility of returns. We intend to investigate whether greater foreign investments in countries belonging to a certain group cause less or more volatility in returns. To examine this, CPIS data is used to obtain shares of investment in selected groups of non-overlapping countries, namely OECD countries, emerging market economies (EMEs) and offshore financial centres (OFCs). Fourth, an important feature of CPIS data is the availability of asset holdings by various economic groups. There are different types of sectors within a domestic economy that hold foreign assets, such as banks, non-bank financial institutions (NBFIs), governments and households; and each sector has its distinct holding motives, particularly with regards to the degree of risk appetite. Therefore, for the first time in the literature, we include asset holding by different economic sectors as likely determinants of the volatility of cross-border asset returns. A complete description of the data and related sources is provided in Table C.2, while Table C.1 contains the list of various country classifications used in the analysis.

Our models thus take the following form,

$$VOL_{it} = \beta_0 + \beta_1 FI_{it} + \beta_2 CR_{it} + \beta_3 RS_{it} + \beta_4 HS_{it} + \epsilon_{it} \text{ (Panel)} \qquad (4.7)$$

$$VOL_i = \beta_0 + \beta_1 FI_i + \beta_2 CR_i + \beta_3 RS_i + \beta_4 HS_i + \epsilon_i \text{ (Cross Section)} \qquad (4.8)$$

where $i = 1, 2, ..., N$ indexes countries and $t = 1, 2, ..., T$ refers to time periods. *VOL* is the dependent variable capturing volatility in the portfolio/equity/debt returns. As discussed earlier, the dependent variable is computed separately for the panel and cross-section models. *FI* is the measure for financial integration and is calculated as the sum of portfolio assets and liabilities scaled by GDP. *CR* is the measure for portfolio concentration, indicating the share of investments in the top five largest destination countries. *RS* is a set of control variables that represent the share of investments in OECD countries, EMEs and OFCs. Further, *HS* is a second set of control variables that indicate the asset holdings of various sectors of the domestic economy such as banks, NBFIs and households. The panel model is estimated using the pooled method developed by Beck and Katz (1995), which uses panel-corrected standard errors to account for heteroskedasticity, panel autocorrelation and contemporaneous correlation across the units of the panel. Whereas, the cross-section model is estimated using the ordinary least squares technique with White's (1980) heteroskedastic consistent robust standard errors.

4.3 Empirical results

4.3.1 Preliminary results

The data at our disposal allow us to explore some interesting patterns in cross-border portfolios, equity and debt investments for the countries in our sample. Table 4.1

reports the descriptive statistics of the variables used in panel estimations.[99] As discussed previously, volatility in foreign asset returns is measured as absolute change in foreign receipts scaled by total foreign investments. This variable has a mean of 0.09, with a maximum value of 1.37 (indicating highest volatility) and a minimum value of 0.0001 (indicating lowest volatility). An interesting feature of this indicator is that volatility in equity receipts (0.23) is found to be much higher than debt receipts (0.12). Moreover, equity markets are more concentrated than debt markets, as almost 70% of equity investments are confined in the top five countries (on average) compared to 63% for debt markets. From this, it can be inferred that equity returns exhibit more volatility, presumably because of a high level of concentration in comparison to debt markets.

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[99] The results are quite similar for cross-sectional data and are therefore not presented. Some of the other calculations from CPIS data regarding the investment shares in different groups of countries and across economic sectors, are also not reported here to conserve space.

Table 4.1: Descriptive statistics for panel estimation

Variable	Mean	Median	Max.	Min.	Std. Dev.	Obs.
A. Portfolio Securities						
Receipt to investment ratio (absolute Δ)	0.092	0.022	1.375	0.000	0.206	231
Financial integration	4.353	1.220	97.886	0.076	14.887	250
Portfolio concentration ratio	0.622	0.595	0.981	0.405	0.112	250
OECD countries' share	0.644	0.640	0.908	0.301	0.125	250
Emerging markets' share	0.048	0.031	0.254	0.001	0.049	247
Offshore financial centers' share	0.195	0.179	0.654	0.031	0.106	250
Banks' share	0.221	0.203	0.544	0.004	0.132	164
Non-bank financial institutions' share	0.504	0.519	0.988	0.087	0.188	151
Households' share	0.099	0.060	0.419	0.000	0.103	94
B. Equity Securities						
Receipt to investment ratio (absolute Δ)	0.238	0.029	5.261	0.000	0.649	234
Financial integration	4.353	1.220	97.886	0.076	14.887	250
Portfolio concentration	0.702	0.691	1.000	0.060	0.131	250
OECD countries' share	0.558	0.570	0.933	0.059	0.177	250
Emerging markets' share	0.074	0.044	0.819	0.001	0.097	242
Offshore financial centers' share	0.306	0.265	0.762	0.039	0.173	249
Banks' share	0.078	0.045	0.726	0.000	0.113	143
Non-bank financial institutions' share	0.626	0.633	1.000	0.112	0.233	144
Households' share	0.157	0.122	0.490	0.003	0.128	87
C. Debt Securities						
Receipt to investment ratio (absolute Δ)	0.123	0.027	2.014	0.000	0.299	238
Financial integration	4.353	1.220	97.886	0.076	14.887	250
Portfolio concentration	0.637	0.614	1.000	0.440	0.107	250
OECD countries' share	0.701	0.696	0.941	0.225	0.123	248
Emerging markets' share	0.034	0.024	0.346	0.000	0.037	241
Offshore financial centers' share	0.125	0.112	0.762	0.007	0.088	250
Banks' share	0.311	0.294	0.856	0.004	0.179	155
Non-bank financial institutions' share	0.415	0.445	0.920	0.000	0.200	142
Households' share	0.081	0.029	0.547	0.002	0.110	86

Notes: This table reports the descriptive statistics of variables used in panel estimations for a sample of 28 industrialized countries for the years 2001-2009. The variables include; receipt to investment ratio (absolute change) represent the absolute value of the change in receipts to investment ratio (i.e. receipts to investment ratio (t) - receipts to investment ratio (t-1)); financial integration is foreign portfolio investments and liabilities to GDP ratio; concentration ratio is the share of investment in five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share are the shares of foreign portfolio investments made in the mentioned groups of countries; and, banks' share, non-bank financial institutions' share, and households' share represent the shares of portfolio holdings by these sectors of source countries.

Although concentration ratios have been computed for the top one, three, five and ten largest destination countries, the results presented throughout the study are based on a concentration ratio for the top five countries due to similarities in the results with alternative concentration measures. For portfolio securities, 62% of investments on average are confined to the top five countries, with this value ranging between 40% (minimum) and 98% (maximum). Also, for the entire sample period, unreported results show that portfolio investments by non-EMU OECD countries (65%) are more concentrated than EMU countries (55%).

The indicator for financial integration has a mean of 4.35, indicating that, on average, portfolio assets and liabilities represent 435% of GDP. Such a high value for this indicator is primarily because of the presence of Ireland and Luxembourg in our sample; without them, this ratio stands at merely 117%. At the country level, the financial integration ratio exhibits a maximum value of 97 for Luxembourg (the most integrated country) and a minimum value of 0.07 for Turkey (the least integrated country). The time series trend of this variable shows a considerable surge in international financial integration over the sample period. There is an increase of 116% in portfolio assets and liabilities (as a ratio of GDP) during the period 2001-2009. Even after excluding Ireland and Luxembourg, the increase in financial integration is a substantial 51%. This increase seems to be largely attributed to debt markets, which witnessed a 62% rise in debt assets and liabilities (as a ratio of GDP) compared to a 12% increase in equity assets and liabilities (as a ratio of GDP) over the sample period.

For the geographical distribution of cross-border portfolio investments, the share of investments in OECD countries is 64%, followed by OFCs (19%) and EMEs (4%).

An interesting feature is that equity markets in EMEs and OFCs have attracted more than double the share of investments documented in debt markets, implying that from the investors' perspective, debt instruments offered by these groups of countries are not as attractive as equities.[100] Our data also shows considerable intra-regional investments by European countries — a phenomenon known in the literature as "euro bias".[101] For instance, about 70% of portfolio investments of EMU countries on average are confined within the European region compared to about 50% of investments by non-EMU OECD countries. In comparative terms, euro bias is more evident in debt markets than equity markets.

