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Harmonizing the Disjointed: Economic Integration and Risk Sharing

Samuel Acheampong
University of Kentucky, s.acheam@uky.edu
Author ORCID Identifier:
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Samuel Acheampong, Student

Dr. Yoonbai Kim, Major Professor

Dr. Josh Ederington, Director of Graduate Studies

HARMONIZING THE DISJOINTED: ECONOMIC INTEGRATION AND RISK SHARING

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Business and Economics at the University of Kentucky

By
Samuel Acheampong
Lexington, Kentucky

Director: Dr. Yoobai Kim, Professor of Economics
Lexington, Kentucky 2020

https://orcid.org/0000-0002-1774-6875

ABSTRACT OF DISSERTATION

HARMONIZING THE DISJOINTED: ECONOMIC INTEGRATION AND RISK SHARING

This dissertation consists of three essays examining the role of risk diversification in European markets. At the economy level the first two essays seek to identify whether economic integration efforts among European countries result in sharing risks to consumption with regional neighbors, as opposed to global partners. At the firm level, the third essay seeks to understand whether managers of large companies in the United Kingdom choose less financial leverage if they are specifically compensated with more cash bonus as opposed to other forms of performance incentives.

In Essay 1, I assess the extent to which European countries diversify consumption risks and share them both within the European region and with major non-European countries. I identify that an empirical model can be obtained from a standard theoretical risk sharing framework, that allows for a direct evaluation of the extent of dependence of a country's own consumption on its own output growth, on regional output growth, and on output growth of the rest-of-world (ROW). The empirical model helps to understand whether growing European regional economic integration changes the patterns of regional and world risk sharing. Using data for 45 European and 15 ROW countries over the 1960 - 2017 sample period, I find that higher levels of risk sharing are associated with growing European Union (EU) and Eurozone (EZ) membership, but Europe's risk sharing with the ROW declines, a possible "competition effect."

In Essay 2, I point out how the long run average increase in risk sharing due to growing financial integration is often taken as given. Yet decoupling financial integration from economic integration at large may lead to very conflicting consequences on risk sharing for economically integrated countries. Using stock, money and bond markets, as well as industrial production and CPI data for European countries, I show that financial integration and real integration point in different directions, minimizing the ability to share consumption risks within Europe. Specifically I find that the European Central Bank may have made progress towards integrating money and bond markets, but stock markets are still highly globally influenced. Also real integration in production and prices is low and do not differ among advanced EU and non-EU countries. The findings give a new perspective as to why inter-country consumption risk sharing appears low in several empirical studies.

Finally, in Essay 3[1], the aim of the study is to investigate whether managerial earnings-based incentive influence firms' leverage policy and the extent to which this relationship is conditional on the firm earnings performance. Further, we show how firms' growth opportunities affect managerial cash compensation - leverage relationship. The paper utilize a sample of 213 non-financial and non-utility U.K. FTSE350 firms for the period 2007 – 2015. In examining these issues, we employ several econometric techniques: OLS, FE, Predicted method, and three-stage least squares (3SLS) to robustly deal with the existing leverage – cash bonus simultaneity problem. We find empirical support for our theoretical contention that managerial cash bonus induces managers to implement lower leverage policy. We further observe that the effect of managerial cash bonus on leverage is more pronounced in a well-performing firm. In addition, we find that cash-motivated executives with huge unexploited growth opportunities tend to keep low leverage level. Overall, our analyses show that the widespread usage of earnings-based incentives in the U.K executives' compensation contract, partly explains the conservative debt policy of the U.K firms.

KEYWORDS: Risk sharing; economic integration; financial markets; compensation; leverage

Author's signature: Samuel Acheampong

Date: May 13, 2020

[1]Essay 3 is a co-authored paper with Emmanuel Adu-Ameyaw (Liverpool Business School, Liverpool John Moores University), Albert Danso(Leicester Castle Business, De Montford University, Leicester Castle Business School, De Montford University), and Cynthia Akwei (Liverpool Business School, Liverpool John Moores University)

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Samuel Acheampong

Director of Dissertation: Dr. Yoobai Kim

Director of Graduate Studies: Dr. Josh Ederington

Date: May 13, 2020

For my wife, Patience, and parents, Samuel & Beatrice

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Chapter 1: Risk Sharing In Europe: Regional or Global?

1.1 Introduction

The study uses a consumption-based approach to analyze the pattern of risk sharing in Europe. A common definition of consumption risk sharing is the situation whereby shocks to a country's consumption are diversified away, being shared with other countries (Rangvid et al., 2016). In several empirical applications, when a country's consumption growth depends less on its own income growth but more on income growth of the rest-of-world (ROW), then consumption risk sharing is considered to be high. The wave of global cross-country asset holding since the mid-1980s has led to the proliferation of research addressing the impact of financial globalization on economic outcomes (Kose et al., 2009). However, an angle that is often not discussed within the same framework of globalization is the fact that regional economic integration could yield separate effects on integrated countries than would globalization outside the region. In particular I demonstrate in this paper that the impact of regional economic integration and integration with ROW can be separately analyzed in a unified model and that they largely have opposite effects.

Economic integration such as through the European Union could, among other things, improve financial stability and economic participation in those regions. When a common currency is involved (for instance as in the Eurozone), Obstfeld (1993) and others have identified that this could lead to less transactions costs and improve trade and financial market activity, which in turn could allow economic agents in various countries to smooth their consumption. By taking a new estimation approach — decomposing the extent to which a country's own consumption growth depends on its own output growth, regional output growth (through regional integration) and ROW output growth (through trade and financial openness) — the paper provides a way of isolating feedback effects of regional integration in particular and "residual" globalization with ROW, in one framework.

The paper finds that taken together, the periods in which countries joined the European Union (EU) and/or adopted the Euro are associated with higher levels of consumption risk sharing. Specifically in the periods before EU membership a 1 percent increase in regional output growth correlated with a .251 percent decrease in consumption growth whereas the periods after EU membership correlate with a .08 percent increase in the same. It is possible that a country that is integrated into the "region" is able to accumulate more from cross asset ownership to increase consumption, whereas at the same time, non-participants in the region experience less inward FDI and asset inflow, leading to slower growth in their consumption. Some evidence also point to the cardinal role of the Maastricht treaty as an important catalyst for greater risk sharing within the European region.

In a closely related article to this paper, Ferrari and Rogantini Picco (2016) specifically evaluate the role of the Euro adoption on consumption smoothing by firstly creating a counterfactual dataset of macroeconomic variables via a Synthetic Control Method. The authors then recourse to the Asdrubali et al. (1996) risk sharing decomposition (discussed under Related Literature) and find that the adoption of the Euro has actually reduced members' ability to smooth consumption risks. That finding however does not consider the role of the EU simultaneously. The analyses in this paper deviate from this path and allow for more insightful identification of impacts not only through the the Euro adoption, but also through the EU arrangements, structural breaks, and "similar country" comparisons. My finding that risk sharing increased in the EMU is however confirmed by Christev and Melitz (2013) who uses the role of the EMU in minimizing consumption volatility as a measure of risk sharing. It is worth mentioning however that the paper does not assume that risk sharing is the reason why countries integrate/globalize. For instance countries may integrate with the region or the world in order to take advantage of profit opportunities or to ward off competitive threats (Christev and Melitz, 2013).

The rest of the paper is organized as follows: Section 1.2 presents related literature, Section 1.3 provides a brief theory and derivation of the empircal model. The data used is described in Section 1.4. In Section 1.5 I present a depiction of the extent of regional & time variations in risk sharing in Europe while detailing the key regression estimates in Section 1.6. I also include robustness checks in section 1.7 and wrap up the paper with Conclusions in Section 1.8.

1.2 Related Literature

The impact of economic integration is often analyzed in the context of Optimum Currency Areas (OCA) criteria. The OCA theory, inspired by Mundell (1961), stipulates that the benefits of a common currency is worthwhile for countries that tend to experience a sufficient degree of symmetric shocks and likely have synchronized business cycles. In other words countries that experience asymmetric shocks to output do not need to give up their independent monetary policy and ability to use exchange rate adjustments to resolve economic imbalances, in favor of having a stable common currency. This line of thought dominated research that sought to project if the Eurozone and any new members that join the zone later would form an OCA. While the OCA criteria emphasize the cost of joining a currency area, another strand of research, inspired by Mundell's later ideas (Mundell, 1973) focus on the "benefits" of joining a currency area even if a country exhibits asynchronous cycles. One of the main benefits is the degree of risk sharing that could be possible by joining a more financially integrated market that allows for consumption smoothing through cross-ownership of financial assets. In theory, complete (financial markets) would allow a consumer to invest in Arrow-Debreu securities that yield state-independent returns that would be used to smooth consumption. This insurance is termed consumption risk sharing. Thus capital market developments outside a country has a tendency to reduce the link between Home consumption and Home output if Home countries participate in global financial markets (Kose et al., 2009; Rangvid et al., 2016).

As with the progress of the European Union, among other things, removal of barriers to trade, capital and labor mobility tend to precede adoption of a common currency. Risk sharing potential is not limited to currency areas. Another important channel for consumption risk diversification is by countries trading more with other countries, ideally with limited barriers. Obstfeld (1993); Imbs (2004); Rangvid et al. (2016) and others have identified that this could lead to less transactions costs and improve trade and financial market activity and the synchronization of business cycles (Frankel and Rose, 1998; Schiavo, 2008). Therefore member countries of the EU could share risks without necessarily being members of the Euro area. However the potential effects of openness could go either way. For instance if increased trade is inter-industry, this could lead to more specialization and result in less synchronous business cycles. The former argument presumes that the trade surge is intra-industry. Thus in principle, the impact of economic integration (financial and trade at least) on risk diversification is inconclusive. Also, insulation against domestic shocks with openness would imply more consumption smoothing, while openness could also expose a country to foreign shocks and hence less consumption smoothing (Christev and Melitz, 2013). Therefore the empirical impact of risk sharing when economic integration efforts such as through the European Union and Euro adoption are introduced into the general globalization discussion cannot be known a priori.

The link between economic integration, business cycle synchronization and risk sharing has evolved. Obstfeld (1993), Imbs (2004), Boewer et al. (2006), Schiavo (2008) and others consider high consumption correlations across cross countries as an indicator of high consumption risk sharing, and high GDP correlations as a measure of business cycle synchronization. High consumption correlations imply that consumers in each country have effectively insured against consumption risks, aided by improved degree of financial integration. Also high GDP correlations intuitively demonstrate similarity in business cycles. By calibrating a theoretical model, Backus et al. (1992) predict that consumption correlation would be higher than output correlations, but empirical evidence find the opposite outcome — the consumption correlation puzzle. The puzzle is however less clear if lower-than-expected financial integration, various barriers to trade, and non-traded goods are taken into account. Also comparing consumption correlations to output correlation is only done by convenience due to data challenges, but to be more accurate, consumption correlations should be compared to GDP correlations net of investment and government consumption, since only this part of outcome can be shared by consumers (Obstfeld and Rogoff, 2000; Boewer et al., 2006).

While recent risk sharing analyses do not link business cycles synchronization with risk sharing, but focus on the roles of “new" measures of financial and trade integration on risk sharing, the changing implied definition of business cycle synchronization could be inferred. Both Kose et al. (2009) and Rangvid et al. (2016) consider the extent of decline in a country’s dependence on its own output as the measure of risk sharing. This implies that the higher the correlation of consumption with other country’s output the higher the extent of risk sharing. The higher correlation could mean increased business cycle synchronization — private consumption (the largest component of GDP) of a country grows as output of other countries grow.

Previous authors have suggested that, over time, the decline in output volatility across countries is another measure of business cycle synchronization. For instance Blanchard and Simon (2001), Heathcote and Perri (2004), Stock and Watson (2005) and Del Negro and Otrok (2008) document a decline in output volatility in G7 over the post-Bretton Woods era. In addition Stock and Watson (2005) find that global shocks dominate domestic shocks in explaining the decline in output volatility across G7 countries – evidence of increased synchronization. Other evidence by Montoya and de Haan (2008) and Schiavo (2008) on the Euro Area indicate an increase in business cycle synchronization.

Risk sharing has been empirically analyzed in various facets. Asdrubali et al. (1996) identifies the channels and extent of risk-sharing among US states, defined as the extent of consumption smoothing that are attained through either capital markets, credit markets or the federal government spending between 1963-90. The work by Sørensen and Yosha (1998) extends the consumption smoothing channels in Asdrubali et al. (1996) to the European Community (EC) countries and OECD countries over the period 1966-90. Their analyses give finer insights into the sources of cross-sectional risk sharing among US states and the EC. However, with the identified levels of risk sharing in these and other studies (such as Rangvid et al. (2016)) being low, Christev and Melitz (2013) casts doubts on the role of cross-country holdings of property claims on risk sharing altogether, finding that risk sharing in the EU rather comes through the encouragement of price competition, contestable home markets, ability to buy insurance at home, and harmonization of regulations. In doing so, the indirect (usual approach) of determining risk sharing — how less relative consumption growth is correlated with related output growth — is questioned, and replaced with a more direct method that uses the impact of economic integration on consumption volatility.

In a closely related topic to this paper, Ferrari and Rogantini Picco (2016) specifically evaluate the role of the Euro adoption on consumption smoothing by firstly creating a counterfactual dataset of macroeconomic variables via a Synthetic Control Method. The authors then recourse to the Asdrubali et al. (1996) risk sharing decomposition identified earlier and find that the adoption of the Euro has actually reduced members' ability to smooth consumption risks. Thus as far as tests for risk sharing in the Euro area go, empirical evidence is inconclusive.

1.3 A Brief Theory and the Empirical Model

I start with the paper published by Obstfeld (1993). Obstfeld (1993) starts by constructing an equilibrium in an economy where consumers have the same iso-elastic utility functions and capital markets are perfectly integrated with consumption risks being perfectly shared. In that case only systematic risks to consumption remain. [1] Obstfeld's final model is of the form:

$$\Delta logC_{it} = \delta + \Delta logC_{Wt} + \epsilon_{it} + \eta_{it}, \tag{1.1}$$

[1] A key mechanism through which market integration works is by allowing an open-economy where international financial integration encourages the representative country to shift away from a low-return, safe investment to a high-return risky investment.

where η_{it} is a function that could capture innovations that cannot be insured against due to incomplete markets (a term that can be ignored if we assume complete markets), in a regression linking country-specific consumption growth to world consumption growth. Obstfeld also justifies that using differenced data in the specification solves the empirical problem of no cointegration between $logC_{it}$ and $logC_{Wt}$. ϵ_{it} is the random error term.

Kose et al. (2009) extend the theoretical set-up in Obstfeld (1993). The authors recognize that in models assuming complete markets and isoelastic utility, discounted marginal utility between two periods are equal for any pair of countries i and j:

$$\frac{U'(c_{it}+1)}{U'(c_{it})} = \frac{U'(c_{jt}+1)}{U'(c_{jt})} = \frac{\lambda_t + 1}{\lambda_t} \tag{1.2}$$

This implies that differences in growth of marginal utilities are not dependent upon country-specific variables. If Z is a vector of country-specific variables, then we obtain

$$E(\Delta logc_{it} - \Delta logC_t | Z_{it}) = 0 \tag{1.3}$$

where C is world per capita consumption[2]. Eq(3) can be stated in a regression specification as:

$$\Delta logc_{it} - \Delta logC_t | Z_{it} = bZ_{it} + \varepsilon_{it} \tag{1.4}$$

Together, Eq(3) and (4) suggest that if consumption risks are perfectly shared with the world, then the growth rate of country-specific consumption and output will be equal, making the left hand side equal zero. Or put differently, any country-specific variables (such as Z) will not move idiosyncratic consumption (left-hand-side), and hence b will tend towards zero. In previous literature, Z is typically replaced with idiosyncratic income growth. Thus Eq(4) can be re-written as:

$$\Delta c_{i,t} - \overline{\Delta c_t} = \alpha + \beta \left(\Delta y_{it} - \overline{\Delta y_t} \right) + \varepsilon_{it}. \tag{1.5}$$

Eq(5) is a regression of deviations of own-country consumption growth Δc_{it} from world consumption growth $\overline{\Delta c_t}$ on idiosyncratic income. A lower β implies higher degree of risk-sharing. If consumption risk is perfectly shared, we expect $\beta = 0$. The world growth (consumption and income) are GDP weighted averages across countries, with the GDP weights updated each year.

Asdrubali et al. (1996) and Sørensen and Yosha (1998) have shown that the β from this regression can be interpreted as a measure of the degree of consumption risk sharing. In principle consumption risk sharing would imply that idiosyncratic shocks to consumption are diversified away and thus shared with other countries; a country's own consumption growth does not significantly depend on its own income growth.

In this paper I propose a modification that allows for evaluating consumption risk

[2]For my purposes the “world" is decomposed into the European region and the ROW

sharing that directly accounts for both regional and ROW risk sharing. The essence of Eq(5) is to “partial out" the amount of growth due to the world, but I propose that risk sharing due to a country's region and that of the “world" could be decomposed and explicitly controlled for in the same regression specification. With country-specific, regional, and world output growth being orthogonal and complementary, I am able to track how consumption risks have been shared with the region and the world. The regional dimension helps with explaining the effect of growing EU economic arrangements, and the global dimension captures the effect of globalization outside of Europe. Given the growing economic integration within Europe, the expectation is that the correlation of country-specific consumption growth with regional output growth should be increasing over time (positive δ in Eq(6)) and the correlation with the world growth is expected to decline (negative γ in Eq(6)). The model used is then of the form:

$$\Delta c_{it} - \overline{\Delta c_t} = \alpha + \beta \Delta y_{it} + \delta \Delta y_{rt} + \gamma \Delta y_{wt} + \varepsilon_{it} \tag{1.6}$$

where Δy_{rt} is regional output growth and Δy_{wt} is world output growth.

It is possible that a country that is integrated into the European region is able to accumulate more from cross asset ownership to increase consumption, whereas at the same time, non-participants in the European region experience less inward FDI and asset inflow, leading to slower growth in their consumption. In a competitive global economy growth outside Europe is likely to draw more investment into those regions. This might lead to less investment into Europe and a decline in the growth of European consumption, if European countries primarily share risks within Europe. A negative value for either δ or γ is therefore possible.

I use the 15 European Union countries (EU 15) as of 1995 (see Table 1.3 for a list of these countries) to represent the European region. The world is also represented by the 15 largest trading partners of European countries (see Table 1.4). The choice of the EU 15 is inspired by the need to choose the core regional players in the goods and financial markets over the entire sample period (1960-2017)[3]. The world is represented by the top 15 trading partners of European countries published by the European Commission in 2017. The paper further assumes that these world countries are the major destinations for capital from Europe, and hence risk sharing through their financial markets.

1.4 Data

The dataset is obtained from Penn World Tables 9.0[4] . Per capita real consumption and real GDP at constant (2011) prices (in Purchasing Power Parity(PPP)

[3]A potential weakness is the exclusion of Russia, a top 20 trading partner for most European countries, but given that the available data for Russia only begins in 1990, the EU 15 countries appear to be a reasonable representation of the region for trade and financial participation (and integration) for most European countries

[4]This is put together by Feenstra et al. (2015)

terms) are used for all 45 European and 15 ROW countries in the sample comprising of annual data over 1960-2014. Of the 45 European countries, 19 belong to the EZ. This dataset however has missing observations (1960-1989) for 20 countries, mostly those that recently joined the EZ and non-EU countries. In Table 1.1 I show each of the 45 European countries, the data available and the years in which there was a structural break (à la Bai-Perron, 2003 method) in the estimated coefficients that I show later. [5]

[Table 1.1 about here]

The dataset from Penn World Tables 9.0 (PWT) is extended to 2017, by obtaining real consumption and GDP data from the World Bank World Development Indicators (WDI). It is important to note that the data from PWT are in 2011 real terms whereas data from WDI are in real 2010 terms. To convert the WDI data into PPP terms, I obtain exchange rates (domestic currency per US dollar, period average rate) from the International Monetary Fund's International Financial Statistics (IFS). Additionally I obtain PPP conversion factor data from 2015 to 2017 from IFS and convert the series with the formula:

$$Series(in\ PPP) = (Exchange\ Rate/PPP\ conversion\ factor) \times Original\ Series$$

Due to data beginning in 1990 for 20 countries in the European sample, the empirical strategy is focused more on European Union (and Eurozone) countries, following the time variation in consumption risk sharing for the original EU countries, and tracking this as the EU became larger. In the case where I compare outcomes with non-EU countries, I focus on structural breaks that may have occurred in the post-Euro adoption era. To do this, I make a generalization about the date of the break by imposing the break dates that I find for non-EU countries that have adequate data for the Bai-Perron test, and also the known break dates such as in 1999 and 2002 (the Euro inauguration and official adoption resp.).

