E C O N O M I C S B U L L E T I N

International Risk Sharing and Investor Protection: Some Evidence from the EU−15

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Abstract

This note analyzes consumption risk sharing among the EU−15 countries. It is found that the reaction of consumption growth rates to idiosyncratic income growth is too sensitive to be consistent with perfect risk sharing. Some evidence is presented in favor the hypothesis that institutional and legal aspects determine the amount of risk sharing a country can achieve. In particular, countries characterized by high levels of investor protection appear to achieve less consumption insurance.

The views expressed in this note are those of the author and do not necessarily represent the position of the Oesterreichische Nationalbank.

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1 Introduction

A central theme of international business cycle models is that if investors have access to markets for financial assets that are complete, then they can perfectly insure against country specific shocks. That is, consumption should only react to aggregate shocks that are uninsurable and consequently, one should observe that consumption is highly correlated across countries. Moreover, even if a complete set of contingent markets is not available, risk sharing is still possible either through a fiscal transfer system or through existing financial markets, e.g. cross-country ownership of productive assets, or trade in non-contingent assets. However, the empirical literature has largely rejected the implications of the theoretical models with complete markets, indicating that the amount of risk sharing is rather limited.[1] Backus *et al.* (1992) find that the consumption correlations are too small in the data to be consistent with complete markets. French and Poterba (1991) document a large home bias in equity holdings and therefore only a small degree of international diversification. In addition, consumption appears to be too sensitive to idiosyncratic income to be consistent with perfect risk sharing as shown by Canova and Ravn (1996) and Lewis (1996) among others.

This paper is an empirical study of the relationship between financial market institutions and risk sharing among the EU-15 countries using the methodology advocated by Asdrubali *et al.* (1996). More specifically, it is tested whether the exposure of consumption allocations to country specific risks is related to financial market characteristics, that influence the enforceability of contracts. This is partially motivated by Kehoe and Perri (2002) who build a model that can generate consumption correlations that are smaller than output correlations. In their model, it is assumed that international loans are imperfectly enforceable. Hence any country can renege on its debt and as a consequence will be punished by exclusion from international financial markets.

It is found that the hypothesis of perfect risk sharing among the countries under consideration is strongly rejected due to the sensitivity of consumption growth to idiosyncratic income growth. Moreover, the results indicate that institutional and legal aspects influence the amount of consumption insurance a country can achieve. Somewhat surprisingly, it turns out that countries characterized by a high degree of investor protection are in general more exposed to idiosyncratic shocks. This result is consistent with the idea that investors in countries that provide good investor protection prefer to invest domestically and will diversify country specific risks to a limited extent.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical motivation and the empirical specification used in the paper. Section 3

[1] For a survey see Lewis (1999).

presents the results and section 4 summarizes and concludes the paper.

2 Theoretical Motivation and Empirical Implementation

Empirical studies of risk sharing are usually based on a central implication of models with complete markets, namely that the representative agents' intertemporal rates of substitution have to be equalized across countries. This result implies that under complete markets, the ex-post consumption growth rates of any two countries should be perfectly correlated. Thus, consumption growth, although individually stochastic, is fully determined by aggregate consumption growth.

Moreover, idiosyncratic variables, in particular idiosyncratic income, should not influence relative consumption growth. Put differently, the influence of idiosyncratic shocks is diversified away. On the other hand, if a complete set of Arrow Debreu securities is not available, consumption growth rates are likely to respond to shocks to idiosyncratic variables. For instance if agents face borrowing constraints or follow rule of thumb behavior as emphasized by Campbell and Mankiw (1990) and Bayoumi (1997), consumption growth will depend on idiosyncratic income growth. Thus, a more plausible specification for the empirical analysis is:

$$\Delta \log c_{it} = \beta_0 \Delta \log c_t^a + \beta_1 (\Delta \log y_{it} - \Delta \log y_t^a) + e_{it}, \tag{1}$$

where $c_{it}, c_t^a, y_{it},$ and y_t^a denotes real per capita consumption of country i, aggregate consumption, per capita output and aggregate output. β_0 and β_1 are coefficients and e_{it} is an error term.

Idiosyncratic output growth is proxied by the term $\Delta \log y_{it} - \Delta \log y_t^a$. Subtracting aggregate output growth eliminates global shocks to some extent and helps to reduce the amount of multicollinearity among the right hand side variables. Testing the joint hypothesis that $\beta_0 = 0$ and $\beta_1 = 1$ constitutes a test of perfect risk sharing. Equations similar to (1) have been estimated by Cochrane (1991) and Mace (1991) with micro data and by Lewis (1996) with international data.