With regards to asset holdings by economic sectors within a domestic economy, NBFIs hold 50% of cross-border portfolio assets on average, while banks hold 22% and households hold 9% of portfolio assets. However, the share of holdings of these sectors differs considerably between equity and debt markets. Banks tend to be more involved in debt instruments as compared to equities, since banking institutions hold almost 31% of total debt securities compared to 7% of equity securities. Moreover, as anticipated, the share of equity holdings by mutual funds stand at 30% compared to only 12% of total debt holdings. Similarly, households appear to be more comfortable in holding equity securities (15%) as compared to debt securities (8%).

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[100] In fact, emerging markets compensate investors with higher returns (i.e., a higher equity risk premium) than those observed in developed markets. See Salomons and Grootveld (2003) for related empirical evidence.

[101] See, for example, Balli et al. (2010).

4.3.2   Core empirical results

Our empirical analysis begins by conducting the unit root test for all series. To this end, we apply the panel unit root test of Im et al. (2003), which does not require a balanced dataset. Results indicate that for most series, the null hypothesis of a unit root is strongly rejected, implying that the series are stationary. In the interests of brevity, unit root test results are not reported.

The estimation results are presented for the dependent variable capturing volatility in cross-border asset returns (portfolio, equity and debt returns), regressed on two base variables (financial integration and the concentration ratio) and six control variables. As mentioned earlier, these control variables comprise two sets of variables, representing (1) the share of investments in different groups of countries, such as OECD countries, EMEs and OFCs; and (2) the economic sectors of the holders of foreign assets such as banks, NBFIs and households. We also include the control variables separately from our base model to investigate their effect on both the sign and loading of the base explanatory variables.

4.3.2.1 Panel estimations

Tables 4.2, 4.3 and 4.4 present panel estimates for portfolio, equity and debt securities, respectively. In all cases, the dependent variable is the volatility in the portfolio/equity/debt returns computed by taking the absolute change in foreign receipts scaled by total foreign investment. We find that a higher level of financial integration is manifested in a reduction in volatility of cross-border portfolio returns, whereas a higher degree of portfolio concentration in a few countries (equivalently, a less diversified portfolio) leads to an increase in the volatility of returns (Column 2a of Table 4.2).

These findings confirm the basic economic intuitions of portfolio choice theory at the international level (see, for example, Karolyi and Stulz 2003). Furthermore, in a study using data from G7 countries, Bhamra et al. (2012) also show that return volatility decreases with (greater) financial integration, while return correlation increases. We are not aware of any academic paper supporting our evidence that higher diversification causes lower return volatility using cross-border portfolio data, although our results are in agreement with the prediction of the theoretical models.

Columns 2b to 2g introduce control variables one at a time to our base model (Column 2a), in order to examine their effect on both the sign and loading of the base explanatory variables. As it shows, a higher contribution of investments from OECD countries and EMEs have the opposite effect on the volatility of returns on cross-border portfolio holdings. With regard to the emerging market effect, a likely reason is the ebb and flow of "hot money" (among other candidate variables) that itself is a major source of market volatility in emerging countries. Typically, emerging market assets "have historically been regarded as inherently risky and particularly vulnerable to international shocks that result in a general increase in investor risk perceptions" (Ammer et al. 2010, p. 1). Not surprisingly, after the collapse of Lehman Brothers in September 2008, EMEs, among other regional groupings, experienced the steepest drop-off in cross-border capital flows including FDI, purchases and sales of foreign equities and debt securities, and cross-border lending and deposits (McKinsey Global Institute 2009).

Table 4.2: Factors explaining volatility in returns on portfolio securities (panel estimations)

	(2a)	(2b)	(2c)	(2d)	(2e)	(2f)	(2g)	(2h)	(2i)
Financial integration	-0.0014***	-0.0006	-0.0017***	-0.0012**	-0.072***	-0.080**	-0.121**	-0.0007*	-0.045
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.026)	(0.031)	(0.052)	(0.0004)	(0.038)
Portfolio concentration	0.273***	0.707***	0.144***	0.263***	0.334**	0.218**	0.604***	0.846***	1.349**
	(0.049)	(0.171)	(0.046)	(0.077)	(0.131)	(0.085)	(0.218)	(0.231)	(0.546)
OECD countries' share		-0.460***						-0.574***	-1.136*
		(0.150)						(0.186)	(0.598)
Emerging markets' share			0.897***					0.798**	3.343***
			(0.318)					(0.388)	(0.915)
Offshore financial centres' share				0.024				-0.261	-0.518
				(0.238)				(0.212)	(0.569)
Banks' share					-0.042				0.141
					(0.156)				(0.309)
Non-bank financial institutions' share						0.191			0.153
						(0.160)			(0.269)
Households' share							-0.546		-0.393
							(0.561)		(0.533)
Observations	231	231	229	231	152	140	90	229	90
R²	0.217	0.281	0.234	0.212	0.161	0.217	0.272	0.294	0.850

Notes: The dependent variable is the volatility in cross-border portfolio returns (computed by taking the absolute change in the portfolio receipts to investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign portfolio investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of portfolio holdings by these sectors in the sample countries. Heteroskedasticity corrected standard errors are shown in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Columns 2e to 2g show the impact of asset holdings by various economic sectors on the volatility of cross-border asset returns. Although parameter estimates on these indicators are not statistically significant, the inclusion of such variables significantly increases the explanatory power of the full model. In Column 2h, we have included the first set of control variables related to the share of investments in distinct group of countries along with the two base variables. As can be seen, financial integration, the concentration ratio, OECD countries share and emerging market share stand as the key determinants of the volatility in cross-border asset returns.

Finally, Column 2i presents the full model with both sets of control variables along with the two base indicators. This leads to a considerable increase of explanatory power, as the value of R^2 increases to 0.85 (from 0.21 for the base model as shown in Column 2a). An interesting result that emerges from the full model is that, albeit not statistically significant, a greater share of assets held by households leads to a reduction of volatility in portfolio returns. A proper interpretation of this result is challenging because household financial behavior has many special features that are not captured by textbook models (Campbell 2006). We will get back to this issue in the discussion of cross-section estimations in the next section. Column 2i also shows that a higher asset holding in OECD countries is associated with a reduction in volatility in cross-border portfolio returns. This is to be expected, since mature stock markets (amongst OECD countries), by definition, exhibit lower price volatility than their EME counterparts.

Since equity and bond investors look at financial investments very differently, it is instructive to compare how differently the key variables of our model affect the return volatility of the two assets. Tables 4.3 and 4.4 report the results for equity and debt

assets, respectively. For discussion purposes, we compare the estimates in the two tables simultaneously. An initial remark is that, in general, the magnitude of the estimated parameters is often higher for debt assets and also tends to be more statistically significant than their equity counterparts. However, in terms of the explanatory power of the model (indicated by R^2), neither of these models seems to dominate. Interestingly, unlike debt assets, we find that portfolio concentration ratio does not always generate a (statistically) significant effect on the volatility of cross-border equity returns, although the estimated coefficients have the correct sign in all cases. A potential explanation for this empirical result is that in the last decade (2001-2010), equity markets have endured more volatility and disappointing returns compared to bond markets. This calls for the need for additional factors to explain the sources of the volatility in cross-border asset returns.

As in Table 4.2, we include a set of geographic variables followed by economic sector variables, one at a time, in the base model. According to Tables 4.3 and 4.4, greater investment share in emerging market economies has elevated volatility in both equity and debt returns. In the past decade, EMEs' financial stock grew much faster than that of developed countries, on account of new issuance and stronger earning expectations, as well as increased valuations. For example, of the $387 billion net new equity issuance in 2010, 60% of new issuance occurred on stock exchanges in China and other emerging markets (McKinsey Global Institute 2011b). Between 2000 and 2009, the stock of equity and debt in EMEs grew by an average of 18.3% a year, compared with only 5% in developed countries (McKinsey Global Institute 2011b). Moreover, as shown in Figure 1 in Ammer et al. (2010), despite the substantial comovement with mature stock markets, the emerging market stock price indices

exhibited a relatively more volatile path over the 1992-2009 period. These facts help to explain the larger magnitude of the estimated parameters associated with the EME share (compared to the share of OECD countries) in explaining the volatility in cross-border asset returns. Moreover, while higher OECD countries' share leads to a reduction in the volatility of debt assets' returns, it elevates the volatility of cross-border equity assets' returns (albeit with a statistically insignificant effect). The former result may be driven by the formation of the EMU, which resulted in a dramatic convergence of bond yields (and hence a lower yield variation) among the EMU member countries.[102]

To date, we have little understanding of the activities of OFCs and their linkages with other financial centres. Although OFCs are not typically the ultimate source or final destination for cross-border investments, data compiled recently by Lane and Milesi-Ferretti (2010) show strong financial interconnections between OFCs and advanced economies.[103] Our results indicate that a greater participation by OFCs depresses (elevates) volatility in cross-border equity (bond) returns. This asymmetric effect is possibly driven by the time-varying share of the global portfolio, equity and debt assets invested in OFCs. As reported by Lane and Milesi-Ferretti (2010), OFCs' portfolio equity share has climbed from just under 6% to over 9% during 2001-2007, whereas the portfolio debt share has remained relatively stable in the 5-6% range.