Summary Statistics

In this section I provide a snapshot of basic regional characteristics using the adoption of the Euro in 1999 as a split point. Table 1.2 presents summary statistics of the levels of real per capita consumption and income, their growth rates and population before and after the adoption of the Euro[6] for countries in the EZ. For non-

[5]For countries with data only beginning in 1990, the Bai-Perron structural break test could not be performed due to limited estimation sample. The Bai-Perron method and many others such as Quant-Andrew method all trim 15% of the data. Hence the test cannot be performed in small samples, such as for the countries in the sample with data beginning in 1990.

[6]Only 11 of the current 19 Euro area countries adopted it when it was officially introduced on January 1, 1999. The remaining 8 countries had staggered adoption of the Euro. Due to this I use a dummy categorical variable to capture exactly when the Euro was adopted to determine the proper split shown in Table 1

EZ countries, I choose 1999 to split that sample to allow for comparison of regional characteristics pertaining to both groups.

[Table 1.2 about here]

The EU 15 countries are more homogeneous, with the highest levels of mean per capita GDP and consumption before and after the adoption of the Euro. For instance per capita GDP in the EU 15 before and after adoption of the Euro were $19,025 and $41,581 respectively, whereas the corresponding figures for the non-EU group were $14,041 and $17,750 respectively. Remarkably, growth rates of output and consumption were roughly 0 in non-EU countries, dominated by former Soviet Union members prior to adoption of the Euro. However growth in consumption and output in the post-Euro era trended decently highly at 4 percent and 5 percent respectively, on average. This result is interesting because the surge in growth coincides with several of these countries joining the EU and the Eurozone, a move that this paper seeks to uncover its potential effect on risk sharing. Average population levels are highest in the world group, as expected — the world sample includes highly populated countries like India, China, and the United States.

[Figures 1.1 & 1.2 about here]

Looking at figure 1.1 the countries with higher correlation between regional output and idiosyncratic consumption growth mostly in the Eurozone — Finland, Italy, Spain, France, and to some extent Ireland, Belgium, Netherlands and Greece. This is expected given the role of the Maastricht Treaty in 1992 in increasing regional integration. Amidst the economic instabilities in the 2000s, this correlation generally dropped, with only Netherlands as an exception (see Plot 2). In these periods countries with moderate correlation were not limited to the EZ. Non-EZ EU countries like Sweden, Bulgaria, and Denmark, as well as Turkey (a non-EU country), seem to have similar correlations in the 2000 - 2008 period. In the period after the economic crisis (Plot 3 in Figure 1.2) the correlations surged, but again not unique to EZ or EU member countries, though they dominate. Notably the correlations for major European players like the United Kingdom, Russia, and Switzerland have remained low.

Computation of weights and key variables

This section details how the regional and world GDP per capita and consumption per capita data are generated and used in the paper. To take into account the relative influence of countries within each group (regional and world) on European countries' economic integration, I weight each country's GDP per capita by their size, proxied by their share of the group's total GDP. The weights are computed as:

$$weights = (GDP_{it}/Total\ GDP_t) \times 100 \tag{1.7}$$

where i is the country index and t is the time subscript. Thus the GDP weights are updated from year to year. In Tables 1.3 and 1.4, I show the average of the weights over various sub-periods for both the regional and the world groups. After weighting, I obtain GDP weighted average consumption per capita and output per capita for both the regional and world groups. Finally I impute these estimates for each country in the European sample — each country has the same time-varying regional and world consumption per capita as well as output per capita.

[Tables 1.3 & 1.4 about here]

1.5 Regional & Time Variation in Consumption Risk Sharing

This section explores the time variation in consumption risk sharing within Europe for each country group described in Table 1.5. Consumption risk sharing is identified as the extent of correlation between country-specific consumption growth and each of regional and world output growth.

[Table 1.5 about here]

From the 10-year rolling panel forecasts in Figure 1.3, panels A, E, and F are similar since most of the EU 15 countries became the 7 core EZ and 5 periphery EZ countries. These panels are characterized by increasing regional risk sharing, as expected – increases in regional output growth allow integrated countries higher consumption smoothing due to more returns on capital and expanded merchandise trade. Noticeably however, the general forecasted trend suggests minimal regional consumption risk sharing until the early 1990s, a decline in much of the 2000s, and a surge towards the end of the sample. The period of decline in regional risk sharing is not surprising due to the economic instabilities in the 2000s but from a risk sharing perspective, this pattern could cast doubts on the robustness of Economic integration initiatives such as the EU and EZ in the face of crisis. After all, risk sharing is most important in the face of crisis. In all of panels A, E, and F the relationship between idiosyncratic consumption growth and world output is forecasted to be mostly negative. The negative relationship is interpreted as depicting declining dependence on the world for consumption smoothing. Thus with economic integration in Europe, the region and the world might "compete" for resources so that a surge in regional growth improves consumption smoothing while a surge in world growth seems to decline consumption smoothing.

Panels C and D show insignificant regional risk sharing if all EU and EZ countries are pooled together. Due to this fact, the identification strategy in this paper is to isolate subsets of countries or use dummy variables to uncover effects that vary by EU or EZ members, specific years of EU membership, OECD membership, among others. Panel B shows an increase in regional risk sharing by other EU member countries, many of which joined the EU in 2004. Prior to this, these countries shared more risks with the world than with the European region. Non-EU countries (panels G and H) are characterized by high dependence on own-country output growth. The more advanced (OECD) non-EU countries show sustained minimal levels of regional risk sharing and a stable negative correlation with the world. Less advanced non-EU countries (panel H) exhibit marked volatile behavior within limited sample period

1996-2017. An overall pattern that may be observed from all panels is that as the EU expands, so does regional consumption smoothing. As Europe strengthens through integration, less participation with the world seems to lead to marked consumption dis-smoothing of European countries with the world.

[Figure 1.3 about here]

1.6 Estimation and Regression Results

The section provides regression estimates that detail the major findings of the identification strategy employed - splitting samples into countries that have joined the EU and/or have adopted the Euro currency as opposed to those that have not joined the EU and/or the EZ. Firstly, I introduce dummy variables for when a country joined the EU and/or the EZ, to identify the impact of growing economic integration. Afterwards, inspired by the time-variation in the levels of consumption risk sharing in Figures 1.1 & 1.2, I conduct structural break tests to identified major shifts in the estimated coefficients. A major challenge encountered is the difficulty in conducting the tests within the panel regression framework[7]. The approach taken then is to conduct country-specific break tests and use common break points across countries to inform the specification of break points within panels. This approach provides a good approximation, as robustness checks showed that switching from this to known break dates does not meaningfully alter the signs and magnitudes of estimates.

Risk Sharing in the EU and EZ

The basic goal of the paper is to identify the extent to which growing economic integration in Europe through increased participation/membership in the European Union and the Eurozone affect risk sharing. A Dummy Variables approach is used to take into account the duration of EU and EZ membership. The “interaction" of the dummy variables with the regressors give the desired effects at the country-specific, regional, and world levels. I first attempt to uncover how growing economic integration overall for the full sample and for the 28 EU countries who joined the EU at various times influence risk sharing. For the estimation, I define dummy variables which equal 1 for the period during which a country is in the EU and/or EZ and 0 otherwise. Finally, I estimate panel regressions and introduce interaction terms to capture the desired effects. The regressions are of the form:

$$\Delta c_{it} - \overline{\Delta c_t} = \alpha + \beta \Delta y_{it} + \delta \Delta y_{rt} + \gamma \Delta y_{wt} + D_k + \phi_1(\Delta y_{it} \times D_k) + \phi_2(\Delta y_{rt} \times D_k) + \phi_3(\Delta y_{wt} \times D_k) + \varepsilon_{it} \tag{1.8}$$

[7]It might be possible to do this for known breaks, but to do flexible tests such as the Bai-Perron (2003), the panel framework is difficult to implement. Such tests are often conducted for time-series at the country-by-country level

where $\Delta y_{r,t}$ is regional output growth, $\Delta y_{w,t}$ is world output growth and the next three terms are interactions with the EU and/or EZ dummies — each D_k included captures the change in estimated coefficients for the periods where countries were EU and/or EZ members in the respective regressions.

The results of the baseline regression are shown in Table 1.6. For the full sample, dependence on own country output growth does not vary with economic integration (no significant change from columns 1 to 5 with the EU interaction terms). The result in columns 6 and 7 however show that EU membership is correlated with a statistically higher impact of regional output and more negative impact of world output growth on domestic consumption growth, as compared to periods without EU membership across countries in the sample (columns 2 and 3). Specifically, whereas a 1 percent increase in regional output growth for non-EU membership period correlates with a .422 percent decline in idiosyncratic consumption growth, this results in a .07 percent increase (.500-.422) in idiosyncratic consumption growth for periods of EU membership. The positive (negative) overall coefficient may be considered to reflect increased (decreased) business cycle synchronization. Taken alone, the period after introduction of the Euro in 1999 produced similar results of increased regional integration (or synchronization) for the members who adopted it. Finally, for the full sample, focusing on EU countries who also adopted the Euro, regional risk sharing was even higher — a 1 percent increase in regional output growth correlated with a .142 percent increase (.455-.313) in idiosyncratic consumption growth.

[Table 1.6 about here]

Before EU integration (membership), regional risk sharing is negative. Output growth in representative regional group may initially draw world capital inflow into the European region away from specific countries in favor of the economically stronger regional representative group. Thus when regional output grows, consumption growth of many specific countries could decline. This would then lead to the observed negative correlation in column 2. As countries integrate into the region (through EU/EZ membership), the observed correlation is positive because most countries may now share in the benefits of regional output growth – growth in country-specific consumption.

Among the 28 EU countries, similar overall results pointing to higher regional and lower world risk sharing after joining the EU are obtained. In the periods before EU membership a 1% increase in regional output growth correlated with a .251% decrease in consumption growth whereas the periods after EU membership correlate with a .08% (.330-.251) increase in same. An insight that emerges from these results is that growing regional integration in Europe is associated with further decline in risk sharing potential with the world.

These findings are important contributions to the consumption risk sharing literature. The paper brings out a "competition" story between an integrated Europe and the rest of the world. The competition is such that growth in the European region correlates with increased consumption smoothing, and growth in the world correlates dis-smoothing. An integrated Europe may compete with the world for capital inflow and trade. Increased capital inflow into the integrated Europe may be associated with decreased inflow into the world representative group and vice versa. As a consequence output growth in the integrated Europe may lead to less growth in the world representative group of countries and vice versa. Hence, as the integrated Europe (world) grows, consumption grows (declines) among European countries, on average. Another explanation for the observed correlations is a business cycles synchronization story. Integrated European countries may be facing relatively symmetric output correlations (Schiavo, 2008). As such output growth in the region is likely to be associated with consumption growth. Conversely, when business cycles in the integrated Europe becomes relatively less synchronous with the world, it is likely that world growth is correlated with decline in domestic consumption growth for European countries.

Risk sharing with EU, EZ membership and structural breaks

In this section, I estimate Eq(8) in separate regressions, split by the identified structural break dates throughout the sample period: 1960-2017. For instance the first regression output in row 2 of Table 1.7 considers panel estimates between 1960-1979 and how the structural break in 1972 changed the estimates between 1973-1979. Similarly, with the regression output associated with the 1980 structural break, column (1)-(3) are estimate for the period 1973-1989 while columns (5)-(7) are estimates for the period 1980-1992. Regional risk sharing was low across board in Europe whereas risk sharing with the world increased for European Economic Community (EEC) member countries after the collapse of the Bretton Woods system (in 1972). The higher risk sharing with the world, for EEC member countries may reflect their ability to more easily adjust to the ensuing floating exchange rates regime system to be able to diversify away consumption risks. The structural break in 1980 resulting in only an intercept decline in risk sharing but EC countries and non-members looked similar — both shared no significant risk with the European region, and became more asynchronous to the business cycles of the world. This is not a surprising result given the European economic slump in the 1980s, manifested in the high unemployment levels that were observed see (Fitoussi et al., 1986).

[Table 1.7 about here]

Regional risk sharing picked momentum with the break that seems to be closely related to the Maastricht Treaty, which was signed in February 1992 and went to effect in November 1993. EU member countries on average shared significantly higher risk with the European region. A 1 percent increase in regional output growth lead to a .147 percent increase in idiosyncratic consumption growth for EU members, an indication of growing business cycle synchronization as the EU grew in economic integration potentially via the Maastricht Treaty. With the structural break in 2003, together with increased EU membership regional risk sharing seems to have become diluted. A 1 percent increase in regional output growth correlated with about a .02 percent (.502-.482). As identified before the global financial crisis may have negatively impacted risk sharing. Taken together, EU countries that also adopted the Euro shared more regional risks and became more asynchronous with the world considering the 2003 structural break. This result is not unique as similar estimates are found if we allow the break point to rather be the introduction of the Euro in 1999.

1.7 Robustness Checks

The novel model introduced in the paper is checked for robustness to verify some baseline results through the approaches described in this section. Firstly, the data is further de-trended using a new approach introduced by Hamilton (2017) (allowing for the possibility of some type of non-stationarity still existing in the series used for estimation thus far). Hamilton proposes a regression of the series at date t on the four most recent values as of date $t-h$ to achieve all the intents and purposes of the HP filter. The basis for this approach is that the HP filter intends to produce a stationary component from an $I(4)$ series but it has been long identified that the approximation in the middle could vastly differ from the approximations are the beginning and end. Hamilton's alternative approach identifies that the main error in forecasting a series more than h=8 quarters ahead is the inability to capture cyclical dynamics. Hence as long as the series is $I(4)$, a great approximate model of the cyclical pattern is the residual (v_{t+h} below) obtained from a model of a non-stationary y series of the from:

$$y_{t+h} = \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 y_{t-3} + v_{t+h} \tag{1.9}$$

where h=8 quarters ahead for quarterly data or h=2 years ahead for annual data. The residual obtained from this regression is the detrended series. After de-trending all time-series, the results of replicating portions of Table 1.6 are shown in Table 1.8. The results do not alter substantially. Non-EU countries are estimated to be more asynchronous with regional business cycles and have no significant consumption smoothing with the world (whereas there was consumption dis-smoothing with the world in Table 1.6). There are slightly lower levels of consumption smoothing for EU countries who adopted the Euro but signs and significance of coefficients remain the same.

[Table 1.8 about here]

As additional robustness checks, the European region is represented by the 28 EU countries and also by all 45 European countries in the sample. Apart from slight changes to the magnitudes of the coefficients in Table 1.6, the signs and significance are unchanged with the results shown in Table 1.8. Finally I estimate the model used in Kose et al. (2009) and Rangvid et al. (2016) in which only idiosyncratic consumption growth is regressed on idiosyncratic output growth. The estimated coefficients shown in column 1 are almost identical to those that have been estimated with the model proposed in this paper. Thus this paper provides a novel way of extending the existing literature to analyze more dynamics in one framework. Specifically the existing literature tend to be agnostic about the rest-of-word, whereas by splitting the ROW into a European representative group and a world representative group, the paper is able to show that regional group may have a positive effect on consumption growth whereas the world group may have a negative effect. While Schiavo (2008) identifies that European integration could lead to synchronised business cycles, I extend the idea by finding that European integration is also associated with higher levels of consumption risk sharing.

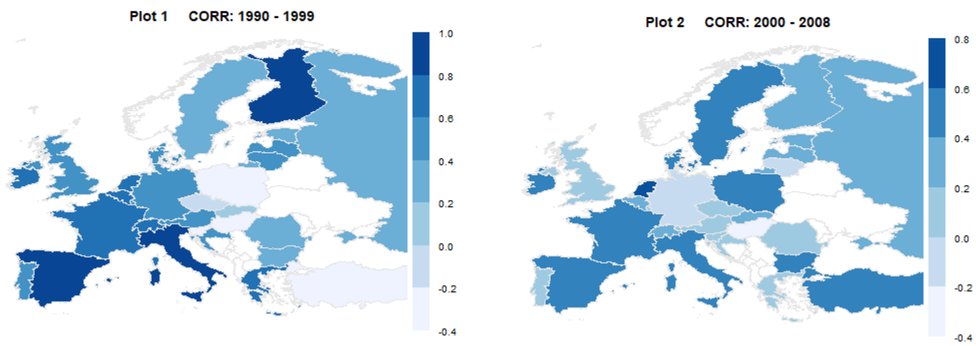
1.8 Conclusion

The prevailing view in the area of international risk sharing is that the extent of risk sharing is much less than theory might predict. Thus while globalization has noticeably surged, countries have not diversified away consumption risks correspondingly. The existing discussion often quantifies how much risk has been shared with the world at large, outside specific countries. The main contribution of this paper is to model the "world at large" (from the European countries' perspective) as consisting of a core European region and a world representative group. This decomposition produces several unique findings that help to analyze consumption risk sharing in the face of growing regional economic integration in Europe.

The paper analyses the evolution of consumption risk sharing within Europe, with emphasis on how belonging the European union and additionally the Eurozone could improve ability of countries to diversify away consumption risks. I find that, taken together, the periods in which countries joined the EU and/or adopted the Euro are associated with higher levels of consumption risk sharing. Of the EU expansion efforts, the empirical evidence also points to the likelihood of the Maastricht treaty being an important catalyst for high risk sharing within the European region. It is possible that a country that is integrated into the "region" is able to accumulate more from cross asset ownership to increase consumption, whereas at the same time, non-participants in the region experience less inward FDI and asset inflow, leading to slower growth in their consumption.

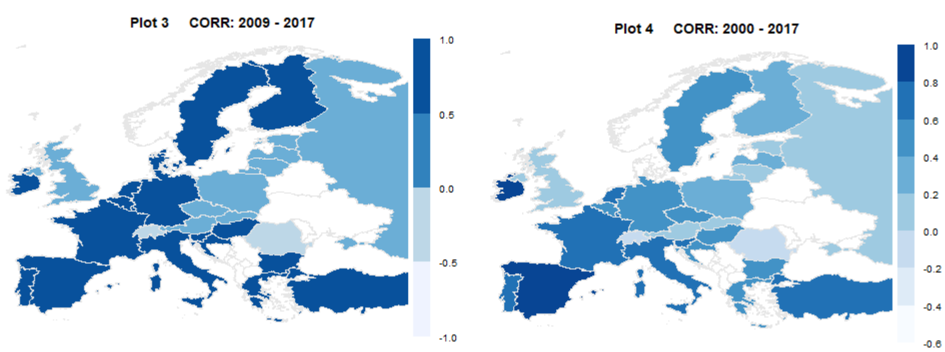
Another key finding is that of a possible "competition effect" between a more integrated Europe and the major countries of the rest-of-world. An integrated Europe competes with the world for capital inflow and trade. Increased capital inflow into the integrated Europe may be associated with decreased inflow into the world representative group and vice versa. As a consequence output growth in the integrated Europe may lead to less growth in the world representative group of countries and vice versa. Hence, as the integrated Europe (world) grows, consumption grows (declines) among European countries, on average.

Figure 1.1: Correlation between idiosyncratic consumption and regional output growth: 1



Note: Correlation maps are drawn for 34 countries that shapefiles could be extracted for from the Nomenclature of Territorial Units for Statistics (NUTS) maps database. Countries whose shapefiles could not be extracted have white spots. Water bodies are also white spots.

Figure 1.2: Correlation between idiosyncratic consumption and regional output growth: 2



Note: Correlation maps are drawn for 34 countries that shapefiles could be extracted for from the Nomenclature of Territorial Units for Statistics (NUTS) maps database. Countries whose shapefiles could not be extracted have white spots. Water bodies are also white spots.

