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Regional risk-sharing in Ukraine

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Contents

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Abstract

This paper analyzes the impact of ethnic heterogeneity and military conflict on the degree of regional consumption risk-sharing in Ukraine. Ethnicity and violent conflicts can influence risk-sharing e.g. through social capital, ethnic fractionalization, migration, and remittances. The sample consists of 25 Ukrainian oblasts and covers the highly volatile period from 2003 to 2016. Our results suggest that the degree of consumption risk-sharing is comparably high; between 70 and 80 percent on average. Moreover, consumption risk-sharing is significantly higher in the regions with a large Russian minority, which are enjoying special treatment by Russia. By contrast, the degree of financial development, as proxied by deposit and loan share in GRP, does not significantly affect the regional degree of consumption risk-sharing. Furthermore, we apply spatial models to control for spatial dependence across regions. Results are confirmed and it is shown that spatial correlation is important. Finally, we show that the recent geopolitical conflict in east Ukraine changed the regional degree of consumption risk-sharing.

JEL-Codes: E32; E21; R12; P25.
Keywords: Ukraine; risk-sharing; ethnic heterogeneity; social capital; remittances; spatial regression.

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1 Introduction

Consumption risk-sharing is a highly debated topic in the field of international finance and macroeconomics. It is defined as a decoupling of aggregate consumption from aggregate income**.** Channels of consumption risk-sharing are tax transfers, loans, saving and deposits (Asdrubali et al. 1996) as well as remittances (Balli and Rana 2015). A high degree of risk-sharing means that income shocks are smoothed between the regions, which reduces a need for fiscal policy measures. This underlines the high relevance of the analyzed issue for the economic policy. Remittances can represent an especially important channel of risk-sharing for developing and emerging economies because their financial institutions are less developed than in industrialized countries. Risk-sharing analysis for emerging economies is especially important because previous literature is focusing on OECD countries.

Research in the field of consumption risk-sharing for Ukraine is especially interesting because of its heterogeneous ethnic composition and the War in Donbass, the east of the country. Based on these country characteristics, the degree of consumption risk-sharing as well as the channels that smooth consumption risk-sharing may differ compared to industrialized countries. For example, Fidrmuc and Degler (2020) show that for Russian regions, consumption risk-sharing is high, and that spatial correlation is important between regions. The availability of loans increases consumption risk-sharing. Bank credits increase risk-sharing only if the main economic centers of Moscow and Saint Petersburg are included.

We use data for 25 Ukrainian oblasts[1] and cover the highly volatile period from 2003 to 2016. The value added by this paper to literature on the subject is three-fold. *First*, it analyzes consumption risk-sharing in an ethnically heterogeneous society and under the circumstances of a military conflict between ethnic groups. *Second*, it applies a panel dataset which has not been used in the context of consumption risk-sharing. *Third*, we use ethnic structure as a proxy for social capital, ethnic fractionalization, migration, and remittances as key channels of risk-sharing in Ukraine. Atamanov et al. (2009) simulate in a computable general equilibrium (CGE) model that the impact of remittances accounts for 7 percent of GDP and even 14 to 21 percent of total consumption in Ukraine.

Ethnicity can affect the degree of consumption risk-sharing through several channels. Lower trust and social capital levels in regions with ethnic minorities (Gundacker and Fidrmuc 2017) can affect consumption risk-sharing, while social capital changes especially in periods of conflict (Guriev and Melnikov 2016). Moreover, ethnic fractionalization may lower cooperation across regions, and this also affects risk-sharing (Alesina and La Ferrara 2005). Furthermore, ethnic

[1] The Kyiv region and city as well as the Autonomous Republic of Crimea and Sevastopol have been combined to one oblast.

minorities may be engaged in trade. Rauch and Trindade (2002) find that ethnic minorities help foster trade links between their country of residence and the ancestral country. Additionally, migration and remittances may be higher because ethnic minorities can possess language and social skills, or the national roots of their ancestors can make them more easily eligible for long or short-term immigration than most of the population (Balli and Rana 2015). Many countries (including, for example Germany, Israel, or Hungary) support immigration from their diasporas. Russia, for instance, applies both compatriot programs as well as simplified citizenship procedures for immigrants with an ethnic Russian background (Karachurina, 2013). Finally, other factors can include discrimination of members of ethnic groups, regional-specific factors (location, distance, and sectoral structure), etc.

Our results show that average consumption risk-sharing is comparably high, reaching about 70 to 80 percent. Within regions with a large Russian population consumption risk-sharing is significantly higher. By contrast, the degree of financial development, as proxied by deposit and loan share in GRP, does not significantly affect the regional degree of consumption risk-sharing. The War in Donbass had multiple consequences on the affected regional economies. On the one hand, it induced significant income and consumption shocks. On the other hand, several channels of risk-sharing were weakened as well. For example, financial institutions were unable to operate, and family and friendship networks were broken. Consequently, remittances from and labor opportunities in the neighboring regions in Russia were interrupted. In sum, this has resulted in a lower degree of risk-sharing in the countries as a whole and even more in the regions directly influenced by the fights. Thus, we document another channel, how the conflict in east Ukraine adversely affects the well-being of the directly involved regions as well as the country.