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[102] See, among others, Balli et al. (2010) for related empirical evidence.

[103] As stated in Lane and Milesi-Ferretti (2010), according to a 2008 report by the US Government Accountability Office, about 732 companies trading in the US stock exchanges are incorporated in the Cayman Islands – a Caribbean island home to nearly three-quarters of all OFC financial transactions. Gonzalez and Schipke (2011) report that against the combined $8 trillion worth of cross-border assets and liabilities held by the US, Germany and France in 2009, the OFCs held assets and liabilities worth some $5 trillion.

Table 4.3: Factors explaining volatility in returns on equity securities (panel estimations)

	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)	(3g)	(3h)	(3i)
Financial integration	-0.002*	-0.002	-0.006***	-0.004**	-0.077**	-0.264*	-0.075	-0.004**	-0.139***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.034)	(0.139)	(0.054)	(0.002)	(0.043)
Portfolio concentration	0.816***	-0.800*	0.549***	1.469***	0.319**	0.280	0.322	1.487**	0.171
	(0.212)	(0.438)	(0.166)	(0.461)	(0.125)	(0.181)	(0.219)	(0.758)	(0.316)
OECD countries' share		0.148						-0.603	0.026
		(0.585)						(0.623)	(0.311)
Emerging markets' share			1.639**					0.990	5.308***
			(0.760)					(0.741)	(0.563)
Offshore financial centres' share				-1.369**				-0.992	-0.042
				(0.654)				(0.718)	(0.299)
Banks' share					-0.093				0.175
					(0.190)				(0.266)
Non-bank financial institutions' share						0.686			-0.215
						(0.483)			(0.199)
Households' share							0.104		0.102
							(0.355)		(0.207)
Observations	234	234	228	233	136	135	85	227	79
R^2	0.200	0.218	0.267	0.250	0.130	0.285	0.098	0.346	0.903

Notes: The dependent variable is the volatility in cross-border equity returns (computed by taking the absolute change in the equity receipts to investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign equity investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of equity holdings by these sectors in the sample countries. Heteroskedasticity corrected standard errors are shown in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4.4: Factors explaining volatility in returns on debt securities (panel estimations)

	(4a)	(4b)	(4c)	(4d)	(4e)	(4f)	(4g)	(4h)	(4i)
Financial integration	-0.0019***	-0.00003	-0.0015***	-0.0016**	-0.159***	-0.085**	-0.140*	-0.0001	-0.072
	(0.0005)	(0.00006)	(0.0004)	(0.0005)	(0.044)	(0.039)	(0.079)	(0.0005)	(0.045)
Portfolio concentration	0.325***	1.195***	0.164***	0.212*	0.368***	0.718***	0.533*	1.167***	1.860***
	(0.063)	(0.263)	(0.062)	(0.083)	(0.132)	(0.159)	(0.279)	(0.373)	(0.641)
OECD countries' share		-0.880***						-0.851***	-0.985*
		(0.235)						(0.279)	(0.508)
Emerging markets' share			1.124					0.356	7.142***
			(0.752)					(0.779)	(1.898)
Offshore financial centres' share				0.673				-0.301	-2.476**
				(0.421)				(0.324)	(1.212)
Banks' share					0.410*				0.688**
					(0.241)				(0.296)
Non-bank financial institutions' share						-0.444**			-0.693***
						(0.196)			(0.238)
Households' share							0.182		0.724
							(1.102))		(0.485)
Observations	238	237	230	238	147	135	84	230	83
R²	0.212	0.365	0.158	0.240	0.352	0.357	0.105	0.248	0.850

Notes: The dependent variable is the volatility in cross-border debt returns (computed by taking the absolute change in the debt receipts to investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign debt investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of debt holdings by these sectors in the sample countries. Heteroskedasticity corrected standard errors are shown in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Among the three economic sectors, both banks and NBFIs exert a statistically significant effect only on the volatility of cross-border debt asset returns. Unlike banks, NBFIs do not face stringent capital and liquidity requirements, which may affect global liquidity conditions in ways that are largely beyond the scope of regulatory policies (see BIS 2011). Our results show that a higher share of NBFIs leads to an elevation of volatility in equity returns, but dampens volatility for debt returns (see Column f in Tables 4.3 and 4.4). This asymmetry in risk exposure is consistent with NBFIs increasing reliance on short-term debt instruments,[104] since by choosing short-term contracts; NBFIs keep the option to pull out quickly in the face of a market crash. On the contrary to the portfolio assets, a higher household share in a country elevates volatility in both equity and debt returns, although none of the effects are statistically significant.

Finally, in Tables 4.3 and 4.4, Columns h and i show the results with, respectively, *one* and *two* sets of control variables added to the base model. Our first remark is that volatility in equity returns appears to be best explained by the model containing only the geographic-specific variables, whereas both geographic and economic sector controls are useful in explaining the volatility of debt returns. The results show that after accounting for the level of financial integration and portfolio concentration, only emerging market share appears as the leading determinant of (higher) volatility in cross-border equity returns. By comparison, an array of factors accounts for the observed volatility in the cross-border debt returns. As Column i in Table 4.4 shows, except for financial integration and households' share, all other variables stand as statistically significant determinants of debt-return volatility, albeit in

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[104] For example, in Ireland, NBFIs accounted for more than half of total bank credit in 2008. Although the total bank credit to NBFIs in the US and the euro area has levelled off since the start of the crisis in 2007, they grew strongly in the years prior to the crisis. See Graph 5 in BIS (2011, p. 19).

different forms and magnitude.

What could explain the difference in the degree of various determinants to explain the volatility in cross-border equity and bond returns? During most of the first decade of the 21st century, the equity and debt markets in developed countries behaved very differently. In the euro area, for instance, the creation of the single currency has led to the remarkable convergence in bond yields (both corporate and sovereign) and the associated reduction in volatility (Balli et al. 2010); whereas such integration seems to have been limited in the euro area's equity markets, relative to its bond markets (Bekaert et al. 2011). In the unravelling of the recent global crisis, although both global equity and bond markets have suffered a clear setback, much of the damage has been witnessed in global equity markets (see McKinsey Global Institute 2009). Both in the UK and the US, the past decade has produced some of the worst real 10-year equity returns in more than a century. As shown in Figure 4.1, the 10-year S&P composite index rolling returns stand at -4% and -3%, respectively, in 2008 and 2009; a rare occurrence in 130 years of US stock market history. Furthermore, measuring volatility by the number of days per year that daily price change exceeded 3%, daily price movements on exchanges across Europe and the US appear to have been more volatile during 2000s, compared to during the 1990s and 1980s.[105] The severe decline in global equity asset value has partly been compensated by increased new issuance of debt securities (both private and government), as well as an acceleration in bank deposits, reflecting both a flight to safety by depositors and aggressive efforts by banks to attract deposits.

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[105] See Exhibit 19 in McKinsey Global Institute (2011a) for a graphical illustration.

4.3.2.2 Cross-section estimations

We now turn to the cross-sectional implications of our empirical model for the determinants of the volatility of cross-border equity and debt returns in OECD countries. Tables 4.5, 4.6 and 4.7 present cross-section estimates for portfolio, equity and debt securities, respectively. As before, the dependent variable is the volatility in the portfolio/equity/debt returns, but, in this case, it is calculated as the standard deviation of returns scaled by total foreign investments. Furthermore, the cross-section regression uses time-averaged data to estimate the parameters, thus providing a long-run perspective of the determinants of the volatility in cross-border asset returns.