Table 1.1: Data availability and structural break dates by country

The Bai-Perron test could not be performed for samples beginning in 1990. In such cases I impose the break in 2003 that was observed for similar countries. The first 11 countries started using the Euro in 1999. * Lithuania joined the EU in 2004. The United Kingdom exited the EU in 2017.

country	data begins	Structural break dates
countries in EZ		
Austria	1960	1969,1991
Belgium	1960	1969,1983
Finland	1960	1992
France	1960	1969,1977,1995,2003
Germany	1960	1976,2004
Ireland	1960	no break
Italy	1960	1970,1978
Luxembourg	1960	1989,2005
Netherlands	1960	1979,2003
Portugal	1960	1974,1987
Spain	1960	1971,1982,2004
Cyprus (2008)	1960	no break
Estonia (2011)	1990	no test
Greece(2002)	1960	1972,1981,1988
Latvia (2014)	1990	no test
Lithuania(2015)*	1990	no test
Malta (2008)	1960	2002
Slovakia (2009)	1990	no test
Slovenia (2007)	1990	no test
non-EZ EU countries		
Bulgaria(2007)	1970	no break
Croatia(2013)	1990	no test
Czech Rep.(2004)	1990	no test
Denmark(1973)	1960	1982,1994,2005
Hungary(2004)	1970	no break
Poland(2004)	1970	no break
Romania(2007)	1960	no break
Sweden(1995)	1960	1983
United Kingdom (1973)*	1960	1970,1978,2006
non-EZ non-EU countries		
Albania	1990	no test
Armenia	1990	no test
Azerbaijan	1990	no test
Belarus	1990	no test
Bosnia & Herz.	1990	no test
Georgia	1990	no test
Iceland	1960	1970
Kazakhstan	1990	no test
Norway	1960	1970,1978,1986
Moldova	1990	not test
Russia	1990	not test
Serbia	1990	no test
Switzerland	1960	1992,2003
Macedonia	1990	no test
Turkey	1960	no break
Ukraine	1990	no test

Table 1.2: Summary Statistics

1. This table presents summary statistics for the major sub-groupings used in the paper.
2. Per capital real GDP and consumption are in US dollars and population is in millions.
consumption^g & output^g are the growth rates in per capita real consumption and real GDP

	EU 15 1960-1998			EU 15 1999-2017		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
consumption	585	13,324	4,833	285	28,439	5,771
output	585	19,025	8,054	285	41,581	14,457
population	585	23.48	24.55	285	26.20	26.62
consumption^g	570	.032	.028	285	.028	.047
output^g	570	.033	.035	285	.026	.046
	EU 13 1960-1998			EU 13 1999-2017		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
consumption	267	7,387	3,651	247	17,249	5,100
output	267	10,000	5,099	247	22,409	7,547
population	267	10.36	11.57	247	8.22	10.28
consumption^g	254	.030	.075	247	.042	.044
output^g	254	.028	.079	247	.045	.049
	non-EU 28 1960-1998			non-EU 1999-2017		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
consumption	293	9,764	6,827	323	13,326	10,048
output	293	14,041	10,923	323	17,752	16,697
population	293	15.47	28.43	323	19.83	36
consumption^g	276	0	.119	323	.049	.073
output^g	276	-.007	.132	323	.055	.078
	All 45 pre-Euro			All 45 post-Euro		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
consumption	1,145	11,029	5,755	855	19,497	9,959
output	1,145	15,645	9,141	855	27,041	17,333
population	1,145	18.37	23.99	855	18.60	28.38
consumption^g	1,100	.024	.073	855	.040	.058
output^g	1,100	.022	.082	855	.042	.062
	World 15 pre-Euro			World 15 post-Euro		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
consumption	555	10,751	10,449	285	20,379	13,782
output	555	10,801	35,522	285	31,630	22,712
population	555	165.35	287.71	285	236.30	411.36
consumption^g	540	.028	.059	285	.034	.063
output^g	540	.028	.073	285	.036	.067

Table 1.3: Regional group GDP weights. The table shows average GDP weights over the specified subsamples.

country	1960 − 1979	1980 − 1999	2000 − 2017	Full sample
Austria	2.15	2.19	2.38	2.24
Belgium	3.19	3.06	2.91	3.06
Denmark	1.90	1.76	1.55	1.74
Finland	1.37	1.36	1.38	1.37
France	17.50	17.13	15.97	16.90
Germany	23.82	23.43	22.16	23.17
Greece	1.75	1.88	2.13	1.84
Ireland	0.60	0.68	1.41	0.88
Italy	13.38	14.81	14.15	14.11
Luxembourg	0.17	0.18	0.29	0.21
Netherlands	4.67	4.64	5.06	4.78
Portugal	1.36	1.48	1.85	1.55
Spain	7.41	7.62	9.98	8.28
Sweden	3.13	2.89	2.65	2.90
United Kingdom	17.60	16.87	16.13	16.55

GDP weights are calculated as the GDP of each country divided by the total GDP of the regional group over time. Thus the weights are updated from year to year.

Table 1.4: World group GDP weights. The table shows average GDP weights over the specified subsamples.

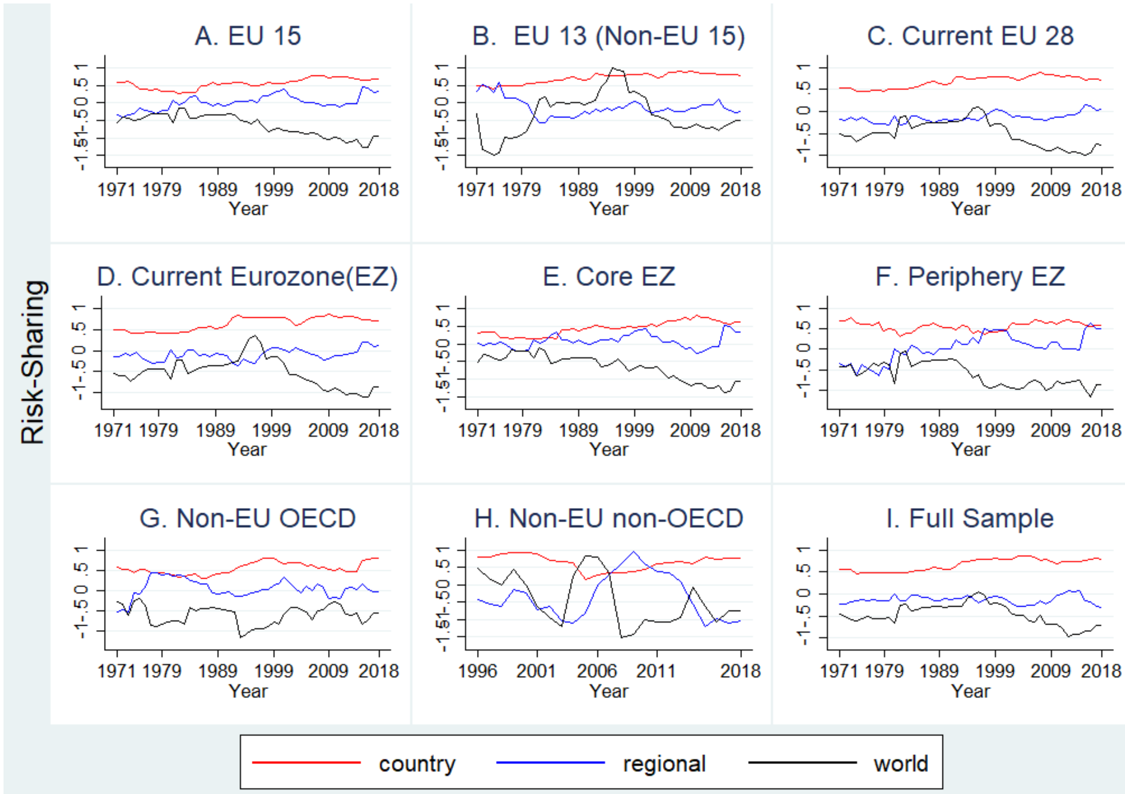
country	1960 − 1979	1980 − 1999	2000 − 2017	Full sample
Australia	2.39	2.28	1.97	2.18
Brazil	3.57	4.14	5.04	4.42
Canada	4.15	4.01	3.08	3.72
China	10.18	11.98	23.57	15.58
Hong Kong	0.31	0.48	0.69	0.54
India	7.04	6.23	9.79	7.34
Japan	12.24	13.45	9.87	12.34
Mexico	4.20	4.33	3.70	4.14
Republic of Korea	0.79	1.56	3.15	2.05
Saudi Arabia	3.90	2.48	2.12	2.34
Singapore	0.12	0.21	0.64	0.34
South Africa	1.74	1.62	1.27	1.52
United Arab Emirates	0.87	0.89	1.02	0.94
United States	50.72	46.88	33.40	42.70
Viet Nam	0.33	0.39	0.68	0.50

GDP weights are calculated as the GDP of each country divided by the total GDP of the world group over time. Thus the weights are updated from year to year.

Table 1.5: Country grouping and corresponding list

country subsets	country list
European Union (EU) 6	Belgium, France, Germany, Italy, Luxembourg, Netherlands
EU 9 (1973)	EU 6,Denmark, Ireland, United Kingdom
EU 15 (1995)	EU 9, Austria, Finland, Greece, Portugal, Spain, Sweden
EU 28 (2013)	EU 15, Bulgaria, Croatia, Cyprus, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia
Core Eurozone (EZ)	Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands
Periphery EZ	Greece, Ireland, Italy, Portugal, Spain
Late-Comer EZ	Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, Slovenia
Non-EZ EU OECD	Czech Rep., Denmark, Hungary, Poland, Sweden, United Kingdom
Non-EZ EU non-OECD	Bulgaria,Croatia, Romania
Non-EU OECD	Iceland, Norway, Switzerland, Turkey
Non-EU non-OECD	Albania, Armenia, Azerbaijan, Belarus, Bosnia & Herz., Georgia, Kazakhstan, Moldova, Russia, Serbia, Macedonia, Ukraine

Figure 1.3: 10-year rolling panel regressions: time-variation in consumption risk-sharing



Note: Coefficients depict dependence on own country output growth, risk sharing with the region, and risk sharing with the world respectively. Panel B represents all EU countries that were not members of the EU prior to 1995.

Table 1.6: Baseline Regression: European Union and Eurozone membership and risk sharing

The estimated equation in each regression is
$\Delta c_{i,t} - \overline{\Delta c_t} = \alpha + \beta \Delta y_{i,t} + \delta \Delta y_{r,t} + \gamma \Delta y_{w,t} + D_k + \phi_1(\Delta y_{i,t} \times D_k) + \phi_2(\Delta y_{r,t} \times D_k.) + \phi_3(\Delta y_{w,t} \times D_k) + \varepsilon_{i,t}$.
$risk^c$ is the level of dependence on own output growth while $risk^r$ and $risk^w$ are levels of risk sharing within Europe and world respectively.

	$risk^c$	$risk^r$	$risk^w$	D_k	$risk^c \times D_k$	$risk^r \times D_k$	$risk^w \times D_k$	R^2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Full sample								
k : EU dummy	.760***	-.422***	-.430***	-.003	-.124	.500***	-.207***	.679
	[18.10]	[-4.45]	[-8.19]	[-1.07]	[-0.18]	[3.29]	[-3.24]	(1955)
k : EU × EZ dummy	.754***	-.313***	-.468***	.004	-.075	.455***	-.420***	.676
	[18.76]	[-4.49]	[-11.61]	[1.37]	[-0.80]	[3.00]	[-4.14]	(1955)
*k : EU × EZ dummy**	.791***	-.400***	-.568***	-.002	-.069	.474***	-.250**	.709
	[18.68]	[-4.09]	[-7.12]	[-0.36]	[-0.72]	[2.84]	[-1.91]	(1215)
EU 28 subsample								
k : EU dummy	.728***	-.251***	-.390***	.000	-.091	.330***	-.247***	.619
	[12.32]	[-3.82]	[-4.93]	[0.08]	[-0.80]	[2.48]	[-3.00]	(1356)
k : EU × EZ dummy	.701***	-.128**	-.471***	.007***	-.022	.270**	-.416***	.617
	[12.49]	[-2.28]	[-9.59]	[2.59]	[-0.22]	[2.02]	[-3.99]	(1356)
*k : EU × EZ dummy**	.819***	-.145**	-.531***	.008*	-.147	.295**	-.341**	.676
	[23.40]	[-2.40]	[-4.87]	[1.69]	[-1.58]	[2.11]	[-2.46]	(756)

1. z-statistics are shown in square brackets and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ are significance at 10%, 5% and 1% respectively. Standard errors are clustered by i.d. Sample size is shown in parenthesis.
2. The regressions with (*) drop pre-1990 data from estimation. This is due to pre-1990 data missing for some EU 28 countries.

Table 1.7: Regression analysis with structural breaks

The estimated equation in each regression is
$\Delta c_{i,t} - \overline{\Delta c_t} = \alpha + \beta \Delta y_{i,t} + \delta \Delta y_{r,t} + \gamma \Delta y_{w,t} + D_k + \phi_1(\Delta y_{i,t} \times D_k) + \phi_2(\Delta y_{r,t} \times D_k.) + \phi_3(\Delta y_{w,t} \times D_k) + \varepsilon_{i,t}$.
$risk^c$ is the level of dependence on own output growth while $risk^r$ and $risk^w$ are levels of risk sharing within Europe and world respectively.

	$risk^c$	$risk^r$	$risk^w$	D_k	$risk^c \times D_k$	$risk^r \times D_k$	$risk^w \times D_k$	R^2
$k : EU \times break$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Break: 1972	.540***	-.200***	-.499***	.003	-.330**	.064	.365*	.509
	[11.02]	[-2.85]	[-7.43]	[0.53]	[-2.36]	[0.30]	[1.74]	(480)
Break: 1980	.584***	-.153	-.454***	-.006***	-.020	.042	.104	.660
	[9.80]	[-1.64]	[-3.84]	[-3.35]	[-0.34]	[0.62]	[1.29]	(584)
Break: 1993	.786***	-.299***	-.237***	.012***	-.181	.446***	-.548***	.725
	[17.35]	[-4.76]	[-2.84]	[3.63]	[-1.43]	[3.27]	[-4.83]	(845)
Break: 2003	.825***	-.482***	-.705***	-.010*	-.065	.504***	-.074	.701
	[12.83]	[-4.30]	[-7.28]	[-1.66]	[-0.79]	[3.52]	[-0.59]	(1125)
$k : EU \times break \times EZ$								
Break: 2003	.825***	-.390***	-.651***	-.001	-.150	.555***	-.275**	.699
	[13.53]	[-4.08]	[-8.90]	[-0.32]	[-1.47]	[3.34]	[-2.17]	(1125)
$k : EU \times break \times EZ$								
Break: 1999	.828***	-.390***	-.656***	-.002	-.148	.532***	-.231**	.698
	[13.48]	[-4.04]	[-8.74]	[-0.51]	[-1.40]	[3.20]	[-1.95]	(1125)

1. z-statistics are shown in square brackets and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered by i.d. Sample size is shown in parenthesis.

Table 1.8: Robustness checks: various specifications

The estimated equation in each regression is
$\Delta c_{i,t} - \overline{\Delta c_t} = \alpha + \beta \Delta y_{i,t} + \delta \Delta y_{r,t} + \gamma \Delta y_{w,t} + D_k + \phi_1(\Delta y_{i,t} \times D_k) + \phi_2(\Delta y_{r,t} \times D_k.) + \phi_3(\Delta y_{w,t} \times D_k) + \varepsilon_{i,t}$.
$risk^c$ is the level of dependence on own output growth while $risk^r$ and $risk^w$ are levels of risk sharing within Europe and world respectively.

	$risk^c$	$risk^r$	$risk^w$	D_k	$risk^c \times D_k$	$risk^r \times D_k$	$risk^w \times D_k$	R^2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Using Hamilton's approach								
k : EU dummy	.753***	-.810***	.098	-.013***	.004	.783***	-.633***	.453
	[7.71]	[-4.42]	[0.65]	[-3.96]	[0.04]	[3.71]	[-3.46]	(1016)
k : EU × EZ dummy	.730***	-.778***	.054	-.014***	.094	.680***	-.656***	.452
	[8.43]	[-4.18]	[0.34]	[-4.60]	[1.35]	[3.19]	[-3.73]	(1016)
Using EU 28 as regional representative group								
k : EU dummy	.794***	-.526***	-.451***	-.003	-.064	.593***	-.344***	.711
	[17.65]	[-4.08]	[-4.39]	[-0.57]	[-0.87]	[3.64]	[-2.93]	(1215)
k : EU × EZ dummy	.796***	-.368***	-.526***	.002	-.133	.551	-.393***	.708
	[18.49]	[-3.79]	[-6.79]	[0.44]	[-1.37]	[3.26]	[-3.18]	(1215)
Using 45 European countries to represent region								
k : EU dummy	.803***	-.332***	-.419***	.007*	-.090	.432***	-.455***	.707
	[17.63]	[-3.43]	[-3.75]	[1.72]	[-1.29]	[3.73]	[-3.50]	(1215)
k : EU × EZ dummy	.798***	-.223***	-.508***	.011***	-.180*	.482***	-.619***	.705
	[18.14]	[-3.02]	[-5.65]	[2.85]	[-1.99]	[3.82]	[-4.05]	(1215)
Estimation using idiosyncratic consumption and output								
k : EU dummy	.754***			-.000	-.082			.667
	[17.88]			[-0.06]	[-0.96]			(1955)
k : EU × EZ dummy	.745***			-.001	-.010			.667
	[18.53]			[-0.71]	[0.09]			(1955)

1. z-statistics are shown in square brackets and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered by i.d. Sample size is shown in parenthesis.
2. To find the immediate impact of the Euro, data prior to 1990 is dropped. Also to do corresponding analysis for countries with data only beginning in 1990, dropping pre-1990 data is useful.

Chapter 2: Economic Integration in Europe: Measurement and Implication on Risk sharing

2.1 Introduction

Europe has become increasingly integrated in the past half century. It started as the six-member European Communities (EC) in 1957, then expanded to a nine-member group in 1973 that was propelled by the collapse of the Bretton Woods system (James, 2013), and ultimately became a 12-member European Union (EU) in 1993 (created through the Maastricht Treaty in 1992). The Maastricht Treaty lead to the creation of the EU as a single market for goods, services, capital, and labor since 1993, and the introduction of the Euro in 1999. The single-markets agreement also extends to countries such as Norway, Iceland, and Switzerland which are non-EU members. Ultimately, the Euro added the dimension of common fixed exchange rates to the integration efforts.

Prior to the Euro, the Exchange Rate Mechanism in 1979 had EC currencies pegged to the deutschmark. In 1993, currencies were then pegged to the European Currency Unit (ECU). Over twenty years into these arrangements, this study seeks to measure the extent of both financial and real integration in Europe, aiming to discover the existence of a EU or Euro effect. Stated differently, the study seeks to find if "more integration" through the EU and Eurozone has lead to similarity in selected financial and real variables across countries. This assessment is crucial considering the fact that major advanced European countries such as Sweden, Denmark and the United Kingdom opted out of the Eurozone arrangements, with the UK currently evaluating the suitability of remaining in the EU.

The approach taken in the study is to split economic integration into its *financial* and *real* components. Financial integration is multi-faceted but often refers to low cross-country dispersion in return of securities (price-based measures) as well as similarity in portfolio allocation behavior of economic agents across countries (quantity-based). Real integration typically refers to similarity in production, trade and labor markets flexibilities (Pisani-Ferry et al., 2006). Progress towards higher levels of financial integration in the EU is evident from yearly reports of the European Central Bank. For instance a 2018 annual report on *Financial integration in Europe* claims that "...cross-country differences in equity returns declined to levels similar to pre-crisis levels and to the dispersion between sectoral returns." Current targets aim to achieve better integration in money and corporate bond markets through "...further progress with the capital markets union and to complete the banking union." However real integration does not appear to be actively pursued and this has important implications for welfare (consumption risk sharing in this study) and policy.

A common definition of consumption risk sharing is the situation whereby shocks to a country's consumption are diversified and shared with other countries (Rangvid et al., 2016). In several empirical applications, when a country's consumption growth depends less on its own income growth and more on the income growth of the rest-of-world (RoW), consumption risk sharing is considered to be high. Historically, consumption risk sharing has been considered a beneficial consequence of strong financial integration because it allows agents to smoothen consumption through cross-border asset ownership (Mundell, 1973; McKinnon and Kenen, 2002; Kose et al., 2009; Rangvid et al., 2016). Despite high integration in global financial markets (Obstfeld, 1993; Lewis, 1996; Sørensen et al., 2007), ECB (2018)) consumption risk sharing is found to be low in these studies, which creates a puzzle. I demonstrate in this study that by analyzing money markets, bond markets, stock markets (for financial), and industrial production and consumer prices (for real), divergent patterns of integration emerge, which provides some explanations for the risk sharing puzzle.

Financial integration amidst uneven or low real integration can be destabilizing. Firstly, the introduction of the euro (leading to a sudden drop in money and bonds rates) represented a shock to wealth and demand in countries noted to have high risk premia. The resulting reduction in public debt burden led to uneven appreciation in real exchange rates and, subsequently, a widening of current account deficits (Pisani-Ferry et al., 2006) particularly in "periphery" countries[1]. The second problem relates to the "Walters critique". Inflation in a country belonging to a currency union leads to a decline in real interest rates that further stimulates domestic demand. Since inflationary pressures are asymmetric in nature across union member countries, it could further lead to divergence in real economic activity (Lane, 2006).

If product markets are highly integrated, the resulting appreciation in real exchange rates could counterbalance the excess domestic demand by a shrinkage in exports. On the other hand, if product markets are not integrated, excess domestic demand could lead to boom and bust cycles that might require foreign borrowing to achieve stability. At best, a long run convergence in price levels could occur as the high inflation countries experience higher labor and other production costs leading to less competitiveness vis-a-vis the lower inflationary currency union members.