Asdrubali *et al.* (1996) suggest to interpret β_1 as the fraction of shocks that is not smoothed. Define $\tilde{y}_{it} \equiv y_{it}/y_t^a$ as the ratio of country i income to aggregate income and similarly $\tilde{c}_{it} \equiv c_{it}/c_t^a$ as the ratio of country i consumption to aggregate consumption. The argument is based on the following identity: $\tilde{y}_{it} = (\tilde{y}_{it}/\tilde{c}_{it})\tilde{c}_{it}$. Taking logarithms and first differences of this identity gives:

$$\Delta \log \tilde{y}_{it} = (\Delta \log \tilde{y}_{it} - \Delta \log \tilde{c}_{it}) + \Delta \log \tilde{c}_{it}. \tag{2}$$

Multiplying both sides of (2) by $\Delta \log \tilde{y}_{it}$, subtracting the means from both sides and taking expectations results in

$$var(\Delta \log \tilde{y}_{it}) = cov(\Delta \log \tilde{y}_{it} - \Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it}) + cov(\Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it}), \quad (3)$$

where var and cov denote the variance and covariance in the cross section. Dividing by $var(\Delta \log y_{it})$ gives:

$$1 = \frac{cov(\Delta \log \tilde{y}_{it} - \Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it})}{var(\Delta \log \tilde{y}_{it})} + \frac{cov(\Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it})}{var(\Delta \log \tilde{y}_{it})}. \quad (4)$$

Note that $cov(\Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it}) = 0$ corresponds to perfect risk sharing since consumption growth is uncorrelated with income growth in this case. However, if $cov(\Delta \log \tilde{c}_{it}, \Delta \log \tilde{y}_{it}) > 0$, then risk sharing is limited since consumption growth comoves with income growth. Thus, the second term on the right hand side can be interpreted as a measure of the fraction of shocks that is not smoothed. Note furthermore that this measure of risk sharing is equal to the ordinary least squares estimate of β_1 in (1) after imposing the restriction $\beta_0 = 1$.

3 Results

The Data used in this paper is annual and covers the period 1960 - 2002. The sample includes the EU-15 countries with the exception of Luxembourg, which is excluded due to limited data availability. Series on real per capita consumption and real per capita GDP are taken from the database of the European Commission. The estimation allows for country-fixed effects. Aggregate consumption and output are calculated as population weighted averages. In order to account for autocorrelation, it is assumed that the error term follows an AR(1) process for each country. All reported test statistics and significance levels are calculated from White corrected covariance matrices.

Results from the estimation of (1) are presented in Table 1. The estimate of β_0 is 0.9 and therefore close to what models with complete markets predict. The null $\beta_0 = 1$ cannot be rejected at the 10 percent level. However, the estimate of β_1 is significantly greater than zero and consequently domestic consumption growth reacts to idiosyncratic income growth, which contradicts perfect risk sharing. The null hypothesis of perfect consumption risk sharing, that is the joint hypothesis that $\beta_0 = 1$ and $\beta_1 = 0$ is rejected at a high level of significance.

As discussed in Section 2, the coefficient on idiosyncratic income growth can be interpreted as the fraction of shocks that is not smoothed. Thus, approximately

35 percent of idiosyncratic income shocks are smoothed among the countries included in the analysis. This is slightly below what Sorensen and Yosha (1999) report. They find that about 40 percent of income shocks are smoothed.[2] Asdrubali *et al.* (1996) find that risk sharing among US states is considerably higher. In particular, about 75 percent of idiosyncratic income shocks are smoothed among the states in the US.

Next, it will be examined whether institutional aspects and in particular characteristics of a country's legal system related to investor protection can help to explain the rejection of risk sharing. Kehoe and Perri (2002) who demonstrate that a model with incomplete markets due to enforcement problems can generate cross country consumption correlations that are much closer to the data than a model with complete markets would predict.

Moreover, in a series of papers, La Porta *et al.* (1997, 1998) argue that financial systems are to a large degree determined by the legal framework. Since the risk-return relationship that investors base their decisions on is likely to depend on the characteristics of the financial system and consequently also on legal aspects, it seems plausible that legal systems also determine the amount of risk sharing that can be achieved. In addition, a certain degree of sophistication of the domestic financial system might be needed to fully exploit the gains from international asset trade. To the extent that institutional aspects also determine the development and sophistication of financial markets this provides another channel through which international risk sharing might be influenced.