The rest of the paper is structured as follows. Section 2 reviews permanent income theory and macro-economic theory as the theoretical foundation of risk-sharing and gives an overview of the existing literature on consumption risk-sharing. Section 3 briefly summarizes the recent history in Ukraine. Section 4 introduces our dataset and presents our empirical strategy. Section 5 presents our panel regressions results and discusses them. Section 6 summarizes and concludes.

2 Literature review

The permanent income hypothesis states that an individual's consumption is consistent with their expected long-term income (Friedman 1957). This means that only changes in permanent income affect consumption patterns. Further, macroeconomic theory states that in a complete market (i.e. assuming convex preferences, perfect competition, and independent demand) consumption is highly

correlated across regions. Therefore, consumption should be equalized in different countries or regions after an income shock (Lewis 1999). Thus, we would expect a high degree of consumption risk-sharing across countries and regions.

However, empirical data disproves the theory. For example, Backus et al. (1992) show that, across countries, income is generally more highly correlated than consumption. Furthermore, Sørensen and Yosha (1998) find for 14 OECD countries that transitory income-shocks are more likely to be smoothed (40 percent) than long-lasting income-shocks (25 percent). Becker and Hoffmann (2006) even show that 27 OECD countries do not share any idiosyncratic consumption risk, neither in the short run nor the long run. One reason for this striking discrepancy between theory and empirics may be found in the strong assumptions of a perfect market. Obstfeld and Rogoff (2001) argue that iceberg transport costs hinder perfect consumption risk-sharing.

Demyanky et al. (2008) find that a common currency raises the degree of risk-sharing. European Monetary Union members (EMU) increased their level of consumption risk-sharing from 42 to 53 percent after the introduction of the euro. Moreover, Kose, Prasad and Terrones (2009) show that financial integration improved risk-sharing in 21 industrial countries, but not in 48 developing countries. In this regard, Bai and Zhang (2012) argue that bounded financial market integration due to incomplete contracts and limited enforceability of debt repayment hampers perfect consumption risk-sharing.

Furthermore, previous literature has shown that consumption risk-sharing tends to be higher within national states than between counties. For example, Asdrubali et al. (1996) find that, for the period from 1963–1990, for the 50 US states, risk-sharing stood at about 75 percent. The channels of risk-sharing are as follows: 39 percent of consumption is smoothed ex-ante via capital markets (cross-ownership of assets), 23 percent ex-post via the credit market (loans) and 13 percent institutionalized via the federal government (tax transfers). The remaining 25 percent of consumption risk-sharing remains unsmoothed. Their findings are confirmed by Crucini (1999) who shows that the degree of consumption risk-sharing was high for the 50 US states and also the 10 Canadian provinces (about 90 percent) in approximately the same period (1970–1991), as compared with about 37–60 percent for the G-7 countries. These findings are also in line with Becker et al. (2006), whose results show that between 30 and 50 percent of idiosyncratic consumption risk was shared for the 50 US regions between 1960 and 1996.

In a nutshell, previous literature agrees that consumption risk-sharing is significantly higher between regions than between countries, unless they share a common currency. Financial integration is shown to be important only for industrialized countries and not for developing countries. The determinants of risk-sharing in developing countries might be different and need to be

examined more profoundly. This paper intends to address this research gap by analyzing conventional and unconventional channels of risk-sharing in Ukraine. We use the ethnic minorities, as a proxy for social capital, ethnic fractionalization, migration, and remittances, to analyze its impact on the degree of risk-sharing. Moreover, this paper will reveal the impact of a violent conflict on the degree of risk-sharing.

3 Ethnic minorities and the war in Donbass

Ukraine is a multinational country because of its historical development. Ethnic and cultural differences have a significant impact on the nature of processes in Ukrainian regions in regard of demographic, social, and economic aspects. That is why we pay significant attention to these differences in our paper. Many Ukrainian oblasts have a large Russian minority. On average, about 13 percent of Ukraine's population are ethnic Russians, while an even larger share of the population reports Russian as the native language (21 percent).[2] Ethnic heterogeneity across regions is substantial and there are no regions with a fully homogeneous population. The share of Ukrainian nationality is at least 24 percent and never more than 98 percent. Behind Russians, the Tatar minority accounts for 10 percent of the population in Crimea, and other ethnic groups (especially Romanians and Hungarians) account for up to 20 percent of the population in three regions (see Table A.2 and Figures A.1 to A.3).