Another source of destabilization is the fact that European monetary unification permits a common external exchange rate for all members with non-union member countries. Upon the introduction of the euro, and with the ECB suddenly cutting interest rates, potential portfolio returns declined (albeit to various levels depending on the initial levels of nominal interest rates) resulting in a decline in the external value of the euro against major RoW currencies. In addition to a surge in domestic demand, Lane (2006) finds unsustainable levels of wages among some countries as a consequence. Having lost the use of nominal depreciation in national currency to correct the over-valuation in labor markets, an adjustment problem necessarily occurs. These observations, however, do not discount the stabilizing nature of a common currency and the efforts of the ECB in achieving some level of monetary stability. Nonetheless, the external value of the euro can expose euro area members

[1] The idea of "core" and "periphery" countries within the then European Community was introduced by Bayoumi and Eichengreen (1992). Greece, Ireland, Portugal, Italy and Spain have been historically considered "periphery" within the EMU (Lane, 2006) and (Skaperdas, 2011). Skaperdas, for instance, considers Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands as the Eurozone "core".

to asymmetric domestic shocks in real sectors.

From a policy perspective, there is a sense in which financial and real integration need to be considered together. Pisani-Ferry et al. (2006) suggests that policy considers carefully if financial and real integration are *complements*, *substitutes*, or if financial integration is *an accelerator* of real integration. If as complements, policy should aim at improving real sectors to catch up with the pace of financial integration. As substitutes, a slow development of real integration should be completely ignored since achieving financial integration by itself would be an end in itself. If real sectors are expected to catch up automatically, then financial integration should be the main focus (accelerator). In this study I consider them as complements, in the sense that advances in the real sector would bolster financial integration by minimizing the likelihood of asymmetric shocks and structural imbalances, creating the enabling environment for cross-border risk polling. To my knowledge, this is the first study that uses an estimation technique capable of comparing both financial and real integration and their implications for consumption risk sharing in one framework.

It is not often emphasized in previous literature that financial globalization has both regional and RoW components that need to be taken into consideration to avoid biases in identification of effects[2]. Regional integration comes with other arrangements such as cross-border labor mobility, fiscal federalism and central monetary policy arrangements. This paper contributes to the literature by proposing a model that identifies regional and global effects. It also contributes to the recent string of studies that aim to fix the puzzle of low consumption risk sharing in the presence of high regional and global financial integration.

Much of previous studies consider only one measure of economic integration – integration with the rest of the world (or global integration)[3]. This may be an outcome of conventional two-country models and postulating economic integration as a move from autarky to exchange. This is interesting given that most policy initiatives to promote economic integration are regional (including bilateral) such as the European Union, North American Free Trade Agreement (NAFTA) and CFA-Franc zones in Africa. Since a primary objective of economic integration is to bolster the regional component (inter alia the world component), it is important to consider the extent of regional integration and, if possible, to consider both regional and global economic integration. For this purpose, I consider a model in which an economic entity – for instance, the stock price – is impacted by global, regional, and country-specific (or domestic) shocks.

Specifically, following Chow and Kim (2003) directly, Blanchard and Quah (1988) indirectly and using monthly data from January 1960 to December 2018, I estimate a vector autoregressive (VAR) model and use the forecast error variance decomposition to measure both financial and real integration at the regional and global levels. This

[2]Bekaert and Mehl (2019) is the most recent study in the financial integration literature that identifies regional and global effects separately in a factor model that measures the degree of financial integration among 17 countries.

[3]Bekaert and Mehl (2019) is a notable exception.

measure is derived from a well-known methodology that uses the extent to which countries are influenced by similar shocks as a measure of the integration between them. Using this approach, integration could be measured across all financial and real variables separately, and at both the regional and global levels.

To measure the degree of financial integration, the dispersion of cross-border prices of securities (price-based) or the quantity of cross-border securities held (quantity-based) are two typical approaches found in the literature. Hoffmann et al. (2019) recently developed regional composite price and quantity-based measures that aggregates across money, bond, equity and banking markets. A similar measure for real integration –whether price-based or quantity-based– is rare. In this study money, bond, stock, and CPI measures are price-based while industrial production is quantity based. By considering how European countries are integrated in regards to each of these variables separately (but using the same estimation framework) – both regionally and globally – clearer insights emerge.

Overall regional shocks are expected to be more important across the five variables, for more economically integrated members. I find, however, that only in the case of money do regional shocks have an influential role in the EMU period (since Jan 1999) for Eurozone countries. Regional shocks accounted for about 37% pre-EMU and 74% post-EMU respectively, for the original EMU members. In the bond market, we find a general switch from regional to country-specific shock importance in the EMU period, even though regional shocks were dominant prior to the global financial crisis in 2007-2009. With regards to industrial production the highest levels of regional integration are found among Germany, Austria, Slovenia, Slovakia, United Kingdom, Hungary and Poland, with about 48% importance of regional shock between them in the EMU period. While an EU effect could be observed, no euro effect could be identified. Additionally, while global shocks dominate stock markets across Europe, domestic shocks dominate consumer prices on average. Another key finding is that Advanced EU countries do not differ from Advanced non-EU countries in terms of how they are affected by regional and global shocks, except for money markets. Risk sharing therefore would not be expected to be as high as theory would predict, confirming the findings from previous studies but providing a more insightful explanation as to why.

The rest of the paper is organized as follows: Related literature is discussed in section 2.2; methodology for estimation in section 2.3; data description in section 2.4; results in section 2.5; and concluding remarks in section 2.6.

2.2 Related Literature

The impact of economic integration is often analyzed in the context of Optimum Currency Areas (OCA) criteria. The OCA theory, inspired by Mundell (1961), stipulates that the benefits of a common currency is worthwhile for countries that tend to experience a sufficient degree of symmetric shocks and likely have synchronized business cycles. In other words countries that experience asymmetric shocks to output do not need to give up their independent monetary policy and ability to use exchange rate adjustments to resolve economic imbalances, in favor of having a stable common currency. This line of thought dominated research that sought to project if the Eurozone and any new members that join the zone later would form an OCA. While the OCA criteria emphasize the cost of joining a currency area, another strand of research, inspired by Mundell's later ideas (Mundell, 1973) focus on the "benefits" of joining a currency area even if a country exhibits asynchronous cycles. One of the main benefits is the degree of risk sharing that could be possible by joining a more financially integrated market that allows for consumption smoothing through cross-ownership of financial assets. In principle, the emphasis of the later idea is one the centrality of financial markets, not labor markets (McKinnon, 2004) and also on the endogeneity of optimum currency areas(Frankel and Rose, 1998).

In theory, complete (financial markets) would allow a consumer to invest in Arrow-Debreu securities that yield state-independent returns that would be used to smooth consumption. This insurance is termed consumption risk sharing. Thus capital market developments outside a country has a tendency to reduce the link between Home consumption and Home output if Home countries participate in global financial markets (see also Kose et al. (2009) and Rangvid et al. (2016)).

As with the progress of the European Union, among other things, removal of barriers to trade, capital and labor mobility tend to precede adoption of a common currency. Risk sharing potential is thus not limited to currency areas. European common markets has improved trade, especially within the EMU. Rose (2000) for instance finds a "home bias" where currency area countries trade about three times among themselves than with those having different currencies. Obstfeld (1993); Imbs (2004); Rangvid et al. (2016) and others have identified that integration reduces transactions costs and improve trade and financial market activity and business cycles synchronization (see also Frankel and Rose (1998); Schiavo (2008)). EU could also share risks without necessarily being members of the Euro area through the European common markets. For instance after controlling for the gradual trend in trade intensity among EMU members, Berger and Nitsch (2008) find that the introduction of the Euro by itself does not correlate with greater trade intensity. However the potential effects of openness could go either way. If increased trade is inter-industry, this could lead to more specialization and result in less synchronous business cycles and industrial structures. The former argument presumes that the trade surge is intra-industry. Thus in principle, the impact of economic integration (financial and trade altogether) on risk diversification is inconclusive.

Also, insulation against domestic shocks with openness would imply more consumption smoothing, while openness could also expose a country to foreign shocks and hence less consumption smoothing (Lane, 2006; Christev and Melitz, 2013). Imagine the extent to which European countries with slow productivity growth might be exposed to import penetration by Asian textiles and electronics producers. Net decline in incomes would be expected. Not only that, varying exposure to global shocks could cause more divergence in economic fundamentals such as inflation differentials of integrated countries.

The costs and benefits of economic integration are situated in the heart of the trilemma concept – that a country has a choice of two among the following three choices: independent monetary policy, capital market liberalization, and a fixed exchange rate. Countries that join a currency area automatically give up the ability to run independent monetary polices but rather choose a fixed exchange rate, leaving only the choice of adjusting the degree of capital account openness. Even for countries that are not integrated, Passari and Rey (2015), Obstfeld (2015) and other recent research argue that the trilemma may have morphed into a dilemma identifying that the US-driven global financial cycles in liquidity and credit reduce the ability of non-US central banks to realistically adjust domestic long-term interest rates (see also Bekaert and Mehl (2019)).

Risk sharing has been empirically analyzed in various facets. Asdrubali et al. (1996) identifies the channels and extent of risk-sharing among US states, defined as the extent of consumption smoothing that are attained through either capital markets, credit markets or the federal government spending between 1963-90. A primary finding from that study is that risk sharing through financial markets are about twice that of risk sharing through US government budget disbursements. The work by Sørensen and Yosha (1998) extends the consumption smoothing channels in Asdrubali et al. (1996) to the European Community (EC) countries and OECD countries over the period 1966-90. There are however major differences between the US and EU cases. Private capital market redistributes 48% of asymmetric output shocks at the state level whereas 15% is redistributed at the national level among EU countries(Marinheiro, 2002). Also, despite financial markets contributing more to risk sharing than government budgets in the US, federal budget redistributes about a quarter of negative shocks to income of states, whereas there is no such inter-country distribution in the Eurozone.

However, with the identified inter-country levels of risk sharing in these and other studies (such as Rangvid et al. (2016)) being low, Christev and Melitz (2013) casts doubts on the role of cross-country holdings of property claims on risk sharing altogether, finding that risk sharing in the EU rather comes through the encouragement of price competition, contestable home markets, ability to buy insurance at home, and harmonization of regulations. In doing so, the indirect (usual approach) of determining risk sharing — how less relative consumption growth is correlated with related output growth — is questioned, and replaced with a more direct method that uses the impact of economic integration on consumption volatility.

The idea of separating regional from global financial integration is not new. Bekaert and Mehl (2019) propose a factor model of equity returns to measure financial integration, in which regional and global factors are distinguished and separately measured. This approach is builds on Rangvid et al. (2016) who measure financial integration as a low degree of equity return dispersion across markets. While I use a different measure of financial integration, separating regional and world impacts helps better when analyzing European countries who are integrated both regionally and globally, to varying degrees.

2.3 Methodology for Estimation

The approach taken is adapted from the optimum currency areas (OCA) literature. An influential study by Bayoumi and Eichengreen (1992) for instance study the correlation of aggregate supply shocks as a measure of how similar integrated countries are in terms of macroeconomic structure. In such studies, among other models that seek to separate aggregate demand and supply disturbances, Blanchard and Quah (1988) shock decomposition is employed. The required underlying assumption is that while aggregate supply shocks transcend the exchange rate regime adopted by a country, aggregate demand shocks tend to be regime-specific. The Blanchard and Quah (1988) technique can as well be used to separate more shocks to domestic macroeconomic variables. For instance Chow and Kim (2003) use it to decompose shocks to global output into “global", “regional" or “country-specific" (u^g, u^r, and u^d respectively).

Global shocks affect all economies both inside and outside the regional boundary. The financial crisis that occurred between 2007 and 2009, and the two oil price increases of the 1970s may be considered global shocks. Regional shocks are restricted to impact only economies within the region. German unification of 1989 and the resulting fiscal expansion, as well as the United Kingdom's decision to leave the European Union may constitute regional shocks for European countries. Country-specific shocks could be related to either aggregate demand or aggregate supply impacts on fiscal policies or trade patterns. In these models, the impact of the three shocks are separated on the basis of the assumption that each country is small in the region, and the region is small in the world. Thus regional shocks are expected to matter in a small open economy whose economic structures are similar to its trading partners in the region. Also global shocks are expected to affect all countries in the same direction.

[Table 2.1 about here]

Let y^d denote the domestic variable of interest (interest rate, stock index, industrial production index, CPI). y^d is subject to u^g, u^r, and u^d such that:

$$y^d = \beta_0 + \beta_1(L)u_t^g + \beta_2(L)u_t^r + \beta_3(L)u_t^d \tag{2.1}$$

if the domestic variable is stationary; and

$$\Delta y^d = \beta_0 + \beta_1(L)u_t^g + \beta_2(L)u_t^r + \beta_3(L)u_t^d \tag{2.2}$$

if the domestic variable is integrated of order one (I(1)). Stationarity test results are reported in Table 2.2. In each equation, $\beta(L) = \beta_{i1}L + \beta_{i2}L^2 + ...$ is a polynomial function of the lag operator, L. The goal is to recover the structural shocks, u^g, u^r, and u^d. With growing European regional integration, the regional shock component is expected to be more important.

To this end we employ the Blanchard and Quah (1988) method of decomposition that relies on separating shocks into its transitory and permanent components. Following this structure and its implementation in Chow and Kim (2003), we take global, regional and domestic indices/variables - y^g, y^r, and y^d - to be affected by the global, regional and domestic shocks, denoted by u^g, u^r, and u^d respectively. The compact matrix moving average VAR representation is:

$$\begin{pmatrix}\Delta y_t^g\\ \Delta y_t^r\\ \Delta y_t^d\end{pmatrix} = \begin{pmatrix}A_{11}(L) & A_{12}(L) & A_{13}(L)\\ A_{21}(L) & A_{22}(L) & A_{23}(L)\\ A_{31}(L) & A_{32}(L) & A_{33}(L)\end{pmatrix}\begin{pmatrix}u_t^g\\ u_t^r\\ u_t^d\end{pmatrix}$$

where $A_{ij}(L) = a_{ij}^0 + a_{ij}^1(L) + a_{ij}^2(L)^2 + a_{ij}^3(L)^3 + ...$ are polynomials of the lag operator L such that individual coefficients of $A_{ij}(L)$ are impulse responses denoted by $a_{ij}(k)$. For instance $A_{11}(L)$ represents impulse responses of global shocks on Δy_t^g. Based on the stationarity tests, all global and regional variables are non-stationary, and hence are entered in first-differences above. While the domestic variable are also entered in first-differences, they are replaced by their levels in cases where they are stationary.

[Table 2.2 about here]

Following the Blanchard-Quah (1989) decomposition method to identify the structural shocks, the following 3 restrictions on the VAR system is required for identification: (1) Regional shocks have no long-run effects on the global index; (2) Country-specific shocks have no long-run effects on the global index; (3) Country-specific shocks have no long-run effects on the regional index. These conditions imply that the cumulative effects of u_t^d shocks on y_t^r and of both u_t^d and u_t^r shocks on y_t^g equal to zero:

$$\sum_{k=0}^{\infty} a_{12}^k = \sum_{k=0}^{\infty} a_{13}^k = \sum_{k=0}^{\infty} a_{23}^k = 0$$

All structural shocks are assumed to have unit variance and are uncorrelated.

These restrictions are assumed to apply only for the long-run responses but not for short-run responses. Besides, transitory global shocks (no long-run effects on global indices) could be classified as regional or local, and transitory regional shocks classified as local. Finally, note that these assumptions work under the generalizations of the small-economy and small region assumptions in international economics.

Given that the stationary form of all variables are known, we estimate a VAR of the form:

$$\begin{pmatrix}\Delta y_t^g\\ \Delta y_t^r\\ \Delta y_t^d\end{pmatrix} = \begin{pmatrix}C_{11}(L) & C_{12}(L) & C_{13}(L)\\ C_{21}(L) & C_{22}(L) & C_{23}(L)\\ C_{31}(L) & C_{32}(L) & C_{33}(L)\end{pmatrix}\begin{pmatrix}\Delta y_{t-1}^g\\ \Delta y_{t-1}^r\\ \Delta y_{t-1}^d\end{pmatrix} + \begin{pmatrix}e_t^g\\ e_t^r\\ e_t^d\end{pmatrix}$$

where $C_{ij}(L) = c_{ij}^0 + c_{ij}^1(L) + c_{ij}^2(L)^2 + c_{ij}^3(L)^3 + ...$ are polynomials of the lag operator L and e^g, e^r, and e^d are residuals from the VAR model. After estimating the VAR, we obtain the moving average representation as before. The $p-$step ahead forecast errors are composites of the pure innovations. Detailed demonstration of how the pure shocks are recovered from the VAR residuals is well-known and hence not shown here.

Introduction of the Euro and Identification

The introduction of the Euro in 1999 was a major policy move toward greater integration, but it was the culmination of decades of different levels of integration.

From a six-member European Communities (EC) in 1957, a nine-member expansion in 1973 that was propelled by the collapse of the Bretton Woods system (James, 2013), to a 12-member European Union in 1993 (created through the Maastricht Treaty in 1992), the Euro added the common fixed exchange rate dimension to the integration efforts. Even prior to the Euro, the Exchange Rate Mechanism in 1979 had EC currencies pegged to the deutschmark, with currencies being pegged to the European Currency Unit (ECU) from 1993. Due to this, it is hard to identify a Euro effect. The study uses the introduction of the Euro for its significant role in the EMU and how its potential impacts on financial markets can be more easily used to make inference about risk sharing, not to identify an Euro effect.

2.4 Data Description

The sources of data and summary statistics are on Table 2.4. Stock market and industrial production indexes are obtained from Main Economic Indicators (MEI), OECD. Money market and bond market rates are compiled from both IMF's International Financial Statistics and MEI. Stock markets had a smooth positive trend until the volatile period beginning in the early 2000s (see Figure 2.1). Periphery Eurozone countries had the most volatile stock markets, but rebounded back to the long-run trend, in line with other country groups (see Table 2.3 for a complete list of country groups). This aside, the RoW group appear to share similar characteristics with Advanced European countries as shown in similar mean, median, standard deviation, minima and maxima across industrial production, money and bond markets, and consumer prices.

[Table 2.3 about here]

Periphery countries appear to have higher money and bond market rates on average as compared to Advanced countries. For instance average money and bond rates were 6.43% and 7.23% for Periphery countries while they were 5.58% and 5.81% respectively. This observation is however characterized by the pre-euro era. Since the inception of the Euro, the European Central Bank maintain the common policy rates, leading to similar money market rates in the Eurozone. In line with theoretical expectations, consumer prices were historically higher among the highest productivity countries (Advanced European and RoW countries), followed by Periphery EZ countries (see Figure 2.1). However over time, consumer prices among the Periphery and Emerging European countries have significantly increased as their economies grow and become more productive. Despite this, a possibility exist that these countries may be experiencing marked inflation with minimal productivity gains.

[Table 2.4 about here]

[Figure 2.1 about here]

[Figures 2.2a and 2.2b about here]

2.5 Results

In this section we provide detailed explanation for financial and real integration separately. This is followed by implication of the findings for consumption risk sharing. The 12-month ahead forecast error variance decomposition were obtained by first estimating the VAR in section 3 and recovering the structural shocks.

Financial integration

For financial integration, we investigate the data for money markets (Table 2.5), bond market (Table 2.6), and stock markets (Table 2.7).

[Tables 2.5 and 2.6 about here]

Among the core EZ countries, the role of regional shocks sharply increased in money markets from 37% percent on average during the pre-EMU period to 74% in the EMU period. In marked contrast, global shocks play almost no role. Among the periphery EZ, the extent of money market integration seems varied and related to the length of each country's membership in the currency union. All economies involved in the EA crisis (Greece, Ireland, Italy, and Spain) show levels of regional integration that is as high as among the core EZ countries. Thus money market integration seems to have been robust through the global financial crisis (2007-2009) and the Euro Area (EA) crisis[4] than before. It is also much higher than that in the newer members such as Estonia and Lithuania, but Slovenia is a notable except (not just in the money markets but across other variables shown later). Outside the EZ and outside EU – with Croatia being a main exception – the money market seems to be driven by country-specific shocks with regional shocks playing the distant second. Global influence is as weak as in the EZ countries. These suggest that, after 20 years since inception, the euro remains a regional currency compared to the US dollar and the interest rate decisions of the European Central Bank reach mainly the EZ countries[5].

Financial integration in the bond market shows several important differences. In the pre-EMU, the bond market is influenced by both global and regional shocks in most core EZ countries. With the introduction of the euro, regional shocks became dominant pre-crisis but global shocks were more important post-crisis. The switch from regional to global shock importance in the EMU period is similarly observed for advanced countries both in the EU (but not EZ) and non-EU members (50% for EU core; 55% for advanced EU; and about 57% for advanced non-EU). The EZ periphery show diversity of the extent of financial integration. This is highlighted by Greece which decently regionally integrated pre-EMU (38%), increasing to 47% prior to the EA crisis, but a drastic drop to 3% taking the EA crisis into account. The other EA crisis countries (Italy, Ireland, Portugal, and Spain) shows strong regional

[4]Begun in 2009 with Greece, and followed by Portugal, Italy, Ireland, and Spain experiencing sovereign debt defaults. Portugal is excluded due to lack of necessary data for estimation.