In order to internationally diversify domestic risks, foreign investors must be willing to buy domestic assets and vice versa. However, countries with poor investor protection may not be able to sell assets abroad, which will reduce the amount of risk sharing that can be achieved through international financial markets. Moreover, a low level of investor protection can lead to less international diversification of domestic portfolios since domestic investors have an incentive to become controlling investors at home in order to protect their rights. Although countries with good investor protection should be able to attract foreign investors, international diversification might also be difficult to achieve since domestic agents might not be willing to invest in countries where investor rights are poorly protected.[3] Thus, whether countries with good investor protection are characterized by more or less exposure to idiosyncratic risks is ambiguous.

The empirical strategy will be to augment (1) with interaction terms that capture the influence of the variables under consideration on the exposure to idiosyncratic income growth. The restriction $\beta_0 = 1$ is imposed in the following estima-

[2]Their sample consists of only eight EU member countries and the sample period is slightly different.

[3]See Giannetti and Koskinen (2003).

tions in order to allow for an interpretation according to Asdrubali *et al.* (1996). The following specification will be used:

$$\Delta \log c_{it} - \Delta \log c_t^a = \alpha_i + \beta(\Delta \log y_{it} - \Delta \log y_t^a)X_{it} + e_{it}, \tag{5}$$

where X_{it} is a vector containing variables that allow to group countries according to institutional and legal characteristics of their financial markets and β is a vector of coefficients.

The additional data used in this Section is from La Porta *et al.* (1998) who construct indices that can be used as proxies for investor protection.

The first variable analyzed is the creditor rights index, CR_i. This index takes on higher values when it is rather easy for creditors to take possession of collateral in case of default. That is, larger values of this index imply more rights for creditors. Let $CR1_i$ be a dummy that takes on the value one if $CR_i < 2$ and zero otherwise. The dummies $CR2$, $CR3$, are defined similarly, $CR2_i = 1$ if $CR_i = 2$ and $CR3_i = 1$ if $CR_i > 2$.

Equation (5) is estimated with $X_{it} = (CR1_i, CR2_i, CR3_i)$. The second column of Table 2 shows the results. Somewhat surprisingly, it appears that countries that offer good protection for creditors are characterized by a higher exposure to idiosyncratic shocks. For countries characterized by a value of the creditor rights index of at most one, the point estimate for the risk sharing coefficient is 0.64. Put differently, 36 percent of idiosyncratic shocks are smoothed. For countries in the medium range, this fraction decreases to 20 percent, and for countries with the best protection for creditors, the null of no risk sharing can not be rejected.

The hypothesis that all countries achieve the same amount of risk sharing can be rejected at a high level of significance. However, equality of the coefficients cannot be rejected for countries falling within the first two categories. Thus it appears that according to the the relationship between creditor rights and risk sharing countries can be classified into two groups, where better investor protection is associated with a higher fraction of uninsured shocks.

The remaining columns of Table 2 repeat the estimation with countries grouped according to the shareholder rights index, SR_i. A high value of this index indicates that shareholders find it less difficult to vote out directors. The dummy variables $SR1, SR2, SR3$ are defined analogously to the ones used in the previous exercise. Again, countries with institutional frameworks that provide good protection for shareholders appear to be more exposed to idiosyncratic shocks.

Overall, it seems that the sensitivity of consumption growth to idiosyncratic income growth and therefore to the amount of risk sharing that can be achieved is indeed related to the quality of investor protection and therefore to the enforceability of contracts. In particular, countries that provide good protection for investors seem to be more exposed to idiosyncratic shocks. A possible explanation could

be a more pronounced home bias in countries with good investor protection. Giannetti and Koskinen (2003) argue that investors from countries with institutions that provide good investor protection are not willing to invest in countries that provide poorer protection. Hence, investors in countries with good investor protection hold portfolios that are biased towards domestic assets, which also limits the amount of insurance against country specific shocks that can be achieved.

As an additional analysis, the estimation will be repeated with countries grouped according to either the quality of their system of legal enforcement, the enforcement of insider trading laws and accounting standards. La Porta *et al.* (1998) argue that a strong system of legal enforcement could substitute for low investor protection. They calculate an index that can be used as a proxy for the quality of enforcement. In order to group countries according to this index, a dummy variable, denoted by EF_i is used that takes on the value one if the enforcement index for country i is above the mean of the enforcement index and zero otherwise. Next, countries are grouped according to whether insider trading laws are enforced, which appears to be another important aspect of investor protection. Let IN_{it} be a dummy that takes on the value one if insider trading laws are enforced. Accounting standards are also considered, since low accounting standards might impose considerable information costs. Countries are grouped according to whether they have above or below average accounting standards. AC_i is a dummy that takes on the value one if the index for accounting standard from La Porta *et al.* (1998) is above average for country i and zero otherwise.