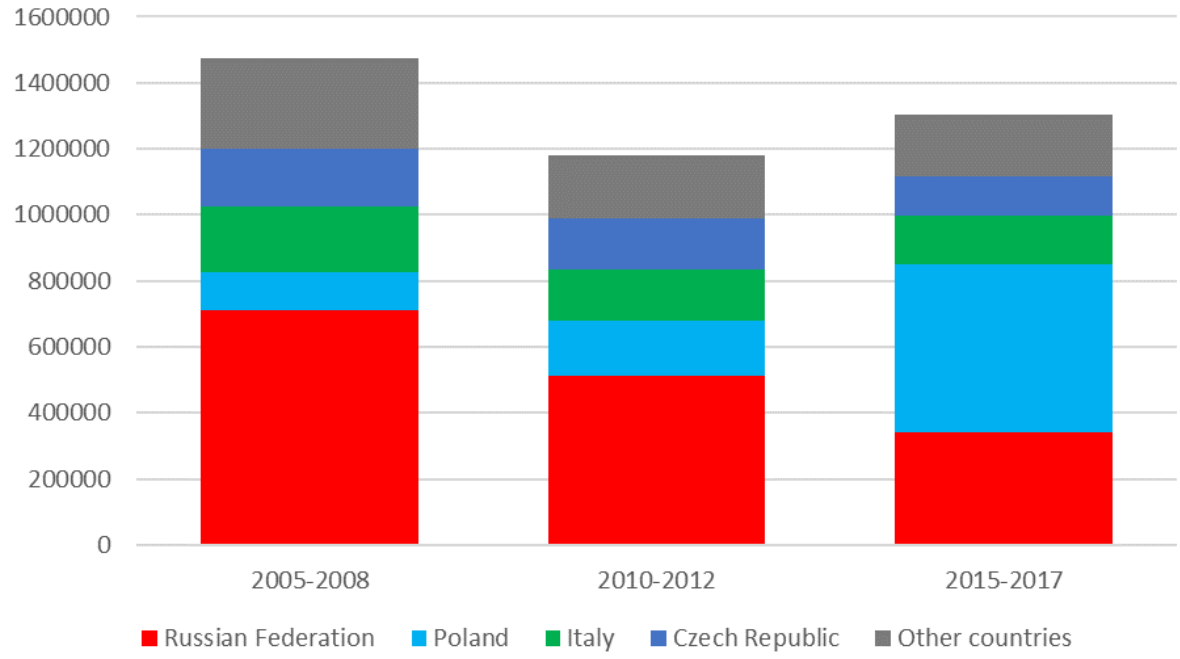
The historical and political roots as well as the economic implications of the current conflict are strong and complex. The recent outbreak started in November 2013, after the former president of Ukraine, Victor Yanukovych, refused to sign the Ukraine-European Union Association Agreement. This induced massive protests in Kyiv which spread across the country. However, this also strengthened the separation-movements in the Donetsk and Luhansk oblasts, which are pro-Russian orientated (Korovkin and Makarin 2019). Since the beginning of the conflict, Russia has strongly supported the pro-Russian rebels in the Donetsk and Luhansk oblasts (Treisman 2018). Moreover, Russia annexed the Autonomous Republic of Crimea in February 2014. The separatists declared independence of Donetsk and Luhansk from Ukraine in April 2014 and held a disputed referendum on separation from Ukraine in May 2014, which started the so-called War in Donbass. The legitimacy of these steps was never recognized by the Ukrainian Government, the EU, the USA, and the UN. Moreover, numerous countries have imposed sanctions on Russia in response to the annexation of Crimea and the conflict in east Ukraine (Dreger et al. 2016). Currently, the separatists control approximately a third of the territory of the Donetsk and Luhansk oblasts (including the cities of

[2] The data comes from the most recent Ukrainian population census in 2001, which is approximately the beginning of our data set (2003).

Donetsk and Luhansk), which represents the so-called zone where the "anti-terrorist" operation is conducted.

The War in Donbass has destabilized the whole country since Ukraine's industrial center, with heavy industries such as coal mining and metallurgy, is located in the eastern part of the country. The armed conflict not only destroyed highways, railways, airports, and other transport infrastructure in the conflict area (Pham et al. 2018) but also directly decreased the financial well-being of civilians (Osiichuk and Shepotylo 2020). The conflict also imposed new administrative and political barriers for transport and migration to or from Russia. As a result, migration from Ukraine to Russia decreased significantly (see Figure 1 and Table A.3).

Figure 1 Main countries of destination of Ukrainian labor migrants, persons



Source: Own calculations based on the data of Ukrainian Center for Social Reforms, State Statistics Committee of Ukraine (2009), ILO, State Statistics Service of Ukraine, Ptoukha Institute for Demography and Social Studies of the National Academy of Sciences of Ukraine (2013), State Statistics Service of Ukraine (2017).

4 Data and empirical strategy

4.1 Data description

The sample consists of 25 Ukrainian oblasts (see Table A.2). The annual data covers the period 2003–2016. The data is retrieved from the State Statistics Service of Ukraine, the National Bank of Ukraine, and the 2001 Ukraine Population Census. The geodata is provided by the United Nations Office for the Coordination of Humanitarian Affairs.

The main information source is the State Statistics Service of Ukraine. *First,* using its website, statistical databases, and publications, we collected annual regional data on indicators, such as

gross regional product, consumer price index, permanent population and final consumption expenditures.[3] *Second*, we include annual regional data of the National Bank of Ukraine on deposits of the corporate sector and households, as well as loans provided by depository corporations to the corporate sector and households as shares of GRP. *Third*, we use the population data of the 2001 Ukraine Population Census, which includes detailed information about the regional distribution of the population by nationality. *Finally*, we obtained the shapefile (i.e. geographical coordinates and regional maps) of Ukraine from the United Nations Office for the Coordination of Humanitarian Affairs. The descriptive statistics of the main variables are summarized in Table 1.

Table 1 Data description for the years 2003-2016

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Ukrainian (%)	350	81.896	16.964	24.015	97.806
Russian (%)	350	13.185	14.373	1.247	60.403
Tatars (%)	350	0.533	2.100	0.007	10.782
Other (%)	350	4.385	5.260	0.656	20.885
GRP per capita (UAH)	347	20556.745	17326.729	2739.241	149786.641
Consumption per capita (UAH)	347	14784.034	10946.188	2086.704	69672.617
Deposits (% of GRP)	347	25.921	10.663	10.780	77.275
Loans (% of GRP)	347	32.151	23.800	6.130	167.316

Source: Own computation.