[5]Norway and Switzerland exhibit remarkable regional markets integration at about 53% in the EMU period

integration even through the crisis period (averaging 45%). Of the new EZ members only Slovenia has strong regional bond market integration. With the exception of Poland, all other emerging European bond markets are influenced by country-specific shocks.

[Table 2.7 about here]

Table 2.7 shows that stock markets across Europe are influenced mostly by global shocks in the EMU period. There is a sharp increase in the role of global shocks in all countries. This is no surprise due to the well-documented surge in global cross financial assets ownership in the last couple decades. Only for Slovakia, Russia, and Turkey are the global component less than 50%. This seems to suggest that stock-market integration is related to the extent of financial market development and the latter progresses in the global direction rather than regional. Thus a more global rather than regional arrangement that regulates stock markets would be more beneficial for European countries overall.

Real integration

For real integration we investigate industrial production (Table 2.8) and consumer prices (Table 2.9). Industrial production results indicate that Germany, Austria, and Finland in the EZ core are similarly affected highest by regional shocks, while France, Belgium, and Netherlands are influenced by country-specific shocks. For instance the average share of regional shocks to industrial production for the former Core EZ members were 43% in the EMU period but only 7% for the latter EZ core. As far as the OCA criteria goes, Germany, Austria, and Finland better fit the similarity hypothesis pre-EMU whereas the latter group does not appear to.

[Tables 2.8 and 2.9 about here]

In the post-EMU period, the role of regional shocks is high for Italy, Estonia, Slovenia and Slovakia in the EZ periphery. Among the original EZ members in the periphery, regional shocks only accounted for 17% pre-EMU and 10% post-EMU. A case could be made for new EZ members such as Slovenia, Slovakia, and Estonia satisfying the OCA criteria after joining the Euro area. This is also consistent with the conventional wisdom that the 12 original EZ members may not constitute an OCA in terms of similarity of economic structures.

In the EMU period, new EZ members such as Estonia, Slovakia, and Slovenia show evidence that regional integration has moved forward. They are influenced by about 52% regional shocks. Among the Baltic 3 newcomer countries however, the role of regional shocks is similar to or even lower than that during the pre-EMU period for Latvia and Lithuania (with Estonia being an exception).

Outside the EMU, EU members are generally integrated in the European region. Advanced EU countries exhibit similar levels of shocks as Core EZ members. Additionally, except for Bulgaria and Romania, emerging non-EZ countries such as Hungary, Croatia, and Poland have reached the levels of regional integration as high as the EZ core in the pre-EMU, being influenced by 41% regional shocks on average in the EMU period. Thus this type of regional integration occurred even without joining the euro area. This suggests that they may be ready to join the EZ based on the OCA criteria. The free trade, single-market arrangements and other EU harmonizing policies may have also motivated this. All non-EU countries have industrial production that is influenced mostly by country-specific shocks.

Consumer prices are influenced by country-specific shocks outside the EU (see Table 2.9). In the EZ countries however, the regional component has increased usually at the expense of country-specific shocks particularly among Finland, France, Germany, Greece and Portugal. The average share of the regional component of shocks is about 50% among them. Price integration has not progressed much for other core and original periphery members. The regional component of shocks is about 16% among this group. While Estonia and Malta have a surge in the regional component after EMU membership (35% from 0%), other new EZ members continue to primarily influenced by country-specific shocks. Outside the EZ, regional shocks became more important as a group only in the Advanced EU countries (similar to core EZ countries like France, Germany, and Finland). Among emerging non-EU countries, there are two key finding, neither in favor of regional shocks. Albania, Azerbaijan, Turkey, and Ukraine have consumer prices that are influenced mainly by global shocks in the EMU period (70%). Consumer prices in Russia and Serbia were influenced more by country-specific shocks at the expense of global shocks.

Risk sharing implications

The bulk of evidence point to increased money and bond market integration in Europe, except for Greece, countries that joined the EZ after 2004, and emerging non-EU members. An interesting characteristic is that money market integration is unique among Eurozone countries. Evidently this suggests that the ECB's policy rate has translated into a unified money market. However with bond markets primary dictated by fiscal policy, Advanced European countries appear to have similar bond markets, regardless of EZ or EU membership. Theory suggests that these similar markets should enable economic agents to smooth consumption through cross-border investments in money and bond markets.

Stock markets across Europe are dominated by global shocks. Thus economic agents in Europe are more likely to smooth their consumption from cross-border securities ownership with the RoW rather than with the European region. To this end, moving from autarky (being influenced more by country-specific shocks) should improve consumption smoothing whether it is with the RoW or the region. However it poses a challenge for the EU and particularly EZ regional arrangements. This is because if global shocks are more influential overall, then a more global rather than the regional arrangement would be needed to regulate stock markets. Repeated efforts by the ECB towards the *capital markets union* may need to proceed with care, because it might not be in the best interest of most European countries.

Consumption risk sharing implications of real integration comes through different channels. Given incomplete markets and under the empirical conditions of low trade elasticity and high shock persistence, Corsetti et al. (2008) have identified that productivity shocks could have large persistent wealth effects across countries. The central idea is that rigidities in technology shock transmission together with low labor mobility would result in slow responses by agents to smooth consumption in economically integrated areas. This also implies that industrial production is likely to be influenced more by domestic shocks under such conditions. However integrated countries are expected to be influenced more by regional shocks. Dominance of regional shocks would suggest reduced barriers to transmission of production technology and higher trade elasticities, permitting increased industrial production co-dependence and wealth (and hence consumption) smoothing. Twenty years into the introduction of the Euro, industrial production is still divergent, minimizing the likelihood of productivity shocks and wealth transmission.

In addition to shocks to industrial production, the study assessed if integrated European countries are more or less influenced by regional shocks to consumer prices. As pointed out earlier, reduction in inflation differentials has the potential for increasing stability, allowing greater financial integration and consumption risk sharing. The relative price convergence observed primarily among advanced countries in Europe suggests that consumption risk sharing can be enhanced more agents across the countries. Among most other countries in Europe risk sharing potential is low due to lack of price integration.

2.6 Concluding Remarks

The study measured financial and real integration Europe. The EU along with the introduction of the Euro marked distinct avenues through which member countries could smooth consumption risks. After having the European single markets, the Euro followed soon afterwards because exchange rate risk remained a key barrier. As long as national currencies existed, corporate bond holders for instance needed to price into the value of their security holdings, not only pure corporate risk but also the macroeconomic level risk of future changes in exchange rates. The United States and Eurozone have completely removed this barrier through the use of common currencies.

However in the European case, De Grauwe (2018) demonstrates though that the Euro alone was not enough – that strong centralized regulatory framework that consolidates national legal systems in accounting rules, corporate taxation, laws concerning shareholders' right among others, is required for the proper functioning of a currency union. For instance whereas a federal deposit insurance system exists in the US to give credibility to retail banks and support them in times of crisis, such is not existent in the Eurozone. He also notes that sovereign debt crisis that hit Greece, Ireland, Portugal, and Spain translated into loss of credibility among struggling banks and shun them from the interbank market for loans to fund themselves. This is because banks are the biggest holders of government debt. As the government loses credibility, so do the banks. Thus an integrated regulatory system is required for full integration across capital markets and retail markets (mortgage, consumer credit and insurance). If these barriers are overcome, theory says, consumption risk sharing should increase.

We find that Eurozone countries have high regional short and long term bond market integration in the post-euro era. Except for newcomer EZ countries regional shocks explain about 74% of short-term and about 40% of long-term rates in the EMU period before the 2007-2009 financial and EA debt crisis for EZ countries. The unique convergence in short-term rates among EZ countries in reasonable given that the interest rate policy is set by the European Central Bank and short term rates are closely related to the policy rate. Franks et al. (2018) argue that convergence in long term interest rates in the Euro zone suggests that markets viewed credit risks across EZ countries the same way with belief that they would not default. Markets only re-priced debt after the 2007-2009 financial crisis as differences in credit risks became obvious. Though short-term rates in advanced non-EZ countries are mostly dominated by country-specific shocks, long term rates are highly regionally influenced, and in some instances more than average EZ levels. The conditions that set long term bond rates do not differ among advanced European countries. Advanced countries such as Denmark, Sweden and UK seem to have continued the process of regional financial integration even outside the common currency area.

In fact Stiglitz (2010) argues that by itself full financial integration is not optimal because if underlying technologies are not convex as is often assumed, moves towards risk-sharing can lower expected utility for integrated countries.

Similar mixed findings were obtained in industrial production and consumer prices. While Advanced EU countries have high industrial and price convergence, boosting consumption risk sharing, Periphery countries go the opposite direction in most instances. Also while emerging EU countries appear to meet the OCA criterion of similarity in industrial structures, periphery countries again go the opposite direction.

However, increased trade among members of integrated countries, another key measure of real integration is not analyzed in this study. Kalemli-Ozcan et al. (2010) have shown that the introduction of the Euro did not result in a statistically significant impact of trade on financial integration, even though it is highly correlated with bilateral financial activities. Since this study uses the introduction of the Euro to understand how real integration either propels or counteracts financial integration in achieving consumption risk sharing, we do not reinvent the wheel by repeating a trade analysis. Also any missed effects of trade integration analysis would likely show up in reduced cross-border price differentials – real convergence that is already captured in analyzing integration in consumer prices (also see (Lane, 2006)).

Among Advanced European countries, overall, real integration seems to corroborate financial integration in increasing consumption risk sharing. No clear-cut advantage of Core Eurozone countries over other Advanced European countries is observed in the study. However Periphery countries seem to continue to struggle to stay in the EMU and diversify consumption risk after 20 years of its inception.

Table 2.1: Regional and Global weights for decomposition

While some countries are constant in all decomposition of variables, others are not due to lack of sufficient data. The estimates reported are GDP weighted averages, indicating the importance of each country in the estimation. For each variable, weights should sum to 100 among both the regional and world groups.

Country	Stock Market Index	Ind. Pro index	Money Market rate	Bond Rate	CPI
Regional Group					
Austria		2.54	2.54	2.54	
Belgium		3.40	3.40	3.40	
Finland		1.54	1.54	1.54	
France	20.37	18.92	18.92	18.92	20.37
Germany	27.98	25.99	26.23	26.23	27.98
Italy	17.74	16.48	16.48	16.48	17.74
Luxembourg		0.24			
Netherlands		5.39	5.39	5.38	
Norway		1.75	1.74	1.74	
Portugal		1.81	1.81	1.81	
Spain	10.16				10.16
Sweden		3.18	3.18	3.18	
Switzerland	3.53				3.53
United Kingdom	20.21	18.77	18.77	18.77	20.21
World Group					
Australia	3.64		3.64	3.64	
Canada	6.15		6.15	6.15	10
Japan	20.37	20	20.37	20.37	10
United States	69.83	80	69.83	69.83	70
China					10

Source: Author's computation using GDP (PPP) data from Penn World Tables 9.0

Table 2.2: Stationarity tests

The table reports results of unit roots tests using the Augmented Dickey-Fuller procedure. BIC optimal lags are also reported for each test performed. H_0: Series has unit roots. H_1: Series is stationary. Critical values are ≈ -3.42 and -3.99 at the 5% and 1% levels of significance respectively for models with trend (stock, industrial production and CPI) and ≈ -3.87 and -3.45 for the interest rates data. (*) and (**) are significance at 5% and 1%.

	Money Market		*Bond Market*		*Stock Market*		*Ind. Pro*		*CPI*	
Country/Group	*ADF*	*Lags*	*ADF*	*Lags*	*ADF*	*Lags*	*ADF*	*Lags*	*ADF*	*Lags*
Region	-1.35	0	-0.67	3	-2.76	1	-3.34	5	0.81	3
Globe	-1.92	3	-1.81	1	-2.53	1	-2.11	4	-2.12	2
Albania									-6.70**	2
Armenia	-5.11**	4								
Austria	-1.39	1	-0.93	1	-2.50	1	-2.50	5	0.26	5
Azerbaijan									-6.23**	2
Belgium	-1.91	1	-0.18	3	-2.92	1	-4.43**	5	0.03	5
Bulgaria	-3.35*	4					-2.27	2	-1.76	1
Croatia	-3.87*	0					-2.53	4	-2.59	1
Cyprus							-4.33**	3	0.78	0
Czech Republic	-2.13	2	-1.56	2	-2.55	2	-3.53*	4	-6.11**	0
Denmark	-1.84	4	-1.28	1	-3.39	1	-3.78*	4	-1.31	1
Estonia	-1.73	4			-2.76	1	-2.71	2	-4.99	4
Finland	-2.23	2	-1.02	1	-1.94	1	-2.68	5	0.25	5
France	-1.64	3	-0.25	1	-2.12	1	-4.17**	5	0.64	3
Greece	-6.12**	3	-1.46	2	-2.29	1	-3.26	2	1.65	5
Germany	-2.70	4	-0.51	3	-3.02	1	-3.25	5	0.49	2
Georgia	-2.23	0								
Hungary	-2.00	1	-1.17	2	-1.83	3	-1.90	4	1.36	2
Iceland	-3.06*	1	-2.40	0	-2.18	3	-2.29	2	-0.04	5
Italy	-0.67	1	-2.11	1	-2.07	1	-3.85*	5	0.47	4
Ireland	-2.53	4	-0.82	1	-1.89	1	-2.52	4	-3.98**	5
Latvia			-1.17	1			-5.38**	0	-6.70**	2
Lithuania	-4.61**	2					-6.40**	0	-9.18**	1
Luxembourg	-1.31	1	-0.57	1	-2.52	1	-3.69*	5	1.01	5
Malta									-0.14	0
Moldova									-5.82**	1
Norway	-1.10	0	-1.40	1	-3.40	1	-2.59	4	1.56	0
Netherlands	-1.85	1	-0.49	1	-2.10	1	-4.35**	5	-0.03	5
Poland	-5.57**	3	-2.17	1	-2.88	1	-1.55	4	-3.87*	3
Portugal	-2.03	0	-1.75	3	-1.97	1	-1.47	5	2.29	1
Romania	-3.39*	0					-3.72*	3	-5.65**	1
Serbia	-1.87	1								
Russia			-6.14**	2	-1.95	1	-4.28**	2	-6.09	2
Sweden	-2.87*	5	-1.17	1	-2.08	1	-3.16	5	2.07	1
Slovakia					-2.30	1	-2.86	4	-2.02	1
Slovenia	-7.65**	3	-2.16	1	-1.83	3	-3.58*	3	-1.12	4
Spain	-1.61	4	-0.93	1	-2.31	2	-2.56	5	1.14	5
Switzerland			-0.47	1	-2.28	1				
Turkey					-1.34	1	-6.04**	1	-1.07	5
Ukraine	-3.23*	4					-4.22**	0	-6.68**	4
United Kingdom	-1.65	2	-0.86	2	-1.73	3	-3.17	5	0.62	3

Table 2.3: Country grouping and corresponding list

Country Groups	list
Core Eurozone (EZ)	Austria, Belgium, Finland, France, Germany, Luxembourg, Netherlands
Periphery EZ	Greece, Ireland, Italy, Portugal, Spain
Late-Comer EZ	Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, Slovenia
Advanced EU	Denmark, Sweden, United Kingdom
Emerging EU	Bulgaria, Croatia, Czech Rep., Hungary, Poland, Romania
Advanced non-EU	Iceland, Norway, Switzerland
Emerging non-EU	Albania, Azerbaijan, Turkey, Georgia, Kazakhstan, Moldova, Russia, Serbia, Ukraine
Advanced Europe	Core EZ, Advanced EU, and Advanced non-EU
Periphery Europe	Periphery EZ
Emerging Europe	Newcomer EZ, Emerging EU, and Emerging non-EU
World (RoW)	Australia, Canada, Japan, USA, and China

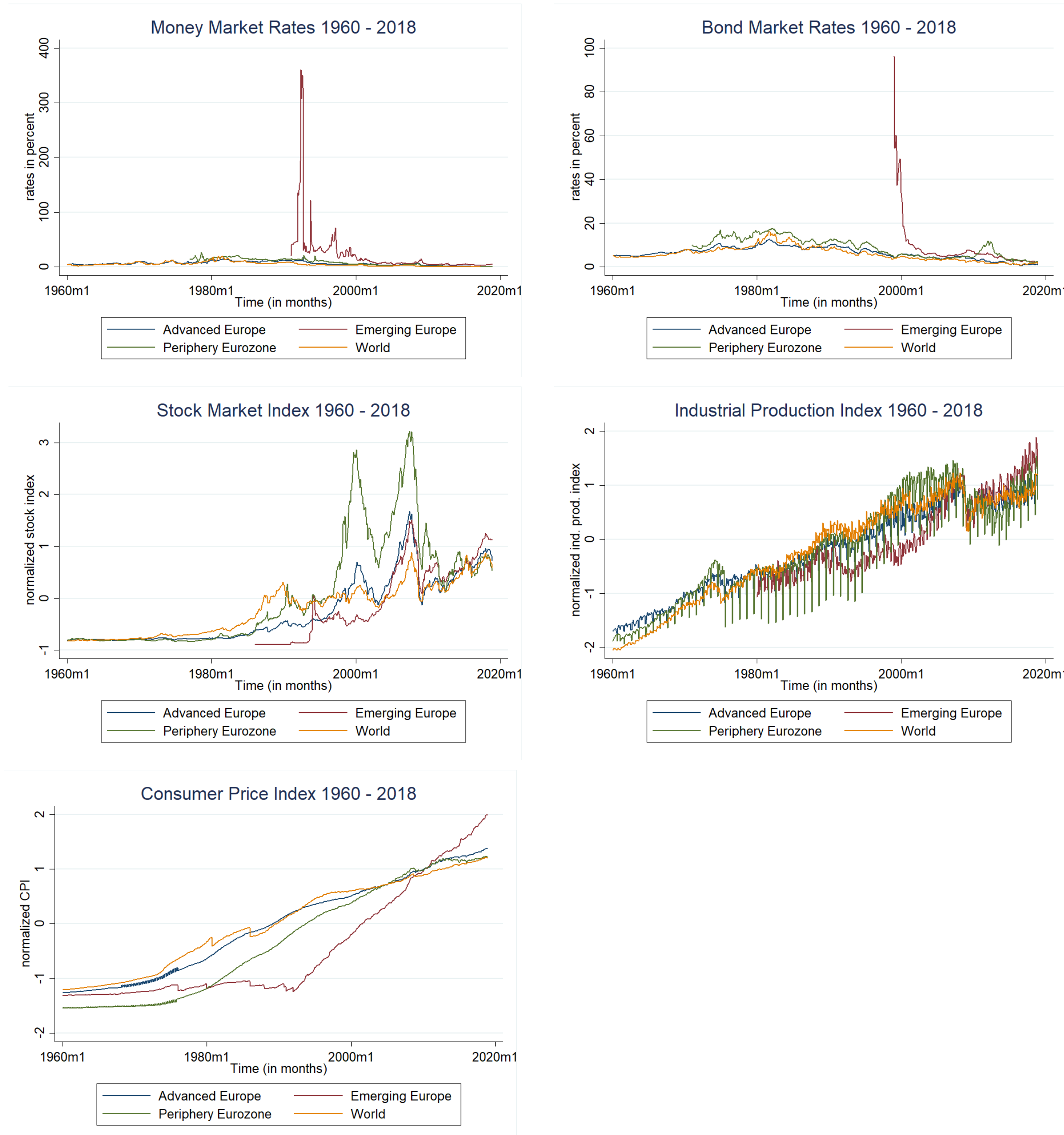
Table 2.4: Overview of Data

This table describes the data for various country groups in Europe and the World group over the period January 1960-December 2018. Data is at the monthly frequency and the unit of observation is the Country. Stock index is not seasonally adjusted but industrial production is. MEI = Monthly Monetary and Financial Statistics. Indexes are defined as follows: Stock market and Industrial production (Index 2015=100); Consumer price (Index 2010=100). Money and bond market rates are in percent.