Examining the results in Tables 4.5-4.7, we notice that, in most cases, while the signs of the estimated cross-section parameters are in the same direction as those of the estimated panel parameters, the magnitude of the estimated parameters of the former is higher than those of the latter.[106] This is possibly due to the failure to adjust for potential parameter heterogeneity, which is expected in a cross-country context. Nevertheless, when using cross-section regressions of time-averaged data, Phillips and Moon (1999) show that both the pooled least squares regression and the fixed effects regression provide consistent estimates of this long-run average relationship. This is because the relations are parameterized in terms of the matrix regression coefficients of the long-run average covariance matrix for the cross-section, instead of using covariance matrix for the data (as used in conventional regressions). We therefore follow Phillips and Moon (1999) and interpret the estimated coefficients as average cross-country long-run effects.

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[106] This upward bias of cross-sectional estimates or the downward bias of panel estimates is not uncommon in empirical research. See, among others, Freeman (1984) and Krol (1996) for evidence of varying estimates due to estimation techniques.

Nevertheless, although it would be difficult to interpret the estimates unambiguously, the cross-section results are suggestive of a negative (positive) impact of financial integration (concentration ratio) on the volatility of cross-border asset returns (Table 4.5). The results of the remaining models reported in Table 4.5 are somewhat similar to their panel counterparts (Table 4.2), albeit with different coefficient estimates. For the full model (Column 5i), the cross-section estimates also suggest that a higher portfolio share in EMEs (by households) elevates (dampens) the volatility of the cross-border asset returns. Since the emerging-market-volatility nexus has already been discussed, here we interpret the results of the household sector as a major determinant of the earning volatility.

The finding that a higher (portfolio) share by households has a long-term negative impact on the volatility of returns is both appealing and puzzling. It is appealing, because it emphasizes the crucial role that households' portfolio holdings play in reducing overall market volatility. Not only the amount invested by households, but also its composition into equity and debt seems important. As shown by Column i in Tables 4.6 and 4.7, the long-run effect of volatility reduction is greater when households hold more equity (than debt) securities. It is worth mentioning that both in the US and Western Europe, households place a larger share of their financial assets in equities than fixed-income securities (McKinsey Global Institute 2011a).[107] On the other hand, the puzzling side of this result is that it appears unconvincing, with the findings of a large body of empirical evidence suggesting that, in general, household portfolios are poorly

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[107] By comparison, investors in emerging markets keep most of their assets in bank deposits or physical assets (such as real estates and gold), which reflects lower income levels, underdeveloped financial markets and other barriers to diversification (see McKinsey Global Institute (2011a) for further discussion). Nevertheless, our preliminary results suggest that households hold almost twice as large a share of equity securities (15%) than debt securities (8%).

diversified, with many people reporting substantial holdings of a single stock — see Campbell (2006) for a survey of the evidence on household portfolio choice. Nevertheless, the observed reduction in volatility through greater household participation can be interpreted as the natural outcome of greater risk-sharing facilitated by increased integration.

Summing up, our analysis has brought to light a number of key determinants that influence the volatility of cross-border asset returns. Among the factors that explain the elevation in the volatility are (rising) portfolio concentration and a greater share of asset holdings by EMEs. In contrast, more financial integration and greater share by OECD countries and household sector cause a reduction in the volatility. Greater asset holdings by OFCs and NBFIs increase overall market volatility, although they affect the volatility in equity and bond markets in the opposite way. Overall, both the cross-sectional and panel estimates provide somewhat similar results, leading us to conclude that results obtained in this study are indeed robust.

Table 4.5: Factors explaining volatility in returns on portfolio securities (cross-section estimations)

	(5a)	(5b)	(5c)	(5d)	(5e)	(5f)	(5g)	(5h)	(5i)
Financial integration	-0.0017*	-0.0014*	-0.0022**	-0.0014	-0.152	-0.175	-0.219*	-0.0025**	-0.085*
	(0.0009)	(0.0008)	(0.0009)	(0.0009)	(0.101)	(0.115)	(0.118)	(0.0010)	(0.042)
Portfolio concentration	0.877**	1.142*	0.932	0.869*	0.547	0.396	1.114	1.427**	2.865**
	(0.401)	(0.676)	(0.565)	(0.434)	(0.477)	(0.549)	(1.497)	(0.640)	(0.781)
OECD countries' share		-0.290						-0.508	-0.674
		(0.380)						(0.323)	(0.368)
Emerging markets' share			2.993*					3.263*	6.340***
			(1.714)					(1.624)	(1.717)
Offshore financial centres' share				0.203				-0.621	1.312
				(0.636)				(0.595)	(0.951)
Banks' share					0.145				-0.402
					(0.363)				(0.419)
Non-bank financial institutions' share						0.218			-0.321
						(0.426)			(0.318)
Households' share							-0.448		-1.593**
							(0.551)		(0.538)
Observations	28	28	28	28	20	20	15	28	15
R^2	0.136	0.156	0.347	0.141	0.268	0.277	0.350	0.386	0.924

Notes: The dependent variable is the standard deviation of portfolio receipts (scaled by the investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign portfolio investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of portfolio holdings by these sectors in the sample countries. Heteroskedasticity consistent standard errors are given in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4.6: Factors explaining volatility in returns on equity securities (cross-section estimations)

	(6a)	(6b)	(6c)	(6d)	(6e)	(6f)	(6g)	(6h)	(6i)
Financial integration	-0.006	-0.005	-0.007	-0.006	-0.201	-0.242	-0.248	-0.008	-0.103
	(0.006)	(0.005)	(0.005)	(0.005)	(0.206)	(0.173)	(0.278)	(0.005)	(0.145)
Portfolio concentration	0.552	0.552	1.090	0.727	-0.479	1.084	0.127	2.574	2.225
	(1.864)	(1.969)	(1.852)	(2.207)	(0.870)	(1.418)	(1.211)	(1.715)	(1.324)
OECD countries' share		-0.840						-2.792	0.181
		(1.080)						(2.469)	(1.084)
Emerging markets' share			5.669***					4.478**	10.269*
			(1.563)					(1.777)	(4.251)
Offshore financial centres' share				-0.349				-3.200	0.939
				(0.943)				(2.518)	(1.326)
Banks' share					-0.505				-1.134
					(0.924)				(0.850)
Non-bank financial institutions' share						0.974*			0.011
						(0.562)			(0.511)
Households' share							-0.479		-0.854
							(0.604)		(1.037)
Observations	28	28	28	28	18	19	14	28	14
R^2	0.022	0.055	0.235	0.025	0.143	0.427	0.179	0.330	0.879

Notes: The dependent variable is the standard deviation of equity receipts (scaled by the investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign equity investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of equity holdings by these sectors in the sample countries. Heteroskedasticity consistent standard errors are given in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4.7: Factors explaining volatility in returns on debt securities (cross-section estimations)

	(7a)	(7b)	(7c)	(7d)	(7e)	(7f)	(7g)	(7h)	(7i)
Financial integration	-0.0018[*]	-0.0016	-0.0016[**]	-0.0011	-0.131[*]	-0.104	-0.112	-0.0010	-0.094
	(0.0010)	(0.0009)	(0.0006)	(0.0009)	(0.072)	(0.073)	(0.117)	(-0.0007)	(-0.077)
Portfolio concentration	1.361[***]	1.750[***]	1.176[***]	1.274[***]	1.355[***]	1.197[***]	0.808	1.571[***]	2.909
	(0.363)	(0.508)	(0.415)	(0.248)	(0.179)	(0.256)	(1.143)	(0.440)	(1.544)
OECD countries' share		-0.349						-0.405	-0.682
		(0.287)						(0.308)	(0.435)
Emerging markets' share			3.915[*]					3.993[*]	7.653
			(2.275)					(2.299)	(4.007)
Offshore financial centres' share				0.734				0.440	-0.395
				(0.442)				(0.478)	(2.823)
Banks' share					0.568[***]				0.352
					(0.167)				(0.548)
Non-bank financial institutions' share						-0.402			-0.598
						(0.270)			(0.450)
Households' share							1.016		0.072
							(1.658)		(0.818)
Observations	28	28	28	28	19	19	13	28	13
R^2	0.272	0.296	0.441	0.312	0.534	0.481	0.334	0.497	0.828

Notes: The dependent variable is the standard deviation of debt receipts (scaled by the investment ratio) for a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign debt investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of debt holdings by these sectors in the sample countries. Heteroskedasticity consistent standard errors are given in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.4   Robustness: Addressing endogeneity bias

In this section we check the robustness of the above analysis allowing for potential endogeneity in the relationship between volatility in asset returns and its determinants. Endogeneity may arise because the foreign receipts to total foreign investment ratio (i.e., the dependent variable) and the level of financial integration or portfolio concentration between countries are jointly determined in equilibrium. In other words, while more financial integration or concentration may influence the volatility in asset returns, there may also be a reverse causality running from the former to the latter. In fact, both Granger's (1969) causality and Geweke's (1982) measure of instantaneous feedback[108] tests confirm the existence of a bidirectional causality between changes in foreign receipts to total foreign investment ratio and portfolio concentration for portfolio, equity and debt assets.[109] Whereas no such bidirectional causal relationship is found between changes in foreign receipts to total foreign investment ratio and the level of financial integration.