4.2 Empirical strategy

Combining the permanent income hypothesis with macroeconomic theory of consumption correlation across countries and regions leads us to the risk-sharing hypothesis. The risk-sharing hypothesis states that regional consumption per capita is not related to region-specific income shocks. Hence, a change in national income should evenly affect consumption in all regions. The risk-sharing hypothesis can be expressed as follows:

$$C_{it} - \bar{C}_{it} = \beta \, (Y_{it} - \bar{Y}_{it}) + \varepsilon_{it} \qquad (1)$$

The variables C and Y represent consumption per capita and income per capita of region i at time t, respectively. The variables $\bar{C}$ and $\bar{Y}$ are the arithmetic averages of consumption per capita and income per capita over all regions, excluding the region of investigation. The idiosyncratic shocks are denoted by ε. The coefficient β measures the degree of risk-sharing and can be interpreted as follows:

[3] The data is available on a regional level. Using the consumer price index and the permanent population we calculated the real gross regional product per capita as well as the real final consumption expenditures per capita.

$\beta = 0$ implies perfect risk-sharing

$1 - \beta > 0$ defines the degree of risk-sharing

4.2.1 Fixed effects model

Following the earlier literature (Asdrubali et al. 1996, Sørensen and Yosha, 1998), the degree of risk-sharing can be estimated in a linear ordinary least squared regression model, which can include fixed effects and additional control variable.[4] We can express the equation as follows:

$$\tilde{C}_{it} = \alpha_i + \theta_t + \beta \tilde{Y}_{it} + \sum_{k=1}^{K} \gamma_k x_{itk} \tilde{Y}_{it} + \varepsilon_{it} \quad (2)$$

The variable $\tilde{C}$ denotes the difference between consumption per capita of a certain oblast at a certain time, and the average consumption per capita over all regions at that time without the one under consideration, with both values in logarithms. $\tilde{Y}$ is computed alike for income. The parameters α and θ denote region and time fixed effects, respectively. The coefficient β measures the extent to which output deviation per capita from the country average explains consumption deviation per capita from the region average, i.e. it measures the degree of risk-sharing. The interaction term $x\tilde{Y}$ denotes k additional control variables which can affect the degree of risk-sharing with a parameter γ_k. The error term ε_{it} represents all disturbances.

The previous literature for developed and emerging economies showed that the degree of financial development is an important factor increasing international risk-sharing. However, less evidence for this channel was found for developing economies (Kose et al. 2009). To control for this potential channel of consumption risk-sharing, we include regional specific financial development, proxied by deposits and loans share of GRP.

Social capital, ethnic fractionalization, migration, and remittances can represent another channel of risk-sharing (Balli and Rana 2015). To proxy for this channel, we consider the regional share of the Russian and Tatar minorities (other minorities are used as the base category) in Ukrainian regions. Given the large size of the Ukrainian workforce abroad, particularly in Russia, remittances are likely to play a key role for regional risk-sharing. In comparison, the Tatars are less connected and hence regions with this minority should show a lower degree of risk-sharing.

4.2.2 Spatial lag model

Moreover, a spatial econometric model is used to incorporate spillover effects from neighboring regions. This approach reflects that, *first*, nearby outcomes may affect outcomes, *second*, nearby

[4] The Hausman test rejects the null hypothesis that the random effect model is unbiased. Correspondingly, we estimate fixed effect models.

covariates may affect outcomes, and *third*, nearby residuals may affect outcomes.[5] In other words, the income and consumption developments may be correlated between neighboring regions. For example, positive or negative income growth can spill over into neighboring regions. People can commute to growing regions, which can strengthen consumption in their home regions. Therefore, it is important to control for spatial correlation in a spatial regression analysis.

Our preferred model is the lagged dependent variable regression model. It reflects that the consumption level per capita of a region is affected by the consumption levels per capita in neighboring regions. We can express the equation as follows.

$$\tilde{C}_{it} = \alpha_i + \theta_t + W\,\tilde{C}_{it} + \beta\,\tilde{Y}_{it} + \sum_{k=1}^{K}\gamma_k\, x_{itk}\tilde{Y}_{it} + \varepsilon_{it} \quad (3)$$

We use a contiguity matrix including all direct neighbors and their neighbors (first-order and second-order neighbors) which are equally weighted. All other variables are defined as above.

The spatial lag model implements the quasi-maximum likelihood (QML) estimator proposed by Lee and Yu (2010). The estimation modifies the approach originally developed by Baltagi et al. (2003, 2007) and Kapoor et al. (2007), who consider spatial models with random effects. Lee and Yu (2010) show that fixed effect spatial models are robust to different specifications in Baltagi et al. (2003) and Kapooret al. (2007), while they are computationally simpler than the ML approach for the estimation of the generalized random effects model in Baltagi et al. (2007).