Variables	Mean	Med.	S.D.	Min.	Max.
Advanced Countries					
Stock market index	47.32	30.55	53.26	0.52	697.88
Industrial production index	74.74	75.87	28.12	12.01	147.11
Money market rate	5.58	4.58	4.85	-1.04	82.38
Bond market rate	5.81	5.42	3.28	-0.54	17.32
Consumer price index	60.61	63.43	33.72	0.04	127.73
Periphery Countries					
Stock market index	81.29	62.68	102.93	0.98	815.84
Industrial production index	80.22	89.66	35.24	7.94	221.44
Money market rate	6.43	4.35	6.28	-0.33	67.23
Bond market rate	7.23	5.44	4.40	0.32	29.24
Consumer price index	50.92	53.25	39.11	1.11	111.60
Emerging Countries					
Stock market index	70.12	71.49	48.80	0.00	349.48
Industrial production index	92.15	94.45	25.88	28.34	187.36
Money market rate	11.04	5.56	14.94	-0.50	93.54
Bond market rate	6.21	5.01	8.36	0.10	110.55
Consumer price index	63.86	66.13	43.70	0	273.02
World Group					
Stock market index	46.17	37.09	38.04	2.98	184.33
Industrial production index	74.27	76.93	29.08	11.26	123.99
Money market rate	3.87	3.53	3.68	-0.06	19.10
Bond market rate	5.55	5.21	3.35	-0.23	17
Consumer price index	67.42	78.23	31.32	13.22	122.74

a. Stock market index: total share prices for all shares in a country b. Industrial production index: measures real output in manufacturing, mining, and electric & gas c. Money (bond) market rates: short-term (long-term) interest rates, % per annum d. Consumer price index: a market weight of all consumer prices

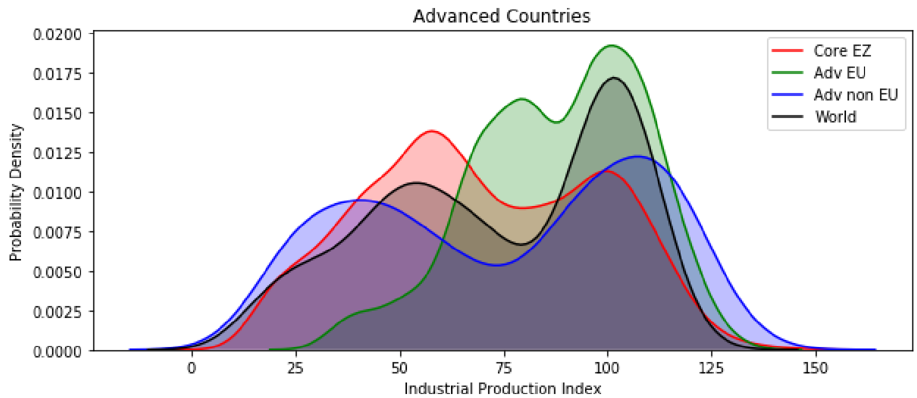
Figure 2.1: Plots of the 5 Variables



Trends in the data tended towards convergence in the mid-2000s; Emerging countries results need to be interpreted with care since they exhibit marked differences from the rest of the groups.

Figure 2.2: Kernel Density Estimation for Industrial Production

(a) Industrial structure of Core EZ, Advanced EU (non-EZ), Advanced non-EU, and the rest-of-world groups



(b) Newcomer EZ, and Emerging countries both in and out of the EU have approximately similar industrial structures

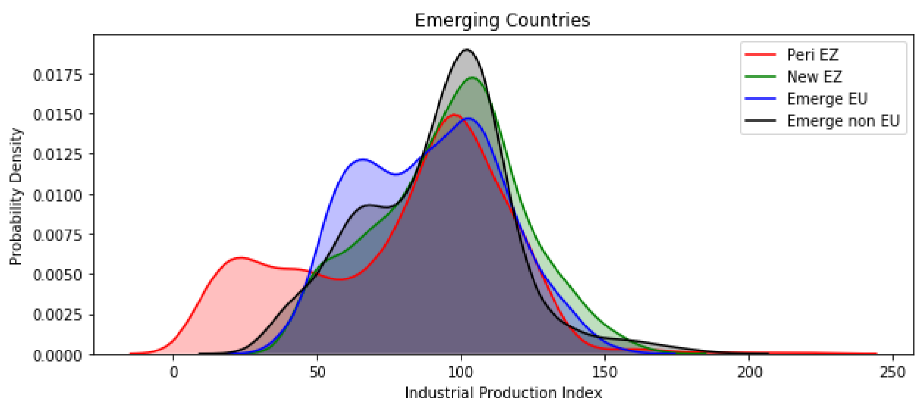


Table 2.5: Decomposition of Money Market Rates

This table provides the results of variance decomposition of short-term interest rates. Results are compiled at the 12-month forecast horizon.

country		*Pre − EMU*			*EMU period*			*EMU pre − Crisis*		
	Month	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$
Core EZ										
Austria	12	17	(40)	[43]	19	(74)	[7]	18	(75)	[7]
Belgium	12	11	(14)	[75]	19	(74)	[7]	18	(76)	[6]
Finland	12	23	(40)	[37]	19	(74)	[7]	18	(76)	[6]
France	12	4	(33)	[63]	19	(74)	[7]	18	(76)	[6]
Germany	12	13	(43)	[44]	19	(74)	[7]	19	(75)	[6]
Luxembourg	12				20	(74)	[6]	19	(77)	[4]
Netherlands	12	6	(54)	[40]	19	(74)	[7]	18	(74)	[8]
Periphery EZ										
Estonia	12	9	(9)	[82]	12	(13)	[75]			
Greece	12	12	(2)	[86]	1	(68)	[31]	8	(42)	[50]
Ireland	12	14	(56)	[30]	17	(73)	[10]	17	(69)	[14]
Italy	12	8	(67)	[25]	19	(74)	[7]	19	(74)	[7]
Lithuania	12	16	(41)	[43]	47	(4)	[49]			
Slovenia	12	9	(61)	[30]	8	(54)	[38]			
Spain	12	13	(28)	[59]	18	(75)	[7]	17	(78)	[5]
Advanced EU										
Denmark	12	7	(4)	[89]	13	(33)	[54]	20	(64)	[16]
Sweden	12	15	(11)	[74]	70	(5)	[25]	84	(1)	[15]
United Kingdom	12	9	(26)	[65]	6	(31)	[63]	5	(18)	[77]
Emerging EU										
Bulgaria	12	1	(8)	[91]	88	(6)	[6]			
Czech Republic	12	1	(2)	[97]	18	(25)	[57]			
Croatia	12	2	(62)	[36]	32	(31)	[37]			
Hungary	12	9	(5)	[86]	45	(30)	[25]			
Poland	12	4	(2)	[94]	4	(9)	[87]			
Romania	12	5	(7)	[88]	87	(5)	[8]			
Advanced non-EU										
Iceland	12	48	(6)	[46]	54	(1)	[45]	42	(26)	[32]
Norway	12	5	(55)	[40]	15	(55)	[30]	9	(53)	[38]
Switzerland	12	1	(13)	[86]	16	(51)	[33]	15	(48)	[37]
Emerging non-EU										
Armenia	12	18	(34)	[48]	10	(9)	[81]	25	(14)	[61]
Georgia	12				36	(43)	[21]			
Serbia	12				12	(2)	[86]			
Ukraine	12				5	(2)	[93]	6	(1)	[93]

Table 2.6: Decomposition of Bond Market Rates

This table provides the results of variance decomposition of 10-year government bond rates. Results are compiled at the 12-month forecast horizon.

country		$Pre-EMU$			$EMU\ period$			$EMU\ pre-Crisis$		
	Month	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$
Core EZ										
Austria	12	30	(41)	[29]	57	(36)	[7]	54	(42)	[4]
Belgium	12	37	(48)	[15]	34	(58)	[8]	47	(51)	[2]
Finland	12	23	(52)	[25]	47	(33)	[20]	33	(58)	[9]
France	12	27	(50)	[23]	53	(41)	[6]	48	(51)	[1]
Germany	12	46	(41)	[13]	68	(21)	[11]	50	(41)	[9]
Luxembourg	12	24	(23)	[53]	32	(31)	[37]	24	(43)	[33]
Netherlands	12	42	(48)	[10]	57	(33)	[9]	56	(42)	[2]
Periphery EZ										
Italy	12	16	(56)	[28]	11	(55)	[34]	47	(50)	[3]
Ireland	12	18	(75)	[7]	19	(24)	[57]	51	(43)	[6]
Latvia	12	15	(12)	[73]	1	(1)	[98]			
Lithuania	12	22	(11)	[67]	3	(5)	[92]			
Slovakia	12	25	(19)	[56]	6	(22)	[72]			
Slovenia	12	10	(55)	[35]	4	(38)	[58]			
Greece	12	42	(38)	[20]	2	(3)	[95]	21	(47)	[32]
Portugal	12	21	(72)	[7]	2	(33)	[65]	49	(43)	[8]
Spain	12	7	(80)	[13]	12	(46)	[42]	48	(48)	[4]
Advanced EU										
Denmark	12	31	(62)	[7]	44	(28)	[28]	38	(56)	[6]
Sweden	12	22	(65)	[13]	64	(21)	[15]	38	(58)	[4]
United Kingdom	12	35	(42)	[23]	56	(17)	[27]	41	(38)	[21]
Emerging EU										
Czech Republic	12	23	(5)	[72]	21	(24)	[55]			
Poland	12	29	(7)	[64]	17	(40)	[43]			
Hungary	12	7	(10)	[83]	7	(18)	[75]			
Advanced non-EU										
Iceland	12	7	(14)	[79]	2	(3)	[95]	12	(1)	[87]
Norway	12	28	(34)	[38]	52	(20)	[28]	20	(49)	[31]
Switzerland	12	24	(40)	[36]	62	(22)	[16]	51	(33)	[16]
Emerging non-EU										
Russia	12				3	(9)	[88]	12	(12)	[76]

Table 2.7: Decomposition of Stock Market Index

This table provides the results of variance decomposition of stock market index. Results are compiled at the 12-month forecast horizon.

country		$Pre-EMU$			$EMU\ period$			$EMU\ pre-Crisis$		
	Month	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$
Core EZ										
Austria	12	7	(32)	[61]	82	(1)	[17]	34	(19)	[47]
Belgium	12	47	(19)	[34]	81	(4)	[15]	56	(1)	[43]
Finland	12	15	(25)	[60]	57	(21)	[22]	49	(27)	[24]
France	12	40	(24)	[36]	78	(20)	[2]	84	(12)	[4]
Germany	12	18	(53)	[29]	69	(17)	[14]	71	(9)	[20]
Luxembourg	12				79	(2)	[19]	56	(9)	[35]
Netherlands	12	43	(24)	[33]	87	(11)	[2]	72	(7)	[21]
Periphery EZ										
Estonia	12	11	(1)	[88]	67	(2)	[31]			
Slovakia	12	2	(1)	[97]	5	(4)	[91]			
Slovenia	12	5	(7)	[88]	56	(2)	[42]			
Greece	12	8	(3)	[89]	56	(2)	[42]	48	(4)	[48]
Italy	12	25	(50)	[25]	67	(18)	[15]	56	(15)	[29]
Ireland	12	51	(14)	[35]	79	(3)	[18]	30	(8)	[62]
Portugal	12	28	(24)	[48]	66	(9)	[25]	40	(30)	[30]
Spain	12	37	(17)	[46]	64	(22)	[14]	70	(17)	[13]
Advanced EU										
Denmark	12	19	(31)	[50]	71	(6)	[23]	52	(6)	[42]
Sweden	12	25	(21)	[54]	77	(16)	[7]	77	(18)	[5]
United Kingdom	12	56	(12)	[32]	87	(4)	[9]	94	(3)	[3]
Emerging EU										
Czech Republic	12	7	(5)	[88]	78	(4)	[18]			
Hungary	12	12	(31)	[57]	61	(2)	[37]			
Poland	12	12	(10)	[78]	82	(6)	[12]			
Advanced non-EU										
Iceland	12	11	(20)	[69]	56	(2)	[42]	41	(6)	[53]
Norway	12	11	(25)	[64]	89	(0)	[11]	64	(1)	[35]
Switzerland	12	38	(29)	[33]	67	(9)	[24]	78	(1)	[21]
Emerging non-EU										
Russia	12				49	(3)	[48]	11	(7)	[82]
Turkey	12	4	(13)	[84]	39	(12)	[49]	39	(14)	[47]

Table 2.8: Decomposition of Industrial Production Index

This table provides the results of variance decomposition of industrial production index. Results are compiled at the 12-month forecast horizon.

country		$Pre-EMU$			$EMU\ period$			$EMU\ pre-Crisis$		
	Month	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$
Core EZ										
Austria	12	19	(24)	[57]	16	(46)	[38]	31	(36)	[33]
Belgium	12	36	(7)	[57]	21	(3)	[76]	41	(14)	[45]
Finland	12	27	(60)	[13]	21	(31)	[48]	29	(26)	[45]
France	12	27	(2)	[71]	35	(23)	[42]	37	(27)	[36]
Germany	12	14	(61)	[25]	19	(52)	[29]	24	(42)	[34]
Luxembourg	12	39	(18)	[43]	16	(13)	[71]	12	(16)	[72]
Netherlands	12	22	(12)	[66]	10	(10)	[80]	8	(21)	[71]
Periphery EZ										
Cyprus	12	29	(6)	[65]	16	(3)	[81]			
Estonia	12	33	(27)	[40]	22	(32)	[46]			
Italy	12	26	(22)	[52]	15	(29)	[56]	19	(49)	[32]
Ireland	12	34	(9)	[57]	10	(10)	[80]	26	(22)	[52]
Latvia	12	72	(2)	[26]	27	(5)	[68]			
Lithuania	12	3	(3)	[94]	4	(8)	[88]			
Slovakia	12	16	(21)	[63]	29	(53)	[18]			
Slovenia	12	36	(46)	[18]	31	(51)	[18]			
Greece	12	28	(7)	[65]	35	(3)	[62]	29	(12)	[59]
Portugal	12	16	(19)	[65]	11	(12)	[77]	11	(11)	[78]
Spain	12	19	(31)	[50]	11	(15)	[74]	14	(11)	[75]
Advanced EU										
Denmark	12	40	(11)	[49]	33	(9)	[58]	34	(22)	[44]
Sweden	12	2	(1)	[97]	41	(37)	[22]	38	(41)	[21]
United Kingdom	12	21	(62)	[17]	23	(40)	[37]	20	(36)	[44]
Emerging EU										
Bulgaria	12	9	(9)	[82]	15	(16)	[69]			
Croatia	12	5	(32)	[63]	12	(32)	[56]			
Czech Republic	12	68	(10)	[22]	21	(26)	[53]			
Hungary	12	11	(11)	[78]	31	(54)	[15]			
Poland	12	15	(14)	[71]	18	(46)	[36]			
Romania	12	6	(10)	[84]	18	(21)	[61]			
Advanced non-EU										
Iceland	12				13	(8)	[79]	13	(6)	[81]
Norway	12	26	(57)	[17]	30	(11)	[59]	26	(27)	[47]
Emerging non-EU										
Russia	12	7	(15)	[78]	7	(20)	[73]	85	(7)	[8]
Turkey	12	40	(6)	[54]	25	(5)	[70]	76	(4)	[20]

Table 2.9: Decomposition of Consumer Price Index

This table provides the results of variance decomposition of consumer price index. Results are compiled at the 12-month forecast horizon.

country		$Pre-EMU$			$EMU\ period$			$EMU\ pre-Crisis$		
	Month	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$	u^g	(u^r)	$[u^d]$
Core EZ										
Austria	12	11	(8)	[81]	17	(28)	[55]	37	(24)	[39]
Belgium	12	31	(2)	[67]	51	(15)	[34]	33	(31)	[36]
Finland	12	44	(4)	[52]	15	(39)	[46]	18	(38)	[44]
France	12	33	(9)	[58]	27	(54)	[19]	29	(59)	[12]
Germany	12	21	(27)	[52]	24	(51)	[25]	43	(24)	[33]
Luxembourg	12	25	(6)	[69]	15	(50)	[35]	18	(40)	[42]
Netherlands	12	8	(2)	[90]	18	(18)	[64]	9	(16)	[75]
Periphery EZ										
Cyprus	12	15	(12)	[73]	14	(28)	[58]			
Estonia	12	22	(0)	[78]	34	(32)	[34]			
Italy	12	56	(29)	[15]	47	(21)	[32]	30	(15)	[55]
Ireland	12	70	(6)	[24]	29	(2)	[69]	70	(12)	[18]
Latvia	12	9	(51)	[40]	4	(13)	[83]			
Lithuania	12	0	(2)	[98]	9	(1)	[90]			
Malta	12	1	(0)	[99]	24	(37)	[39]			
Slovakia	12	43	(1)	[56]	26	(18)	[56]			
Slovenia	12	62	(9)	[29]	23	(15)	[62]			
Greece	12	19	(6)	[75]	14	(52)	[34]	9	(59)	[32]
Portugal	12	56	(17)	[27]	18	(49)	[33]	31	(11)	[58]
Spain	12	51	(8)	[41]	17	(11)	[72]	25	(8)	[67]
Advanced EU										
Denmark	12	9	(5)	[86]	32	(40)	[28]	33	(44)	[23]
Sweden	12	39	(15)	[46]	12	(48)	[40]	5	(63)	[32]
United Kingdom	12	17	(11)	[72]	15	(41)	[44]	14	(42)	[44]
Emerging EU										
Bulgaria	12	4	(1)	[95]	11	(30)	[59]			
Croatia	12	54	(20)	[26]	6	(34)	[60]			
Czech Republic	12	45	(11)	[44]	26	(15)	[59]			
Poland	12	76	(0)	[24]	15	(4)	[81]			
Hungary	12	33	(22)	[45]	38	(17)	[45]			
Romania	12	23	(18)	[59]	19	(0)	[81]			
Advanced non-EU										
Iceland	12	53	(6)	[41]	4	(22)	[74]	20	(15)	[65]
Norway	12	19	(5)	[76]	7	(18)	[75]	9	(41)	[50]
Switzerland	12	36	(32)	[32]	21	(11)	[68]	16	(18)	[66]
Emerging non-EU										
Albania	12	41	(37)	[22]	76	(16)	[8]	78	(7)	[15]
Azerbaijan	12	9	(18)	[73]	98	(1)	[1]	59	(2)	[39]
Moldova	12	2	(70)	[28]	5	(17)	[78]	6	(2)	[92]
Russia	12	59	(10)	[31]	6	(6)	[88]	4	(13)	[83]
Serbia	12	18	(36)	[46]	6	(1)	[93]	2	(11)	[87]
Turkey	12	2	(5)	[93]	1	(10)	[89]	15	(11)	[74]
Ukraine	12	5	(15)	[80]	92	(5)	[3]	48	(27)	[25]

Chapter 3: Do managers play it safe? Managerial cash bonus and financial leverage

3.1 Introduction

Early research posit that professional managers are risk-averse, because of their overinvestment incentive problem (Hölmstrom, 1979; Fama, 1980). Thus, when managers' residual interests (i.e. financial wealth and employment prospects) are high, they become risk conscious and tend to avoid corporate policies that they consider to exacerbate overall firm risk. Consequently, such aberrant behavioral imbalances of managers can hurt shareholders' value. Following this, financial economists theorized that through efficient compensation contracts, managerial risk-related incentive problem is reduced, thereby influencing managers to make value-critical decisions relating to investment and the concomitant financing policies (Mehran, 1995; Guay, 1999; Coles et al., 2006; Chava and Purnanandam, 2010). Although, prior scholarly managerial compensation literature primarily focus on agency conflicts with equity-holders (i.e. shareholders' use of stock incentives to induce managerial risk-taking), Coles et al. (2006), Berger et al. (1997), Berger and Nitsch (2008), and Harris and Raviv (1979) observe that heavily cash-motivated managers are often risk-averse and that they tend to prefer cash pay to equity (Harris and Raviv, 1979) because such component minimizes uncontrolled uncertainties (Liu and Stark, 2009) to their overall economic wealth.

It can be inferred from the above observation that the distinctive nature of compensation types poses different risk-related incentives to managers. Particularly, risk-averse managers may have incentives to reduce firm risks via keeping low leverage ratios (Jensen and Meckling, 1979; Fama, 1980; Grossman and Hart, 1982). Again, because a high debt level increases a firm's financial distress and bankruptcy risks which risk-averse managers seek to prevent (Grossman and Hart, 1982), and reduces cash flows via interest payment (Jensen, 1986), it can be argued that a relatively higher proportion of managerial earnings-based incentives would provide more risk-avoiding incentive to managers. This, in turn, increases bondholders value leading to possibly lower agency costs of debt (John and John, 1993). Thus, shareholders use low risk incentive (e.g. cash bonus) to resolve shareholder-bondholder conflict of interests. More specifically, we examine how providing managers with earnings-based incentive induces them to limit firm risk levels (via lower borrowings).