To deal with the endogeneity problem, we make use of an instrumental variable that is related to financial concentration but does not lead to change in the dependent variable (i.e., foreign receipts to total foreign investment ratio) aside from the indirect

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[108] Unlike Granger's (1969) causality test which tests whether lags of one variable can be used to predict current values of another variable, Geweke's (1982) measure, calculated from the residuals of standard Granger causality tests, provides the instantaneous (or contemporaneous) feedback between pairs of variables. The latter test is desirable in situations where data are measured infrequently (i.e., yearly) and the causality is instantaneous. See Dicle and Levendis (2013) for further discussion.

[109] For portfolio assets, the estimation reveals that changes in foreign receipts to total foreign investment ratio Granger-cause portfolio concentration (p-value: 0.028). There is evidence of instantaneous feedback between the two variables, as reported by Geweke's measure (p-value: 0.047). For equity assets, while financial concentration Granger-cause foreign receipts to total foreign investment ratio, the reverse is not the case. However, Geweke's measure reveals evidence of instantaneous feedback between the two variables (p-value: 0.110). Moreover, the total correlation between the two variables is highly statistically significant (p-value: 0.005). Finally, for debt assets, although foreign receipts to total foreign investment ratio does not Granger-cause financial concentration (p-value: 0.313), both Geweke's measure and total correlation reveal strong linear association between the two variables (p-values: 0.010 and 0.002, respectively). Overall, the above estimation results reveal an empirically acceptable level of causation (both lagged and instantaneous) between the variables under examination.

route via financial concentration. Our chosen instrument is a measure of "trade concentration", since it is very likely that bilateral trade in goods is an important determinant of bilateral asset holdings between countries. The economic rationale that provides the bridge between trade in goods and asset holdings is based on information symmetries, which states that trading in the goods market reduces informational asymmetries in the financial markets, thus helping investors' financing investment plans in foreign markets.[110] Since our objective is to find a suitable instrument for concentration ratio for the top five countries, for each country we construct trade concentration by mapping trade shares of those five countries that enter into the calculation of financial concentration ratio. Thus, for the US (to provide an example), the top five destinations where the US investors are most likely to invest, also appear in the calculation of trade concentration ratio to capture the strong relationship between trade flows and cross-border asset flows. The trade concentration ratios are constructed using both bilateral "exports" and "total trade" shares, and the shares are chosen using two different schemes: (i) the contemporaneous (current period) shares and (ii) a three-year moving average of the current year and the previous two years of trade shares. As a result, we have four alternative measures of trade concentration ratios for each country as possible instruments of the financial concentration ratio.

Table 4.8 presents the correlation coefficients between the financial concentration ratio and four alternative trade concentration ratios for each country in the sample. We find that for majority of countries with large financial markets (such as the US, the UK, Germany, Japan, France and the Netherlands) the correlation coefficients are positive and highly statistically significant, complementing the strong relationship

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[110] Aviat and Coeurdacier (2007) report that a 10% increase in bilateral trade raises bilateral asset holdings by 6% to 7%. The reverse causality is also significant, albeit with a smaller magnitude (2.5%).

between trade flows and cross-border capital flows discussed above. The opposite sign for correlation coefficients between trade flows and cross-border capital flows in some countries might be the result of return-chasing behaviour and portfolio diversification in response to negative domestic macro news in host countries. Overall, the estimated correlation coefficient provides support to the hypothesis that the trade concentration ratio can be used as a relevant instrument for cross-border financial concentration ratio in order to deal with the endogeneity problem.

Table 4.8: Correlation coefficients between portfolio concentration and trade concentration, 2001–2009

	Exports (Current year)	Exports (3-yr mov. avg.)	Total Trade (Current year)	Total Trade (3-yr mov. avg.)
Austria	0.59*	0.35	0.46	0.16
Belgium	0.40	-0.07	0.29	-0.19
Chile	-0.47	-0.19	-0.48	-0.58
Czech Republic	0.55	0.41	0.51	0.43
Denmark	0.69**	0.79**	0.82***	0.88***
Estonia	0.64*	0.62*	0.47	0.55
Finland	0.51	0.72**	0.13	0.39
France	0.89***	0.97***	0.93***	0.98***
Germany	0.69**	0.54	0.49	0.46
Greece	-0.76**	-0.57	-0.80***	-0.83***
Hungary	-0.79**	-0.89***	-0.78**	-0.93***
Ireland	0.71**	0.75**	0.64*	0.75**
Israel	0.37	0.43	0.26	0.38
Italy	-0.72**	-0.72**	-0.72**	-0.70**
Japan	0.89***	0.85***	0.80***	0.85***
Korea	-0.39	-0.01	-0.08	0.22
Luxembourg	0.74**	0.72**	0.80***	0.80***
Mexico	0.19	0.23	0.06	0.16
Netherlands	0.90***	0.95***	0.90***	0.95***
Norway	-0.04	-0.74**	0.33	-0.22
Poland	0.53	0.44	0.53	0.45
Portugal	0.02	-0.08	0.06	-0.06
Slovak Republic	0.45	0.61*	0.50	0.70**
Spain	0.71**	0.93***	0.80***	0.95***
Sweden	0.92***	0.92***	0.90***	0.97***
Switzerland	0.09	-0.50	0.19	-0.34
UK	0.54	0.77**	0.66*	0.70**
USA	0.92***	0.93***	0.88***	0.92***

Source: Authors' calculations based on Direction of Trade Statistics Database, IMF. ***, ** and ** denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 4.9 presents the generalized method of moments (GMM) estimation of the instrumental variable (IV) regressions for both panel and cross-section models by classes of assets (portfolio, equity and debt). For brevity, we only present results of the full model for each asset class. Several remarks are in order. First, except for equity assets, the null hypothesis of weak instrument is rejected for both portfolio and debt assets (as indicated by the very low p-values of the F-test), suggesting that the trade concentration ratio is a valid instrument for the panel and cross-section equations. The relatively lower level of statistical significance of the instrument for equity assets, particularly for the cross-section model, is consistent with the weak causality between foreign receipts to total foreign investment ratio and financial concentration ratio detected with Granger causality test. Second, the estimated coefficients of the instrumented variables (i.e., trade concentration ratio) in the first-stage regression are positive and statistically significant in majority of the cases, consistent with the core empirical findings discussed above.[111] Third, in all but one case, the instrument constructed using the three-year moving average of export shares provides the best estimation results presented in Table 4.9. This suggests that improvements in goods trade integration positively affect cross-border asset trade. Fourth, we see that the coefficients of the financial concentration ratio is less precisely estimated in both panel and cross-section models, as indicated by changing of parameter sign across asset class and the lack of statistical significance of the parameters. However, instrumenting appears to support the results that more financial integration (increase in asset holdings in emerging markets) leads to a reduction (elevation) of the volatility of returns on cross-border asset holdings. Moreover, instrumenting appears to increase the effects of banks' share on the volatility of returns on debt assets. Although subject to a number of

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[111] For the sake of brevity, we do not report the estimated coefficients of remaining instruments included in the first-stage regression.

caveats, the overall findings of the IV regressions are supportive of the core model presented above, suggesting that our main findings are robust to the endogeneity problem.