5 Results

5.1 Fixed effects regression results, 2003–2013

In the first step, we estimate risk-sharing between Ukrainian regions before the War in Donbass (see Table 2). In the specification (1), we can see that regional income shocks do not significantly affect the consumption pattern. Moreover, the traditional channel of risk-sharing through the financial sector, that is the degree of financial development, as proxied by deposits and loans share of GRP, does not affect significantly the regional degree of risk-sharing in Ukraine in specification (2) and (3) either.[6] This would imply a perfect degree of risk-sharing, which is a surprising result for Ukraine, given, for example, the size of consumption fluctuations between the regions. Alternatively, this result can reflect the omitted variable bias as factors that are important in Ukraine but

[5] We use command "spxtregress" with fixed effects in Stata 16. Because the results of the Hausman test for panel estimations recommend the application of fixed effect models, we also use the same approach also in the spatial analysis model. In addition to the spatial lag model, we conduct a spatial lagged dependent variable regression model, a spatial lagged independent variable regression model, a spatial lagged error term regression model, as well as a regression combining all three methods (Table A.5) as a part of our robustness analysis.

[6] The institutional quality can influence the effectivity of the financial sector (Fidrmuc et al. 2017, Deltuvaité et al. 2019).

not covered by the standard control variables. Therefore, we include ethnic structure which proxies a broad variety of factors: differences in social capital (Gundacker and Fidrmuc 2017, Guriev and Melnikov 2016), ethnic fractionalization (Alesina and La Ferrara 2005), and migration and remittances (Balli and Rana 2015).

Table 2 Risk-sharing within Ukraine, FE regression, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.089 (0.116)	0.148 (0.128)	0.078 (0.122)	0.640*** (0.154)	0.636*** (0.144)	0.675*** (0.147)	0.676*** (0.159)
$\tilde{Y}_{it} \times rus$				–0.034*** (0.007)	–0.032*** (0.006)	–0.037*** (0.006)	–0.038*** (0.007)
$\tilde{Y}_{it} \times tat$						0.192*** (0.030)	0.198*** (0.032)
$\tilde{Y}_{it} \times deposits$ [a]		–0.103 (0.160)			0.008 (0.153)	–0.011 (0.154)	
$\tilde{Y}_{it} \times loans$ [a]			0.004 (0.071)		0.005 (0.054)	0.009 (0.053)	
$deposits$ [a]		0.206 (0.288)			0.234 (0.255)	0.233 (0.253)	
$loans$ [a]			–0.088 (0.079)		–0.109 (0.079)	–0.107 (0.080)	
No of obs.	275	275	275	275	275	275	275
No of regions	25	25	25	25	25	25	25
R^2_o	0.575	0.664	0.144	0.387	0.426	0.427	0.389
Risk-Sharing	insig.	insig.	insig.	0.805	0.788	0.706	0.725

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.

Source: Own computation.

In specification (4) we can see that the interaction variable of the Russian minority and the regional income deviations per capita is negative (confirming that ethnic structure lowers the transmission of income shocks to consumption) and highly significant. Moreover, the regional income deviations per capita also become highly significant in the augmented specifications (5) to (7). Adding the Tatar ethnicity decreases regional risk-sharing significantly. By contrast, all financial variables remain insignificant in the remaining columns. The degree of risk-sharing within the whole of Ukraine is shown to be about 70 to 80 percent before 2014.[7]

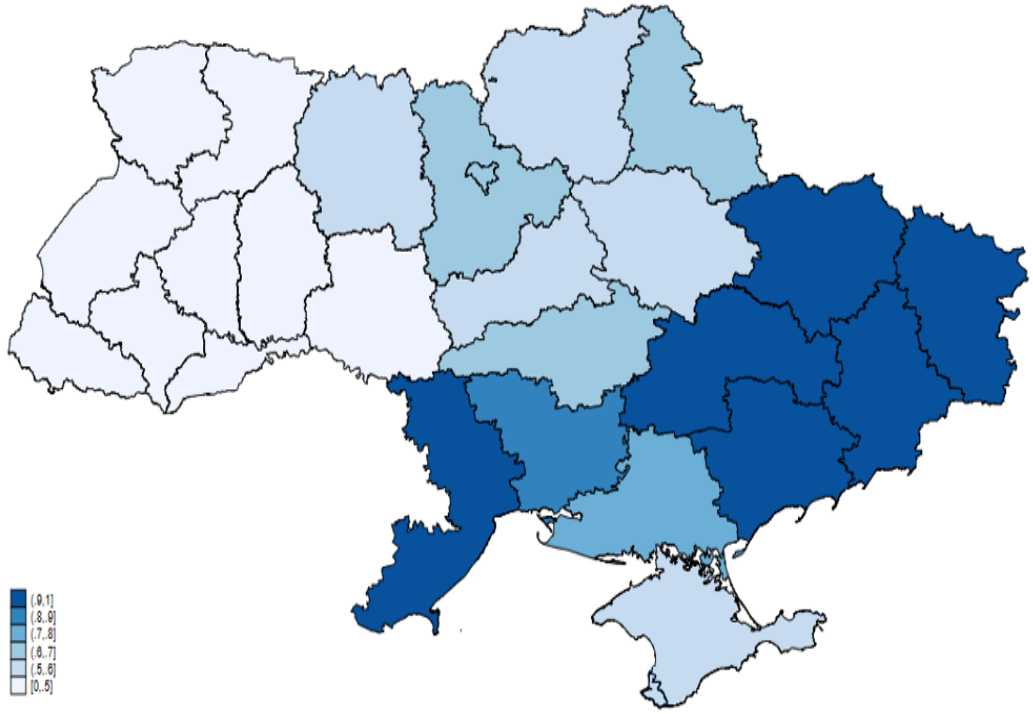
Ethnic interaction terms keep the negative signs but becomes insignificant if consumption risk-sharing per capita is estimated in first differences (see Table A.4 in the appendix). The weak

[7] Calculation for specification (7) is as follows: $1 - \beta_{\tilde{Y}} - (\beta_{\tilde{Y}rus} \times \overline{rus}) - (\beta_{\tilde{Y}tat} \times \overline{tat})$ = 1 – 0.676 – (–0.038 ×13.190) – (0.198×0.533) ≈ 0.725.

performance of the estimation in first differences may imply that mainly long-term income shocks are shared.