The key rationale is that the use of cash bonus is to provide further incentive to risk-averse managers to generate positive and stable cash flow which in turn may lead to lower debt usage. Implicit in this idea is the notion that managerial cash bonus compensation and accounting earnings are related to affect leverage level. Further, the study argues that high growth firms may tend to use less cash bonus, and this can consequently affect how cash-motivated managers adopt debt policy. We also contend that cash-motivated managers with higher ownership stakes are likely to be more concerned and may use debt more conservatively. Lastly, as an extension of Duru et al. (2005) model, we adopt a simultaneous equations model to specifically account for the joint determination of cash bonus and leverage. This is the first study that has responded explicitly to leverage and cash bonus endogeneity problem and that investigating the aforementioned issues in the U.K. context is urgently needed for these reasons. For instance, the U.K firms are seen to have a conservative debt policy (Antoniou et al., 2008; Rajan and Zingales, 1995) and that their executives often receive substantial cash-based compensation (Murphy, 2000; Conyon and Murphy, 2000). Anecdotally, it can be argued that the low debt status of the U.K firms could be attributed to the U.K shareholders usage of more earnings-based bonuses. Hence, the unique characteristics of the U.K publicly listed firms provide a natural setting to extend Antoniou et al. (2008) low-leverage propositions. The advancement of the literature is based on the achievement of the stated objectives.

The findings in this paper suggest that managerial cash bonus compensation negatively impacts firm leverage, generally consistent with our first hypothesis. Our evidence further reveals that the adverse effect of cash bonus on leverage is unlikely to be moderated by accounting earnings performance measurement choice. In addition, we show that executives with more cash bonus in both high and low growth-opportunities firms are likely to increase leverage. Finally, the results show that cash-incentivised executives with lower ownership significantly use more borrowings, however, they become reluctant to increase leverage at higher ownership level, signaling entrenchment effect at higher ownership level. Overall, the findings of this study add to a growing body of literature that contribute to the risk-related story of managerial compensation components on financial leverage policy (Coles et al., 2006; Chava and Purnanandam, 2010; Kini and Williams, 2012). The remainder of the paper is structured along this line: Section 3.2 reviews related literature and formulates testable hypotheses. Section 3.3 considers data and empirical methods. Section 3.4 presents and discusses three-stage least squares regression results and further robustness checks, and finally section 3.5 concludes the study.

3.2 Related Literature and Hypothesis Development

Much of the early research on compensation policy indirectly show how the different compensation components relate to observable managerial decisions. For instance, some researchers suggest possible associations between the various characteristics of firms and compensation pay components. Essentially, the idea is that shareholders consider the nature of firms' assets (tangible asset, growth opportunities), financial policies, presence of monitoring mechanisms (e.g. independent boards, board composition, large institutional shareholdings), the characteristics of product markets, and regulatory and institutional changes (e.g. Cadbury, 1992; Greenbury, 1995) in order to optimize the value-maximizing effects of managerial compensation scheme (see Kim et al., 2017; Amoako-Adu et al., 2011; Brockman et al., 2010; Ortiz-Molina, 2007; Ryan Jr and Wiggins III, 2002, among others). In a related manner, another stream of literature further claim that if through compensation contract, professional managers become more benevolent to shareholders, then there should be an observable relation between firm performance and the structure of managerial compensation scheme. Some scholarly studies provide support for this view (Chen et al., 2016; Core et al., 1999; Mehran, 1995).

However, different from the above models, we contend that the various components of managerial compensation offer different incentives to managers which could affect their selection of operational and financial policies of the firms. Thus, if professional managers are risk-averse (Jensen and Meckling, 1979; Fama, 1980), which can consequently inhibit their policy choices and value, then the design and usage of incentive pay package should provide direct incentives to executives to choose value-critical policies. Some empirical research provide support for this view and that this literature has significantly concentrated on managerial stock-based compensation on risk-taking policies. There is some evidence that suggest that the convexity feature inherent in option-based incentives induce managers to embark on more risky policies. For example, Coles et al. (2006) find that the contemporaneous option-based incentive (measured as the volatility of CEOs stock-based - vega) has a positive effect on leverage, firm risk, research & development activity. Also, Kini and Williams (2012) share similar sentiment after finding a positive (negative) link between option-like tournament incentives and book leverage, research & development (capital expenditure) and interpret it to suggest that senior managers engage in more risk-taking in order to increase their promotion to CEO rank.

Relatedly, Chava and Purnanandam (2010) also show that the value of CEOs option-based - vega (delta) compensation increases (decreases) with firm leverage level. They argued that shareholders use a combination of different pay package schemes to either increase or decrease managerial risk-related agency problem. Similarly, Chen et al. (2006) provide support that risk-motivated incentive (options compensation) encourages executives in the banking industry to take more risk policies, whiles Wu and Tu (2007) contend that option-based incentive influences aggressive allocation of corporate resources into research and development activity. Again, and along the same lines, Holthausen et al. (1995) also find that CEOs equity-based compensation explains the firm's subsequent innovative activity after adopting a system of equations approach. In contrast, others offer different observations (see Hayes et al., 2012; Lewellen, 2006). For example, Hayes et al. (2012) observe that the sensitivity of CEO wealth to stock volatility (vega) and the sensitivity of CEO wealth to stock price (delta) encourage more managerial risk-reduction behavior in both financial and investment policies. Their results show that stock-based incentives rather reduce firms' debt ratio and risky R&D investment. They also find that the risk-motivated incentive inherent in option-based induces lower cash holding. Again, Lewellen (2006) contend that managers' preference for risk-taking activity (i.e. debt ratio) declines as their stock options holdings are in the money.

Furthermore, others also provide evidence on how risk-avoiding incentives affect corporate policies. Specifically, Firth et al. (2016) empirically analyze the sensitivity of CEOs inside-debt incentives on the costs of equity capital using the Standard and Poor's data sets spanning 2006 to 2013. They document that CEOs debt-like incentives have a significantly negative effect on the cost of equity and carefully argued that debt-like pay component lower managerial risk aggressive behavior leading to lower demand by investors. The authors further asserted that the negative effect is more pronounced for shareholders of firms with high bankruptcy risk. Similarly, Cassell et al. (2012) find a significantly negative relation between CEOs inside debt holdings (defined as pension benefits and deferred pay) and financial leverage, R&D, and volatility of firm stock returns. They explain that shareholders' usage of more CEOs inside debt-like pay induce lower risk policies. Kabir and Veld-Merkoulova (2013) apply a relatively more comprehensive CEOs pay components and argue that bondholders incorporate the nature of CEO's pay incentives when lending to the U.K firms. The authors made this conclusion after applying OLS estimator to their model and find that cash bonus and defined pension incentives show a decreasing effect on bond yield spread (cost of debt), while an increase in stock options intensify it. In a similar vein, Florackis and Ozkan (2009) reveal a non-monotonic relation between firm leverage and CEOs ownership after applying different estimating techniques, while both Friend and Lang (1988) and Agrawal and Knoeber (1996) show a negative effect of managerial ownership on a firm's debt level and suggest that CEOs become wary of debt levels when their residual interest is high.

As indicated, however, others have examined the reverse issue: i.e. whether shareholders consider firm strategic policies (investment, leverage, cash holdings etc.) when designing managerial optimal compensation. More specifically, this strand of research looks at the role of firm's observable characteristics in explaining optimal compensation (Papa and Speciale, 2011; Brockman et al., 2010; Ortiz-Molina, 2007; Duru et al., 2005). For instance, Brockman et al. (2010) show a positive effect of short-term debt on the sensitivity of CEOs wealth to stock return volatility (vega) but report a negative effect on the sensitivity of CEOs wealth to stock price (delta). They interpret to show that short-term debt intensifies shareholders - bondholders agency conflicts, but stock (delta) incentive minimizes such conflicting interests. Ortiz-Molina (2007) further argues that shareholders usage of stock-based incentives helps reduce equity-debt agency conflicts after reporting an increasing effect of leverage on stock options incentive. Ryan Jr and Wiggins III (2002) report a positive (negative) effect of debt ratio on cash bonus (stock and stock options), while Papa and Speciale (2011) find similar positive association between leverage and cash compensation. Again, and with similar sentiment, Duru et al. (2005) assert that corporate debtholders incorporate managerial risk-avoiding cash incentive when deciding lending rate after finding a negative effect of corporate bond yields on cash bonus. They also find a positive effect of leverage on cash bonus and explicitly argue of the existing endogeneity concerns among leverage and cash bonus.

Clearly, these two independent strands of literature reviewed above show the existence of endogeneity bias and possible causation problems in the empirical design. In response, and departing from extant literature, our basic model is that shareholders choose earnings-based compensation to induce managerial optimal risk reduction attitude (i.e. lower optimal leverage) and that such efficient financial leverage policy together with other firms' characteristics determine the probability distribution of a firm's accounting earnings and stock returns. Thus, our chosen model accounts for the simultaneous determination of leverage and managerial cash bonus in an attempt to address the empirical design problems and to avoid possible spurious inferences and to isolate causation effect that runs from cash bonus to affect leverage policy. Again, we further argue that managerial cash bonus compensation and financial leverage is accentuated by the firm's accounting earnings performance. In the same vein, we contend that a firm's growth opportunities and managerial ownership stakes are likely to moderate cash bonus - leverage relationship. This paper adds to the limited research that explore the impact of managerial cash bonus on financial leverage by accounting for the existence of possible reverse causality among financial leverage and managerial cash compensation.

Managerial cash bonus and firm leverage

It is argued that the distinctive nature of managerial compensation components poses different corporate risk-taking behavior to managers (Kabir and Veld-Merkoulova, 2013; Cassell et al., 2012; Kini and Williams, 2012; Chava and Purnanandam, 2010; Coles et al., 2006). Thus, market-based performance rewards (stock-based component) induce professional managers risk-taking incentive while earnings-based compensation discourages risk-taking appetite (Duru et al., 2005; Coles et al., 2006; Harris and Raviv, 1979). For instance, Liu and Stark (2009) find an increasing relation between accounting earnings measures and managerial cash bonus compensation. A simple inference from this is that, shareholders usage of accounting-based earnings tend to influence managers to generate positive and stable cash flow, which in turn, enable them to receive cash bonus rewards. Again, as the firm generates and holds more cash flows, it can be able to sponsor activities via cash reserves leading to lower debt contraction. Consequently, bondholders' interest is safeguarded resulting in lower agency costs of debt (John and John, 1993). In a related vein, Harris and Raviv (1979) argue that risk-averse managers prefer to have their compensation structured in such a way that it bears minimal uncertainties to their economic wealth. In tune with this, it is argued that executive boards cash compensation is implicitly protected from uncertainties (Liu and Stark, 2009). From this intuitive argument, it can be postulated that risk-averse managers who want to lower leverage level may prefer earnings-based pay to stock-based compensation. In this regard, shareholders of firms that use more accounting cash bonuses may tend to experience lower leverage levels.

Hypothesis 1: *Managerial cash bonuses will be negatively related to firm leverage.*

Managerial cash bonus, performance (ROA) and leverage

One of the key objectives of this paper is to test the validity underlying the assumption that shareholders usage of risk-avoiding compensation (cash bonuses) encourages a lower leverage ratio. The hypothesized relationship does not, however, pay attention to the interaction between managerial cash bonus and accounting earnings. In fact, the literature on performance measurement choice in remuneration contracts critically conditions executives cash bonus on the levels of accounting earnings (Liu and Stark, 2009; Duru et al., 2005; Core and Guay, 1999). Liu and Stark (2009) show that cash bonus and accounting earnings are positively related. Again, with lower debt levels, firms are able to generate positive cash flow through higher accounting earnings. Consistent with this observation, it seems to suggest that managers of firms with earnings-based incentives are likely to achieve higher accounting performance targets. We use return on asset (ROA) as our accounting performance measure, similar to prior literature (Liu and Stark, 2009; Firth et al., 2006; Mehran, 1995). Therefore, following previous research, we argue that managerial cash bonus and accounting earnings performance interact in a dynamic way to affect firm leverage level. With this, we formulate our second hypothesis:

Hypothesis 2: *Earnings performance (ROA) negatively accentuates (moderates) the relationship between cash bonus and financial leverage.*

Managerial cash bonus, growth opportunities and leverage

The literature on managerial compensation provide different perspectives on the role of firms' growth opportunities. For example, Ryan Jr and Wiggins III (2002), Bizjak et al. (1993) among others posit that firms with high growth opportunities tend to use more equity-based but less cash bonuses because such firms need to reserve enough cash surplus to sponsor future growth opportunities. Consistent with this argument, it tends to suggest that firms with high growth opportunities are likely to use lesser cash bonuses and this may consequently affect the assumed relation between cash bonus and leverage. Therefore, following prior research (Ryan Jr and Wiggins III, 2002; Smith Jr and Watts, 1992) assertion, we make a natural prediction that managers of high growth opportunity firms are likely to face lower cash bonus compensation. We formulate our third hypothesis as follows:

Hypothesis 3: *The negative effect of cash bonus on leverage is smaller (bigger) for firms with high (low) growth opportunities.*

3.3 Method

Data

In order to test our stated hypotheses, we collected both managerial cash-based compensation and the firm financial information for the sampled U.K FTSE 350 firms spanning 2007 to 2015. Specifically, the dataset is obtained from two sources: we manually collected data on managerial cash compensation, their ownership holdings, ages and other corporate governance variables (large stakeholders and non-executives ownership) from the firm's annual reports, whiles accounting and financial data is sourced from the COMPUSTAT database. Further, because firms operating in financial and utility industries tend to have different capital structure and often face other regulatory constraints which may implicitly affect managerial decisions, we exclude these firms (Coles et al., 2006; Chava and Purnanandam, 2010). Guided by this, we base our analyses on a total number of 1,784 firm-year observations for the 213 firms operating in nine industries over nine years period.

Measurement of variables

Dependent Variable - Financial leverage

In line with other studies (e.g. Coles et al., 2006; Florackis and Ozkan, 2009; Chava and Purnanandam, 2010) financial leverage was used as our dependent variable. This variable was measured as the ratio of total book value of debt to the book value of total assets.

Independent Variable - Cash bonus

Consistent with Duru et al. (2005), we use natural log of total annual cash bonus component of the executives (including CEO, CFO and COO - chief operating officer) as a proxy for cash compensation – which is our main independent variable.

Control variables

Finally, we account for the following non-hypothesized control variables. These include logarithm of sales to proxy for firm size (SZ); growth opportunities defined as market value of assets to book value of assets to proxy for growth (GR); return on assets (ROA) defined as EBITDA scaled by total assets; stock return shows the firm annual stock return (STKR) over the fiscal year; financial distress (Z-score, Z-SC) to proxy for probability of bankruptcy; tangibility defined as net investment in property, plant and equipment (PPE) and research and development (R&D) scaled by total assets for the respective measures. Indifferent to the prior work (Coles et al., 2006; Chava and Purnanandam, 2010), we include executives salary (SAL) to proxy for managerial risk aversion in our leverage model as a control variable. We argue that executive salary poses a minimal risk-motivated incentive for managers (Bebchuk and Fried, 2003). Also, we include fixed effect variables to account for industry and time fixed effects. The acronyms and definitions of variables are provided in Table 3.1.

[Table 3.1 about here]

Model specification

In this section, we model the empirical relationship between cash compensation and financial leverage. Specifically, we employ the following econometric framework:

$$Book\ leverage_{it} = Cash\ bonus_{i,t} + Controls_{i,t-1} + \alpha_i + \upsilon_t + \nu_{i,t} \tag{3.1}$$

The above regression equation is later modified to capture the moderating effects of ROA and firm growth. First, Ordinary Least Squares (OLS) estimation is employed to test the above relationship and to minimize reverse causality problem, by using lagged values rather than the contemporaneous ones (Coles et al., 2006). However, since OLS fails to account for unobserved firm-level heterogeneity and therefore leading to biased estimates (Wooldridge, 2010), Fixed Effect (FE), Predicted method and Three-Stage Least Squares (3SLS) methods are employed for robustness checks. All the results of the analyses are presented in Tables 3.5 and 3.6 respectively.

Summary Statistics and bivariate Correlations

Table 3.2 provides summary statistics of the variables used in this study. The average executives' cash-based compensation shows these mean values: total salary is £1,414 million and that of cash bonus is £1,183 million. The average natural log of salary and cash bonus show 6.09 and 5.89 respectively. The mean of book leverage is 0.288 (i.e. 28.8% of the total assets). The other firm characteristics show the mean values of return on assets (ROA), Z-score (Z-SC), market-to-book (GR), stock return (STKR), and log sales (SZ) are 0.099, 1.539, 4.265, 0.066 and 9.013 respectively. The tangibility (PPE) and R&D show about 24.0% and 0.6% of the total assets. Further, on the ownership stakes, executives (EO), non-executives (NEO) and large shareholders (LO) show average values 4.8%, 2.1% and 39.3% of the firm's total shareholdings. In Table 3.3, we present the correlation between all the variables used in this study. In general, the evidence obtained from the correlation matrix, as well as the descriptive statistics, suggest that our sample does not seem to suffer from any serious issues such as multicollinearity, limited variation and heterogeneity or large outliers.

[Tables 3.2 & 3.3 about here]

3.4 Results and Discussion

Univariate analysis

Table 3.4 shows univariate mean and standard deviation comparisons of firm and manager-specific characteristics by leverage quartiles. To perform this, we segregate firms into quartiles based on their leverage level and test whether the firm and manager-related characteristics differ across low-leverage (1st quartile) and high-leverage (4th quartile) levels. The mean cash-based compensation: salary in low-leverage firms is lower than that in high-leverage firms while cash bonus in low-leverage firms is higher than that in high-leverage firms. For the cash bonus, it is plausible to argue that low-leverage firms spend less on interest payment, which in turn, gives the firm a leeway to store enough cash balance and can motivate managers using more cash bonuses. However, the mean differences marginally missed out on significance.

Moreover, the findings on other firm characteristics are largely consistent with most of the extant literature (see Florackis and Ozkan, 2009; Antoniou et al., 2008). For instance, it shows that low-leverage firms normally have lower tangible assets, higher performance (return on assets and stock return) higher growth (market-to-book ratio) than high-leverage firms. Again, it is also observed that low-leverage firms usually have larger R&D spending than the high-leverage ones. The reported mean differences are all significant. The table further reveal that the mean values of executive ownership and large shareholders in low-leverage firms are higher than that of high-leverage ones, implying that managers and large shareholdings become risk cautious as their residual interests go up (Florackis and Ozkan, 2009).

In brief, the univariate analysis shows how cash incentives and other firm characteristics behave across different leverage levels. However, the univariate analysis does not effectively account for control variables. Also, as stated, endogeneity problem is a major concern in the leverage – compensation empirical investigation (Duru et al., 2005; Coles et al., 2006). These raised issues can affect the validity of the assumed leverage-cash bonus relationship. To address this, we adopt efficient econometric techniques to analyze the linkage.

[Table 3.4 about here]

The effect of cash bonus on leverage

The univariate analysis shows that the U.K executives pay considerable attention to their earnings-based cash incentive when determining the leverage level. The supposed anecdotal evidence fails to effectively control for other potential factors that affect leverage choice. Also, as indicated earlier, managerial cash bonus and leverage policy are likely to be jointly determined (Duru et al., 2005), rendering our univariate results less likely to specifically quantify the magnitude of cash bonus effects on leverage.

[Table 3.5 about here]

Table 3.5 presents the empirical results of our baseline model testing the effect of cash bonus on leverage (LEV). We employed several estimation methods: OLS, FE, predicted approach and Three-Stage Least Squares - 3SLS. Our main results are based on OLS models 1 to 2 while FE, predicted and 3SLS techniques are used as robustness checks. Specifically, model 2 shows that cash bonus is negatively and significantly related to firm leverage. The reported coefficient estimates of -0.0210 (t-statistics -2.28), suggesting that an increase in cash bonus is associated with 2.1% decrease in firm leverage. The finding confirms our assertion that shareholders usage of earning-based compensation induces managerial risk-reduction incentive, thereby lowering firm leverage (Coles et al., 2006; Harris and Raviv, 1991).

[Table 3.6 and 3.7 about here]

Robustness checks

Our estimated OLS models (1 & 2) of Table 3.5 consistently show that cash bonus partly drives firm leverage level. Here, we further test if indeed our results are robust to alternative econometric specifications. In Table 3.5 column 3, our fixed effect estimator qualitatively reports similar coefficient on cash bonus, and it is statistically significant at 1% confidence level. Further, in column 4, we again re-estimate our model using Predicted approach. In this method, cash bonus is regressed on leverage and control variables (controls defined in Table 3.1) to obtain predicted cash bonus values and then use the predicted cash values in the leverage model. As shown, the predicted model shows a cash bonus sign is still negative and statistically significant.