Table 4.9: Two-step GMM estimation of instrumental variable regressions

	Panel Model			Cross-Section Model		
	Portfolio	Equity	Debt	Portfolio	Equity	Debt
	First-stage regression results					
Trade concentration (instrument)	-0.369***	0.137	0.276**	0.579***	0.284	1.027**
	(0.078)	(0.089)	(0.122)	(0.165)	(0.257)	(0.335)
F-test of excluded instrument (p-value)	0.000	0.127	0.027	0.009	0.309	0.027
	Second-stage regression results					
Financial integration	-0.006	-0.311	-0.074	-0.124*	-0.295	-0.079
	(0.036)	(0.261)	(0.065)	(0.064)	(0.214)	(0.068)
Portfolio concentration	1.287	-3.768	-1.131	0.003	-2.822	0.468
	(0.960)	(3.577)	(1.772)	(0.644)	(2.156)	(0.722)
OECD countries' share	-0.990*	3.490	0.921	0.240	2.387	-0.210
	(0.593)	(4.547)	(1.056)	(0.512)	(1.781)	(0.632)
Emerging markets' share	3.499***	5.408*	8.479***	7.251***	10.612***	7.757***
	(0.435)	(3.282)	(1.186)	(1.630)	(4.042)	(2.608)
Offshore financial centres' share	-0.060	3.147	-1.079	0.800	2.275	-3.574***
	(0.315)	(4.070)	(1.071)	(0.807)	(1.594)	(1.237)
Banks' share	0.034	-0.439	1.078***	-0.470	0.733	0.670**
	(0.124)	(1.021)	(0.377)	(0.309)	(1.184)	(0.326)
Non-bank financial institutions' share	-0.153	0.436	-0.505***	-0.090	-0.015	-0.279
	(0.159)	(0.288)	(0.130)	(0.323)	(0.449)	(0.340)
Households' share	-0.905	1.674	1.431*	-0.329	1.299	1.136
	(0.749)	(1.545)	(0.834)	(0.541)	(1.292)	(0.741)
Observations	90	79	83	15	14	13

Notes: The dependent variable for the panel model is the volatility in cross-border portfolio returns (computed by taking the absolute change in the portfolio receipts to investment ratio), while the dependent variable for the cross-section model is the standard deviation of portfolio receipts (scaled by the investment ratio). Data includes a sample of 28 industrialized countries for the period 2001–2009. Financial integration is measured as the ratio of foreign portfolio investments and liabilities to GDP; portfolio concentration is the percentage share of investments in the five largest destination countries; OECD countries' share, emerging markets' share and offshore financial centres' share reflect the percentage shares of foreign portfolio investments made in that particular group of non-overlapping countries. Banks' share, non-bank financial institutions' share and households' share represent the percentage shares of portfolio holdings by these sectors in the sample countries. Heteroskedasticity robust standard errors are given in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.5   Concluding remarks

In this study, an attempt is made to understand the likely determinants of the volatility of cross-border asset returns. Given that over the past decade, EME financial assets grew more robustly than mature economies, and given that (future) global wealth is shifting to EMEs due to aging populations in developed economies,[112] the finding of our analysis that a greater share of assets invested in emerging market economies is associated with higher earning volatility has important implications for policy decisions. To attain higher risk sharing gains, appropriate policy steps should include strengthening the legal and regulatory foundations to improve the financial transparency of stock markets in EMEs. As emphasized by our results that higher asset holdings in mature economies lead to a reduction in volatility, an improvement in conditions for investments in EMEs, therefore, would be the right step towards managing and mitigating (output) risks in global capital markets.

Furthermore, in view of the finding of a negative association between households' investments and market volatility, policies to facilitate households to have a better access to equity markets could help lessen the volatility and improve risk sharing benefits. Like institutional investors, households have long time horizons and can provide "patient capital" to the market, as well as volume and liquidity. While our results point to (greater) financial integration as a dampening factor influencing earning volatility, despite the globalization of capital markets achieved so far, investors in mature economies have been slow to diversify their portfolios internationally (i.e., a

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[112] In addition, forces such as a growing interest in alternative investments, the move to defined-contribution pension schemes and new financial regulations in mature economies will shape the pronounced rebalancing of global financial assets in the coming decade. See McKinsey Global Institute (2011a) for further discussion.

higher "home bias").[113] Thus to encourage risk sharing, policy-makers in both mature and developing economies should implement appropriate measures to discourage home bias. Some relevant measures, as suggested by McKinsey Global Institute (2011a, p. 59), include, (i) removing any limits on the amount that households and pension funds can invest in foreign markets, (ii) creating mutual funds and other vehicles that will enable emerging market investors to purchase foreign securities, (iii) ensuring that appropriate currency hedging instruments are widely available and cost-effective and (iv) increasing the financial education of consumers.

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[113] See Table 1 in Balli et al. (2011) for the extent of home bias reduction in selected OECD countries over the 1997–2007 period.

Appendix:

Table C.1: List of countries

Sample countries: Austria, Belgium, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Republic of Korea, Luxembourg, Mexico, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States.

OECD countries (OECD): Australia, Austria, Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Israel, Italy, Japan, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom and United States.

Emerging market economies (EMEs): Brazil, Chile, China, Czech Republic, Egypt, Hungary, India, Indonesia, Republic of Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russian Federation, South Africa, Taiwan, Thailand and Turkey.

Offshore financial centers (OFCs): Andorra, Anguilla, Antigua and Barbuda, Aruba, The Bahamas, Bahrain, Barbados, Belize, Bermuda, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong, Ireland, Isle of Man, Jersey, Lebanon, Liechtenstein, Luxembourg, Macao, Malta, Marshall Islands, Nauru, Netherlands Antilles, Niue, Palau, Panama, St. Kittis and Nevis, St. Lucia, St. Vincent and the Grenadines, Samoa, Seychelles, Singapore, Switzerland, Turks and Caicos Islands, Vanuatu and British Virgin Islands.

Table C.2: Data description

Variable	Description	Source
VOL (panel)	Absolute change in foreign receipts scaled by total foreign investments	OECD & authors' calculations
VOL (cross-section)	Standard deviation of foreign receipts scaled by total foreign investments	-do-
FI	Sum of foreign portfolio assets & liabilities scaled by GDP	CPIS (IMF) & authors' calculations
CR	Portfolio concentration ratio	CPIS (IMF) & authors' calculations
GDP	Gross domestic product	WDI, World Bank
Exchange rate	National currency per US$	OECD
Geographic control variables		
OECD	OECD countries	CPIS (IMF) & authors' calculation
EMEs	Emerging market economies	-do-
OFCs	Offshore financial centers	-do-
Economic sector control variables		
Banks	Asset holdings by commercial banks	CPIS (IMF) & authors' calculation
NBFIs	Asset holdings by non-bank financial institutions	-do-
Households	Asset holdings by households	-do-

Note: OECD (OECD's Annual National Accounts Detailed Tables (Volume II)); IMF (International Monetary Fund); CPIS (Coordinated Portfolio Investment Surveys); WDI (World Development Indicators).

CHAPTER FIVE

CONCLUSION

The final chapter of the thesis contains three sections. The first section provides a brief summary of the key findings from each of the three essays and highlights the contributions that each provide to the current literature. The policy implications that arise from these findings are also discussed in this section. The second section outlines the limitations of the three essays, while the last section discusses some suggestions for further research in this area.

5.1   Major findings and policy implications

5.1.1   Essay one

The first essay examines the role of migrants' remittances in smoothing income against domestic output shocks in the recipient countries. A higher degree of smoothing through remittances would ensure stable national income, that would lead to stable consumption and investment patterns and thus sustained economic growth. We first measure the extent of risk sharing via remittances for each country in our sample. Employing the approach of Asdrubali et al. (1996) and Sørensen and Yosha (1998), our risk sharing measure is based on the sensitivity of domestic income (GDP plus remittance inflows per capita) to idiosyncratic output (GDP per capita) fluctuations. While, on average, a country is found to absorb around 3.3% of output shocks through remittances, there is substantial cross-country variation in the extent of risk sharing, ranging from Tajikistan (38%) to Haiti (-13%). Next we examine why the estimated degree of risk sharing varies so much across developing countries. After reviewing the

theoretical and empirical studies on risk sharing and remittances, a number of potential determinants are identified.

We estimate that an index of diversification of emigrants is the leading determinant of the extent of risk sharing through remittances: countries with well-diversified migrants globally, share more risk than others. This finding is supported by specific country examples. For instance, the Philippines is well-known for broad geographical dispersion of its migrants and absorbs around 15% of output fluctuations according to our estimate. In contrast, remittance inflows to Turkey and Haiti cause dis-smoothing of output shocks as an overwhelming majority of Turkish and Haitian emigrants are concentrated in a few destinations (i.e. Germany and the US, respectively). This evidence is consistent with prior studies (Sayan 2004, 2006; Sayan and Tekin-Koru 2007a, 2007b; Ratha et al. 2010) that find a high degree of business cycle synchronization between Turkey and Germany, and between Haiti and the US, thereby generating remittance inflows that are procyclical with respect to the output of the recipient country.