For individual regions, the degree of risk-sharing was highly heterogeneous given the different shares of Russian minorities (see Figure 2, more details are presented in appendix B). The implied degree of risk-sharing varies between nearly 0 in west Ukraine and 1 in eastern Ukraine with high proportion of the Russian minority (see Table A.2 and Figures A.1 to A.3).

Figure 2 Risk-sharing by oblast, FE regression, 2003–2013



Source: Own compilation.

5.2 Spatial regression results, 2003–2013

In the next step, we consider spatial correlation between Ukrainian regions (see Table 3). In our preferred spatial model, we include the spatially lagged dependent variable defined as direct as well as secondary neighbors. Table 3 confirms fully the previous results: income shocks are insignificant in the base specification (1) but positive and significant in the extended specification (4). The interactions of income deviations per capita and ethnic structure are again highly significant but all other interaction variables remain mainly insignificant. The degree of risk-sharing for the whole of Ukraine is almost identical when using a spatial regression.

The spatial lag model reflects that consumption is affected by the consumption in neighboring regions. We find a negative correlation. This pattern may seem to be unexpected at first

glance. It contradicts positive spatial autocorrelation which is confirmed for income levels (consumption levels show no significant spatial autocorrelation, as predicted by consumption smoothing hypothesis). Nevertheless, this pattern is consistent with a situation where employees commute and thus generate income in a different region from their consumption. Shopping in the neighboring regions can also lead to this pattern. It can be also explained by informal transfers within families and friendship networks within different neighboring regions. In Table 3 it can be also interesting to note that the coefficients of the spatial lags are often higher than 1 in absolute value, which may be related to the definition of dependent variable as consumption deviation per capita from the national average. According to our preferred specifications (4) in Tables 2 and 3, the degree of risk-sharing within the whole of Ukraine was about 70 to 82 percent before 2014, independent of the estimation method.

Table 3 Risk-sharing within Ukraine, spatial lagged dependent variable regression, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.092 (0.063)	0.171** (0.074)	0.123* (0.068)	0.575*** (0.110)	0.592*** (0.113)	0.629*** (0.114)	0.608*** (0.110)
$\tilde{Y}_{it} \times rus$				–0.030*** (0.006)	–0.028*** (0.006)	–0.032*** (0.006)	–0.034*** (0.006)
$\tilde{Y}_{it} \times tat$						0.177* (0.093)	0.181* (0.094)
$\tilde{Y}_{it} \times deposits$ [a]		–0.194 (0.122)			–0.046 (0.156)	–0.064 (0.155)	
$\tilde{Y}_{it} \times loans$ [a]			–0.045 (0.040)		–0.017 (0.055)	–0.014 (0.055)	
$deposits$ [a]		0.201 (0.126)			0.229* (0.126)	0.228* (0.125)	
$loans$ [a]			–0.012 (0.027)		–0.091* (0.048)	–0.089* (0.048)	
$W \times \tilde{C}_{it}$	–1.136*** (0.225)	–1.188*** (0.227)	–0.936*** (0.216)	–1.030*** (0.222)	–1.093*** (0.223)	–1.090*** (0.222)	–1.024*** (0.221)
No of obs.	275	275	275	275	275	275	275
No of regions	25	25	25	25	25	25	25
Risk-Sharing	insig.	0.829	0.877	0.815	0.774	0.700	0.742

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.

Source: Own computation.

5.3 Impact of the war in Donbass

The results change dramatically when looking only at the years of the War in Donbass between 2014 and 2016 (see Table 4). However, we have to keep in mind that the number of observations is

low for this sample (three observations per region, 72 observations in total). Moreover, data is no longer available for Crimea. We also drop the last specification comparing the Russian and Tatar minorities, because the Tatar minority is concentrated in Crimea, which was annexed by Russia in 2014.

The conditions of the War in Donbass result in highly nonstandard results. The coefficient of income deviation per capita is significant and larger than one in specifications (1) to (3), meaning that consumption deviations are even larger than the underlying income shocks. In specifications (4) to (6), this coefficient becomes insignificant, while its interaction term with the Russian minority becomes significantly positive. This would also imply negative risk-sharing, which is inconsistent with macroeconomic theory.