Table 3 displays the results for these three variables. In general, the results from Table 2 are confirmed. Countries characterized either by a strong system of legal enforcement, the enforcement of insider trading laws or good accounting standards have consumption allocations that tend to be more exposed to idiosyncratic shocks. However, equality of the coefficients across countries cannot be rejected for IN_{it}.

Finally, the estimation is repeated with the original variables included in X_{it} instead of the dummies. This allows to incorporate all the information available in the various indices. Table 4 shows the results. Basically, the findings from the earlier regressions are confirmed. The coefficients on all interaction terms have positive signs, indicating that an increase in the respective proxy for investor protection also increases the exposure to idiosyncratic shocks. Hence, higher levels of investor protection are associated with a higher fraction of uninsured shocks. However, it turns out that only the interaction terms involving the creditor rights index and the quality of enforcement are significantly greater than zero. Shareholder rights and in particular accounting standards do not appear to play a role.

4 Summary and Conclusion

This paper analyzes international risk sharing among EU countries. First, it is found that the extent of consumption risk sharing is substantially smaller than among states in US which confirms results previously reported in the literature.

Next, it is explored whether the amount of consumption risk sharing is related to institutional and legal aspects that determine a country's financial system. Some indications are found that this is indeed the case. The estimation results suggest that countries with good institutions in the sense of good investor protection tend to be more exposed to idiosyncratic shocks. This is particularly true for countries with good protection for creditors and a highly efficient legal system. A potential explanation for this result is the argument presented in Giannetti and Koskinen (2003) according to which good investor protection might induce a home bias and could therefore reduce the amount of consumption risk sharing that can be achieved.

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Table 1: Testing for Risk Sharing

β_0	0.9094 (0.0494)
β_1	0.6514 (0.0462)
Adj. R^2	0.56
$p - val(H_0 : \beta_0 = 0, \beta_1 = 1)$	0.00

Notes to Table 1: Standard errors in parenthesis. Standard errors and test statistics are calculated with White Heteroskedasticity-Consistent Covariance Matrix.

Table 2: Institutional Variables and Risk Sharing.

	$X = (CR1, CR2, CR3)$		$X = (SR1, SR2, CR3)$	
β_1	0.6424	(0.0778)	0.4308	(0.1137)
β_2	0.8027	(0.1105)	0.7924	(0.0738)
β_3	1.1829	(0.1208)	0.8439	(0.1296)
Adj. R^2	0.50		0.49	
$p - val(H_0 : \beta_1 = \beta_2 = \beta_3)$	0.00		0.01	
$p - val(H_0 : \beta_1 = \beta_2)$	0.23		0.00	
$p - val(H_0 : \beta_2 = \beta_3)$	0.02		0.72	

Notes to Table 2: Standard errors in parenthesis. Standard errors and test statistics are calculated with White Heteroskedasticity-Consistent Covariance Matrix.

Table 3: Institutional Variables and Risk Sharing.

	$X = (EF, 1 - EF)$		$X = (IN, 1 - IN)$		$X = (AC, 1 - AC)$	
β_1	0.8072	(0.0572)	0.7040	(0.0682)	0.7936	(0.0550)
β_2	0.5974	(0.0588)	0.6546	(0.0635)	0.5924	(0.0711)
Adj. R^2	0.42		0.41		0.41	
$p - val\ (H_0 : \beta_1 = \beta_2)$	0.00		0.59		0.03	

Notes to Table 3: Standard errors in parenthesis. Standard errors and test statistics are calculated with White Heteroskedasticity-Consistent Covariance Matrix. Due to limited data availability, Ireland is excluded from the estimation including the dummy for accounting standards.

Table 4: Institutional Variables and Risk Sharing.

	$X = (SR, CR, AC, EF, 1)$		
β_1	0.0553		(0.0481)
β_2	0.0849	*	(0.0465)
β_3	0.0007		(0.0045)
β_4	0.0712	**	(0.0314)
β_5	-0.2203		(0.2698)
Adj. R^2	0.43		

Notes to Table 3: Standard errors in parenthesis. Standard errors are calculated with White Heteroskedasticity-Consistent Covariance Matrix. ** and * stand for 5% and 10% significant. Due to limited data availability, Ireland is excluded from the estimation.