This study also establishes a positive impact of the size of remittance inflows on risk sharing. This is further supported by evidence that the stabilizing impact of remittances is much higher in top remittance-receiving countries (as measured by remittances to GDP ratio). To cite a few examples, Lesotho has the highest remittance to GDP ratio (i.e. 29%) in our sample and is found to absorb 26% of output fluctuations. Likewise, remittance inflows smooth out 38% of output fluctuations in Tajikistan, which has a remittance to GDP ratio of 26%.

The study finds evidence which shows that remittances originating from neighbouring countries and from countries that belong to the same continent as the recipient country, do not enhance smoothing. This is because business cycles are more synchronized among neighbouring countries, thereby increasing the probability of procyclical remittance flows as opposed to remittances originating from more distant countries. This finding is consistent with the international business cycle literature which has found high business cycle correlations among countries that share the same border or region, known as the border effect (Clark and van Wincoop 2001; Massmann and Mitchell 2004; Martincus and Molinari 2007; Montoya and de Haan 2008).

This essay makes several contributions. First, contrasting with the current literature that usually examines the relative contributions of different channels of smoothing in advanced industrial countries, this study explores a distinct channel associated with remittance inflows that grew in importance for many developing countries in recent years. Second, this study examines the complex relationship between remittances and macroeconomic instability in developing countries. In doing so, it contributes by bridging the gap between two quite separate strands of literature on risk sharing and remittances. The positive empirical association between diversification of migrants and income smoothing establishes the missing link between the two strands of literature. Moreover, the finding that a higher level of remittances is likely to have a greater risk sharing impact, shows that (all else being equal) an upsurge in remittance inflows should be a source of macroeconomic stability in developing countries. Third, unlike the majority of empirical research that focuses on consumption risk sharing, our empirical approach uses an income measure of risk sharing that is preferred over the consumption measure, because of several issues with international consumption data as

documented by Deaton and Heston (2010) and Volosovych (2013). Finally, this essay provides important implications by identifying the ways to reap large potential gains from risk sharing through remittances.

5.1.2 Essay two

The second essay investigates the viability of a currency/monetary union between Australia and New Zealand based on the extent of the interstate risk sharing mechanism. The first step of the analysis is the computation of the welfare gains that Australian states and New Zealand regions might obtain on account of complete integration of financial markets. The second step consists in ascertaining the degree of risk sharing and intertemporal smoothing among regions of the two countries in isolation, and together for the period 1998─2008.

Prior to undertaking the regression analysis, this study measures the potential welfare gains to individual states of Australia and regions of New Zealand from perfect risk sharing. It employs the methodology of Kalemli-Ozcan et al. (2001), which measures the gain as the permanent percentage increase in consumption when an economic region moves from financial autarky (where it consumes its own output) to perfect risk sharing (where consumption is completely detached from output fluctuations). The results indicate that in case of a union between the two countries, the increase in permanent consumption amounts to 0.48% for each state of Australia and 0.86% for each region of New Zealand. These gains are comparable to the average estimated gains of about 0.68% for European Union countries (Demyanyk and Volosovych 2008) and OECD countries (Kalemli-Ozcan et al. 2001). Moreover, consistent with the findings of Kim and Sheen (2007), the increase in welfare gains to

Australian states is negligible as they move from perfect risk sharing with each other to a union with regions of New Zealand (i.e. from 0.45% to 0.48%).

The empirical findings from the standard consumption smoothing estimation suggest that Australia and New Zealand would be better-off forming a union as about 76% of idiosyncratic shocks are absorbed in a union. This amount of consumption smoothing is substantially higher than what has been found in case of the OECD, European Union and East Asian countries (Sørensen and Yosha 1998; Kim et al. 2006b; Balli and Sørensen 2007; Asdurabali and Kim 2008a). This implies that Australia and New Zealand would constitute a relatively more viable union than the aforementioned groups of countries.

This initial result is further examined by using the empirical models proposed by some recent studies. Asdrubali and Kim (2004, 2008b) argue that risk sharing and intertemporal smoothing mechanisms display a strong interaction and should therefore be examined in a single framework to fully assess the insurance arrangements among countries. Based on this argument, risk sharing and intertemporal smoothing tests are jointly conducted in this study by utilizing the regression model of Asdrubali and Kim (2008a). The results indicate that there is no intertemporal smoothing among Australian states and New Zealand regions reflecting the inability of credit markets in stabilizing output shocks. Likewise there is negligible risk sharing between Australia and New Zealand as domestic consumption growth is not dependent on aggregate output growth. The estimates of risk sharing coefficients are smaller than those obtained earlier from the standard model, which is an expected outcome of examining intertemporal smoothing and risk sharing hypotheses simultaneously. Accordingly, this result shows

support for the argument of Asdrubali and Kim (2004, 2008b). Since idiosyncratic shocks are considered to be temporary in nature, comparing the aforementioned results suggest that although temporary shocks are insulated, the permanent ones remain unabsorbed between Australia and New Zealand.

Finally, in order to evaluate the strength of risk sharing arrangements across business cycles, idiosyncratic and aggregate shocks are decomposed into positive and negative components using linear and quadratic filtering method. It is essential for the viability of a union that it absorbs both types of shocks successfully. While there is a low degree of risk sharing under positive aggregate shocks, the study shows a complete lack of risk sharing when Australia and New Zealand experience negative aggregate shocks. The absence of risk sharing under negative aggregate fluctuations points towards a potential breakup of the union during economic downturns. From a policy perspective, these results suggest that there is a greater scope of enhanced macroeconomic coordination and integration of financial and goods markets between the two countries.

In terms of contributions, this essay expands the current literature on risk sharing by presenting the first cross-country evidence on the extent of risk sharing among regions of a selected group of countries. It also offers the first evidence at the regional level gains from complete financial market integration between Australia and New Zealand. The findings of the essay contribute to the argument of Asdrubali and Kim (2004, 2008b) that a clear recognition of risk sharing and intertemporal smoothing mechanisms is necessary for complete assessment of insurance arrangements among countries. This has been one of the major limitations of Kim and Sheen (2007)'s work

which this study attempts to address. Further, the essay expands the empirical literature by splitting up aggregate shocks into positive and negative components, with the purpose of exploring their distinct impacts on the extent of consumption smoothing. The finding of an inability to absorb negative aggregate shocks in a union framework, suggests that a distinction between positive and negative aggregate shocks should be essential in evaluating the strength of risk sharing mechanisms across business cycles.

5.1.3 Essay three

The third essay examines the determinants of the volatility of returns on cross-border asset holdings in a sample of 28 OECD countries for the period 2001 to 2009. To the best of our knowledge, no previous study has used aggregate (country-level) portfolio holdings data to examine the factors that contribute to the volatility of returns. Understanding the sources of the volatility is crucial, since returns from cross-border portfolio holdings potentially contribute to consumption smoothing by stabilizing national income. Thus, the findings of this study would help formulate adequate policy measures to stabilize income against domestic output fluctuations.

The empirical analysis makes a distinction between equity investments and debt investments, which collectively form portfolio investments. The main motivation for using disaggregated data is to find out how the impact of our chosen determinants varies between debt and equity, while the use of portfolio asset allows us to see whether the total (aggregate) component makes any noticeable difference. The empirical analysis also involves both panel and cross-section estimations to check the robustness of results. For the panel model, the dependent variable is the volatility measure computed by taking the absolute change in foreign receipts scaled by total foreign investments; while for the cross-section model, it is calculated as the standard deviation of foreign receipts

scaled by total foreign investment. The independent variables include the standard measures of financial integration and portfolio concentration, and two sets of control variables, representing (i) the share of investments in different groups of countries, such as OECD countries, emerging market economies (EMEs) and offshore financial centres (OFCs); and (ii) the share of asset holdings by economic sectors within a domestic economy, such as banks, non-bank financial institutions (NBFIs) and households.