Table 4 Risk-sharing within Ukraine, FE regression during the war in Donbass, 2014–2016

	(1)	(2)	(3)	(4)	(5)	(6)
$\tilde{Y}_{it}$	1.402***	1.627***	1.447***	–0.124	–0.291	–0.301
	(0.266)	(0.274)	(0.275)	(0.164)	(0.245)	(0.244)
$\tilde{Y}_{it} \times rus$				0.052***	0.051***	0.033**
				(0.008)	(0.008)	(0.014)
$\tilde{Y}_{it} \times tat$						1.972
						(1.641)
$\tilde{Y}_{it} \times deposits$ [a]		–0.734*			2.111	1.975*
		(0.420)			(1.312)	(1.133)
$\tilde{Y}_{it} \times loans$ [a]			–0.154		–0.962*	–0.907*
			(0.112)		(0.507)	(0.442)
$deposits$ [a]		1.605**			0.259	0.161
		(0.677)			(0.419)	(0.454)
$loans$ [a]			0.343		0.130	0.136
			(0.204)		(0.117)	(0.126)
No of obs.	72	72	72	72	72	72
No of regions	24	24	24	24	24	24
R^2_o	0.591	0.609	0.575	0.837	0.883	0.856

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP. The implied risk-sharing would be inconsistent with economic theory (negative) and hence is not reported.

Source: Own computation.

In addition to standard estimation problems due to the low number of observations, this shocking feature can be explained by several factors. *First*, income data may be heavily underestimated. *Second*, population decreases consumption even more than the income shocks in order to save money for expected future income declines. *Third*, supply shortages can restrict consumption development. Finally, a part of the population has been evacuated or left the regions for security reasons.

Furthermore, we can see that the coefficient for the Russian minority has changed its sign. This is not surprising because the regions in eastern Ukraine with the highest Russian minority were mostly affected by the War in Donbass. There are also most important problems with unreliable data because parts of the regions are controlled by the separatists.

5.4 Robustness analysis

The main results are highly robust regarding several robustness checks for the pre-war estimation period 2003–2013. These results remain almost unchanged when excluding the main economic center of the Kyiv region & city (see Table 5). The degree of risk-sharing changes only by one percentage point in the preferred specification (7). The results are also similar if alternative spatial regression models, spatial lags of covariates and spatial autoregressive errors, are used (see Table 6).

Table 5 Risk-sharing within Ukraine, FE regression without Kyiv region & city, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.090 (0.113)	0.155 (0.170)	0.125 (0.145)	0.595*** (0.147)	0.695*** (0.173)	0.747*** (0.180)	0.630*** (0.152)
$\tilde{Y}_{it} \times rus$				–0.031*** (0.006)	–0.032*** (0.005)	–0.037*** (0.006)	–0.035*** (0.007)
$\tilde{Y}_{it} \times tat$						0.210*** (0.027)	0.195*** (0.032)
$\tilde{Y}_{it} \times deposits$ [a]		–0.258 (0.671)			–0.432 (0.459)	–0.510 (0.454)	
$\tilde{Y}_{it} \times loans$ [a]			–0.108 (0.185)		–0.020 (0.142)	–0.008 (0.140)	
$deposits$ [a]		0.064 (0.370)			–0.053 (0.327)	–0.073 (0.325)	
$loans$ [a]			–0.053 (0.063)		–0.052 (0.061)	–0.048 (0.061)	
No of obs.	264	264	264	264	264	264	264
No of regions	24	24	24	24	24	24	24
R^2_o	0.274	0.306	0.157	0.138	0.0849	0.0286	0.0779
Risk-Sharing	insig.	insig.	insig.	0.811	0.725	0.631	0.733

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.

Source: Own computation.

Table 6 Risk-sharing within Ukraine, comparison of spatial methods, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Method	SLDV	SLDV	SLIV	SLIV	SLIV	SLIV	SLE	SLE	Comb	Comb
$\tilde{Y}_{it}$	0.674***	0.602***	0.724***	0.660***	0.712***	0.661***	0.657***	0.573***	0.684***	0.640***
	–5.9	–5.44	–5.87	–5.5	–5.78	–5.55	–5.54	–4.88	–5.81	–5.53
$\tilde{Y}_{it} \times rus$	–0.034***	–0.033***	–0.039***	–0.038***	–0.039***	–0.039***	–0.031***	–0.030***	–0.034***	–0.034***
	(–5.62)	(–5.59)	(–5.94)	(–5.92)	(–6.08)	(–6.09)	(–4.96)	(–4.72)	(–5.66)	(–5.62)
$\tilde{Y}_{it} \times deposits$ [a]	0.187**	0.176*	0.201**	0.193*	0.203**	0.196*	0.160*	0.145	0.180**	0.168*
	–2	–1.89	–1.99	–1.92	–2.01	–1.94	–1.71	–1.56	–1.99	–1.88
$\tilde{Y}_{it} \times loans$ [a]	–0.210*		–0.125		–0.113		–0.276**		–0.223**	
	(–1.81)		(–1.00)		(–0.90)		(–2.38)		(–1.99)	
$deposits$ [a]		–0.0262		0.0053		–0.00583		–0.0673		–0.0871**
		(–0.59)		–0.11		(–0.12)		(–1.63)		(–2.20)
$loans$ [a]	0.139		0.135		0.129		0.167		0.16	
	–1.16		–1.03		–0.99		–1.36		–1.34	
$W \times \tilde{\tilde{C}}_{it}$	–1.088***	–1.079***							–1.045***	–1.034***
	(–4.88)	(–4.85)							(–3.10)	(–3.17)
$W \times \tilde{Y}_{it}$			0.102	0.0363					0.0619***	0.0645***
			–0.43	–0.15						
$W \times \tilde{Y}_{it} \times rus$ [a]					0.016	0.0131			–3.71	–3.91
					–1.35	–1.06				
$W \times \varepsilon_{it}$							–1.036***	–1.033***	–0.253	–0.2
							(–4.38)	(–4.28)	(–0.81)	(–0.66)
No of obs.	275	275	275	275	275	275	275	275	275	275
No of regions	25	25	25	25	25	25	25	25	25	25
Risk-Sharing	0.668	0.741	0.677	0.74	0.692	0.744	0.662	0.738	0.666	0.714

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively.
Time effects are not reported. a – percentage of GRP.
SLDV – spatial lagged dependent variable model,
SLIV – spatial lagged independent variable model,
SLE – spatial lagged error model, comb – combi. of different spatial terms.