Moreover, it is worth mentioning that our key premise is that managerial compensation (i.e. cash bonus) causes firm leverage policy. However, others suggest that leverage also causes compensation policy. For example, some researchers argue that shareholders of firms with high leverage will structure managerial compensation to have high cash bonus, so that managers choose low leverage and shareholders bear lower agency costs of financial distress (for instance see Duru et al., 2005; Ryan Jr and Wiggins III, 2002; Humphery-Jenner et al., 2016). This means that the issue of direct causation may still remain a concern despite our various adopted techniques: numerous control variables, lagged values of cash bonus, fixed effects and predicted method. To further reduce the likelihood that our reported results are spurious and to isolate the effects of leverage on cash bonus compensation, we adopt simultaneous systems of equation. Table 3.6 shows results of a two-system specification. In each model, the simultaneously determined variables are leverage and cash bonus. For cash bonus model, we draw independent variables as well as instruments from previous studies (see Ryan Jr and Wiggins III, 2002; Duru et al., 2005; Kini and Williams, 2012; Humphery-Jenner et al., 2016). Based on theoretical economic intuition, our chosen instruments are industry-median cash bonus, lagged values of ROA and stock return (STKR). For instance, similar to Armstrong and Vashishtha (2012), we argue that firms' past performance (R0A, STKR) is likely to affect shareholders decisions to use cash bonus to compensate managers which in turn can affect managerial leverage policy. Again, our industry-median cash bonus instrument is consistent with Kini and Williams (2012). The inclusion of instruments in our first-stage (CB) model allows us to test for over-identifying restrictions and to improve the efficiency of coefficient estimates. To conform to the underlying reasoning for simultaneous equations, we use contemporaneous values of leverage and cash bonus and estimate using 3SLS technique. Again, evidence obtained from our 3SLS results shows that the coefficient sign on our independent variable (CB) remain qualitatively similar to what is already reported in Table 3.5. In short, the 3SLS result suggests that our earlier findings are not plagued by endogeneity problems and that the main results reported in Table 3.5 are robust to an alternative econometric specification.

Cash bonus and leverage - the moderating role of ROA

The evidence presented above suggests that managerial cash bonus induces managers to decrease firm leverage. One key role of shareholders' use of earning-based cash bonus compensation is to provide an incentive for managers to generate more accounting earnings making it easy for the firm to sponsor future activities from internal sources. This tends to indicate that accounting performance is more sensitive to cash bonus. Due to this, we further hypothesize that the adverse effects of managerial cash bonus on leverage are likely to be accentuated by the firm's earnings performance. In Table 3.7, we argument our baseline specification by including the interaction term of cash bonus and accounting performance. Similar to Firth et al. (2006) Firth, and Kini and Williams (2012), we use return on asset (ROA) as a measure of performance. Table 3.7, model 1 reports the results of our modified leverage equation while models 4-6 (FE) show the robustness checks. The results reveal that the estimated coefficient on the interaction term between cash bonus and ROA is negative and statistically significant across all models. The finding suggests that, ceteris paribus, cash-motivated managers with better earnings performance (ROA) are more likely to decrease firm leverage. This lends support to the proposition that the use of risk-avoiding incentive (earnings-based) induces managers to generate positive cash flow resulting in future lower agency costs of debt.

Cash bonus and leverage - the moderating role of growth

We also hypothesized that the effect of managerial cash bonus on leverage is likely to be moderated by the firm's growth level because high growth firms tend to use less cash bonus to reward their executives (Humphery-Jenner et al., 2016; Ryan Jr and Wiggins III, 2002). Also, firms with growth opportunities often keep low leverage (Rajan and Zingales, 1995). Thus, the interaction term is used to test the hypothesis that firm growth is likely to affect leverage policy only through managerial cash incentives. In Table 3.7 models 2 and 5, we extend our baseline model to accommodate for the interaction term. Following prior research (Ryan Jr and Wiggins III, 2002; Coles et al., 2006), we used market-to-book as a proxy for growth opportunities and then interacted with cash bonus. Specifically, the interaction term coefficient shows a negative sign and it is statistically significant at 1% confidence level. Thus, the coefficient estimates is -0.0006 (t-statistics -4.88). The result tends to indicate that cash-motivated managers with more growth potentials prefer to keep low leverage level. This is not surprising because as managers of firms with accounting performance measure generates positive and stable cash surplus to meet performance evaluation criteria, they are able to sponsor growth opportunities through internal source thereby limiting firm's leverage ratio. In other words, our evidence shows that through the incentive's effects of cash bonus, managers of firms with unexploited growth opportunities are likely to enjoy a low leverage status.

3.5 Conclusion and Implications

In this paper, we examined how risk-avoiding incentive (earnings-based compensation) affects firm financial leverage policy. Specifically, we concentrated on these issues: (a) establish a direct causal effect of cash bonus on leverage, (b) the extent to which firm's earnings performance accentuates cash bonus and leverage relationship, and (c) how shareholders of firms with growth opportunities use earnings-based incentive to influence managerial leverage policy. Using U.K non-financial and non-utility FTSE 350 datasets covering the period 2007 to 2015 and applying varied econometric techniques, we found some interesting evidence. Consistent with our expectation, we observed that the managerial cash bonus - leverage relationship is negative and significant across all our models. In addition, our result shows that the adverse effect of cash bonus on leverage is significantly accentuated by the firm's earnings performance. We further found evidence to indicate that through cash-motivated incentives managers of growth potentials firms tend to hold low leverage status. Significantly, the results are robust to all our adopted econometric specifications, including three-stage least squares (3SLS) which account for the simultaneous effects of managerial cash bonus and the firm's leverage policy.

Essentially, our results offer support for the risk-motivated argument under the optimal compensation theory. The practical implication of the study's evidence shows that managerial cash bonus compensation (risk-avoiding incentives) is a useful mechanism in influencing managerial risk reduction attitude. Thus, through earnings-based compensation, the U.K managers are induced to reduce leverage level thereby leading to possible future lower agency costs of debt. Again, the effect of managerial cash bonus on leverage is further intensified by the firm's performance and growth levels. Overall, the supplied findings show that the U.K firms' dominant use of cash-based incentive (Conyon and Murphy, 2000) partly explains the debt conservative behavior or preference of these firms (Antoniou et al., 2008). However, our study has limitations due to scope. There is some evidence, however, that other managerial policy choices are likely to be influenced by higher cash compensation, we leave this extension for future research.

Table 3.1: Description of Variables

Dependent Variable	**Description**	**Literature**
Leverage (LEV)	long-term debt plus short-term debt scaled by Total Assets	Coles et al. 2006; Chava and Purnanandam, 2010
Independent variable		
Cash bonus (CB)	Natural logarithm of total managerial cash bonus	Duru et al. 2005
Control variables		
Salary (SAL)	Natural logarithm of total annual base salary of the three executives	Cadman, Carter, and Hillegeist, 2010; Chen et al. 2016.
Firm Size (SZ)	Natural logarithm of total sales	Coles et al. 2006
Growth (GR)	[Total Assets – Book Equity + Market Equity] / Total Assets	Floarackis et al. 2009; Chava and Purnanandam, 2010
Profitability (ROA)	EBITDA scaled by total assets	Coles et al. 2006; Firth, Fung and Rui, 2006; Floracktis et al. 2009.
Annual stock return (STKR)	Annual stock return (12-months period).	Coles et al. 2006
Research and Development (R&D)	R&D expense scaled by Total Assets	Coles et al. 2006; Ryan and Wiggins, 2001
Assets Tangibility (PPE)	Net Property, Plant and Equipment / Total Assets	Coles et al. 2006; Chava and Purnanandam, 2010
Altman's Z-score (Z-SC)	[3.3 (EBIT / Total Assets) + 1.0 (Sales / Total Assets) + 1.4 (Retained Profits / Total Assets) + 1.2 (Working Capital / Total Assets)]	Chava and Purnanandam 2010
Executives Ownership (%) (EO)	Total annual shareholdings of the three executives (CEO, CFO and Chief operating officer) divided by the firm's total common shareholdings	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999
Non-executives' ownership (%) NEO)	Total annual shareholdings of non-executive directors divided by the firm's total common shareholding	Mehran, 1995
Large ownership % (LO)	Total shareholdings of large owners (defined as ownership above 3%) scaled by the total common shareholdings	Florackis et al. 2009; Ryan and Wiggins, 2001; Core et al. 1999

Table 3.2: Descriptive Statistics

	Mean	**St. Dev.**	**Min**	**Max**	**25%**	**50%**	**75%**	**N**
CB	5.89	0.55	0	7.19	5.7	5.95	6.17	1613
LEV	0.29	0.22	0	2.71	0.14	0.25	0.38	1606
SAL	6.1	0.21	5.08	6.96	5.96	6.09	6.24	1743
SZ	8.69	1.9	0	11.51	8.53	8.96	9.45	1738
GR	4.66	1.95	0	8.15	1.08	1.52	2.35	1746
ROA	0.1	0.19	-3.92	2.83	0.05	0.09	0.14	1712
STKR	0.06	0.49	-5.46	2.85	-0.13	0.09	0.3	1675
R&D	0.01	0.03	-0.3	0.41	0	0	0	1743
PPE	0.24	0.23	0	0.94	0.05	0.17	0.37	1664
Z-SC	1.52	1.24	-13.66	16.92	0.9	1.46	2.04	1740
EO	0.05	0.22	0	6.06	0	0	0.01	1720
NEO	0.02	0.11	0	3.51	0	0	0	1697
LO	39.82	18.94	3	97.8	25.34	38.17	52.22	1708

This table presents the descriptive statistics for the entire data used for the study. The sample comprises 213 UK FTSE 350 firms over the period 2007 to 2015. The variable descriptions are provided in Table 1 above.

Table 3.3: Correlation matrix

	CB	LEV	SAL	SZ	GR	ROA	STk	R&D	PPE	Z.SC	EO	NEO	LO
CB	1.00												
LEV	-0.06	1.00											
SAL	0.39*	0.00	1.00										
SZ	0.09*	-0.50*	0.12*	1.00									
GR	0.00	0.02	0.00	-0.11*	1.00								
ROA	-0.01	-0.39*	-0.02	0.08*	0.01	1.00							
STKR	0.09*	-0.11*	0.00	-0.03	0.02	0.24*	1.00						
R&D	0.00	-0.12*	-0.05	0.02	-0.01	0.01	0.03	1.00					
PPE	-0.07*	0.09*	0.05	0.22*	-0.03	0	-0.06	-0.08*	1.00				
Z-SC	-0.04	-0.52*	-0.08*	0.27*	0.02	0.79*	0.16*	0.04	0.00	1.00			
EO	-0.05	0.00	-0.09*	0.00	0.00	-0.06	0.04	0.00	0.06	-0.05	1.00		
NEO	-0.07*	0.00	-0.11*	0.00	0.02	-0.09*	-0.02	-0.03	0.05	-0.04	0.56*	1.00	
LO	-0.18*	-0.02	-0.43*	-0.03	-0.02	-0.01	-0.03	-0.03	0.10*	0.03	0.29*	0.21*	1.00

This table presents the correlation matrix for the sample data. The sample and variable definitions are as described in Table 1. * indicates significance at 1% levels.

Table 3.4: Managerial and firm characteristics by Leverage quartiles

	Quartile 1	Quartile 4	t-test
CB	5.623	5.464	1.56
	(1.425)	(1.581)	
SAL	6.088	6.099	-0.77
	(0.213)	(0.211)	
SZ	9.071	8.703	5.37***
	(0.737)	(1.141)	
GR	18.831	10.678	1.13
	(146.42)	(40.21)	
ROA	0.122	0.045	6.35***
	(0.097)	(0.228)	
STKR	0.117	0.006	3.51***
	(-0.341)	(-0.537)	
R&D	0.01	0.001	4.53***
	(0.041)	(0.003)	
PPE	0.209	0.281	-4.16***
	(0.203)	(0.282)	
Z-SC	2.013	0.807	17.35***
	(0.946)	(1.098)	
EO	0.041	0.038	0.42
	(0.118)	(0.112)	
NEO	0.019	0.022	-0.53
	(0.076)	(0.067)	
LO	41.285	39.113	1.64*
	(19.93)	(18.629)	

t statistics in parentheses* p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01 are significance at 10%, 5% and 1% respectively. Notes: The table above provides univariate mean comparisons of both firm-specific and managers incentives characteristics by book leverage (dependent variable) quartiles (normal font) and standard deviation (in square brackets). The t-statistics show the difference of means from the first (1st) to the fourth (4th) quartiles. The column (4) shows t-tests of whether the means of quartiles 1 and 4 differ statistically (*Ho : mean* (1) *mean* (4) = 0; *H1 : the diff*≠0). Definitions for all the variables are shown in table 1.

Table 3.5: Managerial cash bonus and leverage regression

	Main Results		Robustness Check	
	OLS Model 1	**OLS** Model 2	**FE** Model 3	**Predicted** Model 4
CB	-0.0256***	-0.0210**	-0.0148**	-0.1442**
	(-2.99)	(-2.28)	(-2.28)	(-2.17)
SAL		0.0847***	0.0838***	0.1804***
		(2.73)	(2.82)	(2.71)
SZ		-0.0442***	-0.0340*	-0.0421***
		(-6.32)	(-1.74)	(-5.36)
GR		-0.0008	0.0008	-0.0013
		(-0.86)	(0.93)	(0.83)
ROA		0.0991	0.0853**	-0.0891
		(1.46)	(1.95)	(-1.31)
STKR		-0.0134	-0.0141**	0.0043
		(-1.38)	(-2.42)	(0.37)
R&D		-0.360**	0.184*	-0.4914***
		(-2.17)	(1.63)	(-4.00)
PPE		0.0759***	0.273***	0.0510*
		(3.2)	(4.39)	(1.81)
Z-SC		-0.0639***	-0.0439***	-0.0661***
		(-7.92)	(-4.76)	(-9.31)
EO		0.0576	-0.199***	0.0391
		(1.15)	(-2.73)	(0.84)
NEO		0.159**	0.0976	0.1094
		(2.2)	(1.23)	(1.42)
LO		-0.0005*	-0.0001	-0.0003
		(-1.70)	(-0.44)	(-1.16)
_Cons	0.437***	0.376**	0.188	0.500***
	(7.99)	(2.26)	(0.85)	(3.21)
N	1441	1231	1231	1199
R^2	0.05	0.256	0.165	0.281

The table shows the OLS, FE and Predicted estimation results of the effects of cash bonus on leverage. All variable definitions are described in Table 1. ***, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.**

Table 3.6: Managerial cash bonus and leverage: Three-stage least squares (3SLS) method

	Second Stage **LEV**	**First-Stage** **CB**
CB	-0.852*	
	(-1.83)	
SAL	0.921**	1.007***
	(1.96)	(11.92)
SZ	-0.039**	0.0142
	(-2.42)	(0.62)
GR	0.002	0.0036**
	(0.79)	(2.09)
ROA	-0.311***	
	(-4.24)	
STKR	0.0303	
	(0.55)	
R&D	-0.483	0.0378
	(-1.47)	(0.08)
PPE	-0.19	-0.332***
	(-1.20)	(-4.69)
Z-SC	-0.066***	
	(-5.36)	
EO	-0.216	-0.388***
	(-1.12)	(-2.69)
NEO	-0.131	-0.481**
	(-0.57)	(-2.36)
LO	-0.0001	0.001
	(-0.16)	(0.67)
LEV		0.162
		(1.02)
Indus-medianCB		-2.249
		(-1.48)
ROA_lag		0.088*
		(1.73)
STKR_lag		0.005
		(0.20)
_Cons	0.148	12.98
	(0.39)	(1.45)
N	1127	1127
Chiz	942.94	386.23
P-value	0.00	0.00

Simultaneous system of equations regression of book leverage and cash bonus results. The predicted sign for the variable of interest are shown in the book leverage model. The models included fixed effects in all estimations. The reported t-statistics are based on robust standard errors are within parentheses. Cash bonus (CB) model includes leverage, controls and instruments (i.e. industry median_CB, one-year period log of ROA and STKR). Variable definitions are described in Table 1.***, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.**

Table 3.7: Managerial cash bonus and leverage – with ROA and Growth interaction terms

	OLS Model 1	OLS Model 2	OLS Model 3	FE Model 4	FE Model 5	FE Model 6
CB	-0.0148*	-0.0207**	-0.0141	-0.0115*	-0.0162**	-0.0114*
	(-1.62)	(-2.22)	(-1.55)	(-1.74)	(-2.37)	(-1.72)
SAL	0.0821**	0.107***	0.0883***	0.0625**	0.0803**	0.0624**
	(2.50)	(3.38)	(2.74)	(2.10)	(2.61)	(2.10)
SZ	-0.0417***	-0.0476***	-0.0441***	-0.0469**	-0.0433**	-0.0475**
	(-4.68)	(-7.18)	(-5.10)	(-2.40)	(-2.14)	(-2.43)
GR	-0.001	0.0033**	0.0032**	0.0008	0.001	0.001
	(-1.03)	(2.37)	(2.31)	(1.01)	(1.16)	(1.21)
ROA	0.130***	0.0994	0.128***	0.0187	0.0626	0.019
	(3.18)	(1.47)	(3.11)	(0.42)	(1.37)	(0.43)
STKR	-0.012	-0.0131	-0.0121	-0.0076	-0.0132**	-0.0076
	(-1.22)	(-1.32)	(-1.23)	(-1.31)	(-2.20)	(-1.30)
R&D	-0.340**	-0.332**	-0.342**	0.174	0.184	0.173
	(-2.13)	(-2.03)	(-2.14)	(1.58)	(1.61)	(1.57)
PPE	0.0741***	0.0694***	0.0739***	0.231***	0.264***	0.231***
	(3.06)	(2.80)	(3.05)	(3.72)	(4.11)	(3.71)
Z-SC	-0.0581***	-0.0629***	-0.0576***	-0.0257***	-0.0378***	-0.0257***
	(-7.17)	(-7.65)	(-7.18)	(-2.73)	(-3.92)	(-2.72)
EO	0.0781	0.0598	0.0766	-0.155**	-0.207***	-0.156**
	(1.5)	(1.17)	(1.46)	(-2.16)	(-2.80)	(-2.18)
NEO	0.180**	0.163**	0.179**	0.113	0.0946	0.11
	(2.57)	(2.2)	(2.56)	(1.45)	(1.18)	(1.41)
LO	-0.0005*	-0.0005	-0.0005*	-0.0001	-0.0002	-0.0001
	(-1.63)	(-1.46)	(-1.65)	(-0.39)	(-0.59)	(-0.38)
CB x ROA	-0.0443***		-0.0449***	-0.0526***		-0.0519***
	(-4.93)		(-4.97)	(-8.51)		(-8.36)
CB x GR		-0.0006***	-0.0006***		-0.0005*	-0.0003
		(-4.88)	(-5.01)		(-1.65)	(-0.94)
_Cons	0.341**	0.271	0.328*	0.423*	0.297	0.431**
	(1.99)	(1.57)	(1.92)	(1.91)	(1.30)	(1.94)
N	1165	1167	1165	1165	1167	1165
R^2	0.257	0.257	0.263	0.215	0.158	0.215

The table presents the OLS and FE estimation results for the interaction effects of cash bonus, ROA and Growth opportunities on leverage. Models 1, 2 and 3 include firm fixed effect. Time dummies are included in all estimations. The reported t-statistics are based on robust standard errors. All variable definitions are described in Table 1.***, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.**

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Vita

Samuel Acheampong

Education

M.S. in Financial Economics	Illinois State University	2015
B.A. in Economics	Kwame Nkrumah University of Science & Technology	2010

Professional Experience

Vice President of Financial Forecasting
Citigroup Inc., Irving, Texas — April 2020

Economist/Quantitative Risk Modeler
Simmons National Bank, Oklahoma City, Oklahoma — Jan 2020

Research Assistant
Illinois State University, Normal, Illinois — 2013 - 2015

Teaching Experience

Instructor of Record

University of Kentucky	ECO 391-009,010 Economic and Business Statistics (3 sections)	2017-2019
University of Kentucky	ECO 202, Principles of Macroeconomics (4 sections)	2016-2019
University of Kentucky	ECO 201-022 Principles of Microeconomics (2 sections)	2017-2019

Teaching Assistant

Kwame Nkrumah University of Science & Technology	Econometrics	2010-2011

Awards and Certificates

Block Funding Award	University of Kentucky (UKY)	2019-2020
Luckett Fellowship	Gatton College, UKY	2018-2019
Gatton Fellowship	Gatton College, UKY	2017-2018
Max Steckler Fellowship	Department of Economics, UKY	2016-2017
Lyman T. Johnson Fellowship	Gatton College, UKY	2015-2018

Conferences and Presentations

2019

University of Kentucky, Economics Department Workshop	Lexington, KY	Oct. 7
Kentucky Economic Association Annual Conference	Louisville, KY	Oct. 25
Center College, Economics and Finance Seminar	Danville, KY	Nov. 1
Virginia Tech, Future Faculty Development Program	Blacksburg, VA	Nov. 10-13
Southern Economics Association	Fort Lauderdale, FL	Nov. 23-25