Descriptive statistics show that volatility is higher in equity returns than in debt returns. Moreover, equity markets are more concentrated than debt markets as almost 70% of equity investments are confined in the top five countries compared to 63% for debt markets. From this, it can be inferred that equity returns witness more volatility presumably because of a high level of concentration in comparison to debt markets. The empirical findings from regression analysis indicate that volatility of cross-border returns decreases with greater financial integration, whereas a higher degree of concentration leads to an increase in the volatility of returns. These results are consistent with the portfolio choice theory at the international level (e.g., Karolyi and Stulz 2003) and suggest that continued international financial integration would further improve income smoothing through stabilization of returns. Our results also indicate that a greater share of investments in EMEs increases the volatility of returns, whereas a greater share of investments in OECD countries leads to a reduction in the volatility of returns. Employing cross-section and panel estimations reveal that although our main findings remain unaffected, only the emerging market share appears as the leading determinant of the volatility in cross-border returns.

Finally, we address the endogeneity bias in the relationship between the volatility measure and its determinants. The Granger causality test suggests evidence of reverse causality from our dependent variable to the financial concentration ratio, but no such reverse causality is found from the dependent variable to financial integration. To deal with the endogeneity problem, we construct an instrument that is related to financial concentration but does not necessarily lead to change in the dependent variable. Our chosen instrument is a measure of "trade concentration", since it is very likely that bilateral trade in goods is an important determinant of bilateral asset holdings between countries. The overall findings of the instrumental variable (IV) regressions are supportive of the core model, suggesting that our core results are robust to the endogeneity problem.

The findings of the essay provide important policy implications by suggesting the appropriate steps that need to be taken to attain higher risk sharing gains from cross-border investments. In view of the findings of a negative (positive) impact of financial integration (diversification of investments) on the volatility of cross-border returns, policy-makers should implement appropriate measures to encourage diversification of investments internationally. Some relevant measures, as suggested by McKinsey Global Institute (2011a, p.59), include (i) removing any limits on the amount that households and pension funds can invest in foreign markets, (ii) creating mutual funds and other vehicles that will enable emerging market investors to purchase foreign securities, (iii) ensuring that appropriate currency hedging instruments are widely available and cost-effective, and (iv) increasing the financial education of consumers.

The finding that a greater share of assets invested in emerging market economies (OECD countries) is associated with higher (lower) volatility of returns has important implications for policy decisions. To attain higher risk sharing gains, appropriate policy steps should include strengthening the legal and regulatory foundations to improve the financial transparency of stock markets in EMEs. In addition, given the fact that global wealth is shifting to EMEs, an improvement in conditions for investments in EMEs would be the right step towards managing and mitigating risks in global capital markets. Finally, in view of the findings of a negative association between households' investments and return volatility (although the result is not stable), policies to facilitate households' access to equity markets could help improve the risk sharing benefits.

5.2   Limitations of the research

This section outlines the limitations of each of the essays, which supports the need for future research opportunities discussed in the next section.

The first essay utilizes the decomposition approach of Asdrubali et al. (1996) and Sørensen and Yosha (1998), that suffers from some limitations as documented by Bayoumi (1999), Mélitz and Zumer (1999), and Jeanneney and Tapsoba (2012). For instance, Bayoumi (1999) argues that although it is a useful approach, researchers should be careful in interpreting the risk sharing coefficients. There has also been criticism on the assumption of the exogeneity of output shocks vis-à-vis the risk sharing processes. However, Mélitz and Zumer (1999) and several others use different empirical techniques (e.g., instrumental variables approach) and conclude that results remain very similar. Another limitation of our study is the scarcity of bilateral data on remittance inflows that is only available for a few years for our sample countries. In addition, the

quality of remittances data is often questioned as a large chunk of remittance flows that are transmitted through informal channels, remain unrecorded in official estimates.

An obvious limitation of the second essay is the short time period of analysis. This is primarily for the reason that regional level data for New Zealand is not available for a long time period. Accordingly, the small number of observations reduces the robustness of analysis. In particular, the end-point distortion problem inherent in the standard filtering methods can be severe in short samples. This is why the study has employed various filtering techniques as a robustness check. In addition, it would be interesting to see whether results are similar when quarterly data are used (subject to its accessibility). Besides, further investigation and justification of why negative aggregate fluctuations remain unabsorbed in a union between Australia and New Zealand can be an interesting area for future research.

The third essay puts forward some possible explanations for the volatility of returns on cross-border asset holdings. The question remains as to whether there are other factors beside the ones examined in the study, that influence volatility of returns. In particular, there is a need for an in-depth examination of the role of the exchange rate as a potential determinant of volatility of returns. To appreciate this point, the study has considered an exchange rate volatility measure — constructed as annual percentage change of domestic currency viz. the US dollar — as an added determinant in the empirical models. However, when included it has a statistically insignificant coefficient estimate and leads to a small increase in explanatory power. There is still a need to explore how sensitive the regression results are to the currency of denomination. Finally, using a small number of countries reduces the robustness of empirical results,

particularly in case of the cross-section estimations. The only result that seems relatively stable across specifications is that emerging market investments drive up volatility. Moreover, some alternative measures of financial integration and concentration (or diversification) of investments could be used to confirm the results.

5.3   Future areas of research

The essays contained in this thesis suggest a number of areas of research that might be undertaken in the future.

It is expected that the first essay will encourage further work in several directions. First, future research with even larger sample of developing and developed countries may confirm or refute our findings. Given the differences in the size and patterns of remittance inflows, the evidence from developing countries may not be inferable to developed countries. Second, further work should compare and contrast the relative risk sharing contributions of major external flows such as, foreign aid, private debt and equity flows, and remittance inflows, in a large set of countries. Third, it would be interesting to explore the role of remittance outflows on smoothing output fluctuations. Fourth, since economic agents are ultimately concerned about their consumption, it would be desirable to estimate the direct impact of remittance inflows on consumption risk sharing (despite the poor quality of consumption data). Finally, it would also be interesting to examine whether remittances have a more effective stabilizing impact in countries that face frequent output fluctuations.

The findings of the second essay reinforce the argument of Asdrubali and Kim (2004, 2008a) that risk sharing and intertemporal smoothing channels should be jointly explored to fully assess the insurance capabilities of an economy. The essay shows that

by following Asdrubali and Kim (2008a) and Pierucci and Ventura (2010), it is possible to examine both risk sharing and intertemporal smoothing in a single framework; besides, distinguishing and measuring the extent of various types of shocks. Therefore, from a methodological viewpoint, the analysis used in the second essay can be extended to assess the risk sharing opportunities among other groups of countries which have either established or considering the formation of a currency/monetary union. Further research should present more cross-country evidence using state-level data. As a case study, it would be interesting to examine the extent of interstate risk sharing among US states and Canadian provinces. It would also be interesting to explore why economies behave differently in absorbing different types of shocks; specifically, what are the underlying factors that may cause certain types of shocks to be absorbed while the others remain unabsorbed? From the Australia and New Zealand perspective, expanding the sample period would not only improve accuracy of results, but it would also allow examining the extent to which the global financial crisis of 2008-2009 has affected income and consumption smoothing patterns (see e.g., Balli et al. 2013).

The third essay presents a number of findings that should be useful for further theoretical and empirical work in investigating the impact of the volatility of returns on the degree of income smoothing. This is an issue which is not directly addressed in this study but which constitutes the underlying motivation for examining the potential determinants of the volatility of cross-border asset returns. Also ending the sample in 2009 is somewhat problematic given that the recent financial crisis had huge impacts on cross-border capital flows. We focus on the time period 2001‒2009, because of data availability from International Monetary Fund's Coordinated Portfolio Investment Surveys (CPIS) database, which is the main source of our data. Future research should,

therefore, re-examine our analysis with additional years of data for the more recent period. In that case, it would be worthwhile to control for the impact of financial crisis with an additional crisis dummy. Given the availability of data, it would also be useful to extend the country coverage to developing countries for whom income smoothing might be a greater priority because of higher macroeconomic volatility.

To capture more accurately the determinants of the volatility of returns, it is necessary to distinguish the two established channels of returns, namely the investment income channel (that reflects direct payments such as dividend and interest payments) and the capital gains channel (that reflects changes in market price of the asset and fluctuations in the exchange rates). While examining the capital gains channel is beyond the scope of this study, it is known to be an effective channel of income smoothing even when investment returns remain ineffective in stabilizing shocks. It is therefore necessary to extend the empirical analysis by including the capital gains channel in future research.

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