Source: Own computation.

In addition, we define a dummy variable for regions with a significant Russian minority (approximately 14 percent or more, which represents the average share of Russian minority in the whole of Ukraine) as an alternative measure of ethnic diversity. This also reflects that the data for ethnic structure is available only from the population census in 2001. For the prewar period (2003–2013), income deviations per capita and the interaction of income deviations per capita with the dummy variable are significant (see appendix C). The implied levels of risk-sharing are very similar to our previous estimations.

Finally, we consider further minorities in Ukraine, including all other nationalities of the former Soviet Union countries and EU countries. To allow for possible non-linearities, we also include quadratic terms of minority shares. The results show that other minorities and quadratic terms are insignificant. Alternatively, we use the Shannon index to take a deeper look at heterogeneity. The results are like our preferred estimations (see appendix D).

Overall, the results are in line with Fidrmuc and Degler (2020) who found that between 70 and 90 percent of idiosyncratic income risk is smoothed across Russian regions. Moreover, spatial correlation was also shown to be important between Ukrainian regions. The results are also in line with Kose et al. (2019) who show that financial integration improves risk-sharing outcomes only in developed countries but not in developing countries such as Ukraine.

6 Conclusions

For a long period of time, Ukraine has been under a strong influence of Russia. The aggravation of relations between the countries occurred when Ukraine had declared its commitment to European values and intentions of joining the EU in the future. For Ukraine, the military conflict in Donbass is a shock that will have long-term negative consequences. This conflict significantly affects life in east Ukraine. The directly involved regions, Donetsk and Luhansk, belonged to the most developed areas. Nowadays, key parts of infrastructure are destroyed, economic ties between Ukrainian and Russian enterprises are disrupted, and the war-regions are in international isolation. As a result, population experienced a sharp decline in the living standards, also in the regions not directly involved in the Donbas war.

Our results suggest that consumption risk-sharing in Ukraine differs significantly from developed economies. On the one hand, traditional factors of risk-sharing, i.e. the degree of financial developments, seem to be largely inefficient. On the other hand, social capital, ethnic fractionalization, migration, and remittances (estimated with our proxy Russian minority) represent a significant channel of risk-sharing.

On average, risk-sharing reached a comparably high level of 70 to 80 percent, while there can be significant regional differences in risk-sharing corresponding to different ethnic structures.

Moreover, spatial correlation also plays an important role in risk-sharing. We observe a negative spatial correlation of consumption deviations between regions and their neighbors. This can be consistent with a situation where commuters generate income and make shopping in one region and consume in other regions, or with informal transfers of income within family and friendship networks. This implies that informal ways of risk-sharing within family and friendship networks may play an important role in Ukraine as well.

In addition, our results show that the War in Donbass drastically changed the degree of regional consumption risk-sharing. We can see that consumption response to income shocks is overshooting, possibly as a result of unreliable statistics, supply shortages, saving behavior, etc. This documents several channels in terms of how the conflict in east Ukraine can have important adverse implications for the welfare of the Ukrainian population.

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[retrieved on 18th of October 2019]

Appendix A Statistics and definitions

Table A.1 Definition of analyzed variables

Variable	Definition	Source
Consumer price indices	Consumer price indices measures changes in the price level of market basket of consumer goods and services purchased by households.	State Statistics Committee of Ukraine State Statistics Service of Ukraine
Deposits	Deposits of the corporate sector and households, by region mln. UAH	Source: data received from National Bank of Ukraine
Final consumption expenditures of households	In actual prices, mln. UAH	State Statistics Committee of Ukraine (2011). (Incomes and expenditures of the population in 2009 by region of Ukraine. Statistical publication, Kyiv) State Statistics Service of Ukraine (2019). (Incomes and expenditures of the population in 2017. Statistical publication, Kyiv)
Gross regional product	In actual prices, mln. UAH	State Statistics Committee of Ukraine (2009). (Regions of Ukraine 2009. Part II. Statistical publication, Kyiv) State Statistics Service of Ukraine (2012). (Regions of Ukraine 2012. Part II. Statistical publication, Kyiv) State Statistics Service of Ukraine (2017). (Regions of Ukraine 2017. Part II. Statistical publication, Kyiv) State Statistics Service of Ukraine (2018). (Gross regional product in 2016. Statistical publication, Kyiv).
Permanent population	Permanent population in Ukraine - total (at the beginning of the year)	http://database.ukrcensus.gov.ua/MULT/Dialog/statfile_c.asp
Loan	Loans provided by depository corporations (with exclusion of the National Bank of Ukraine) to the corporate sector and households, by region mln. UAH	Source: data received from National Bank of Ukraine
Ukraine, Russian, other speaker	Percentage of Ukraine speakers	http://database.ukrcensus.gov.ua/MULT/Database/Census/databasetree_en.asp

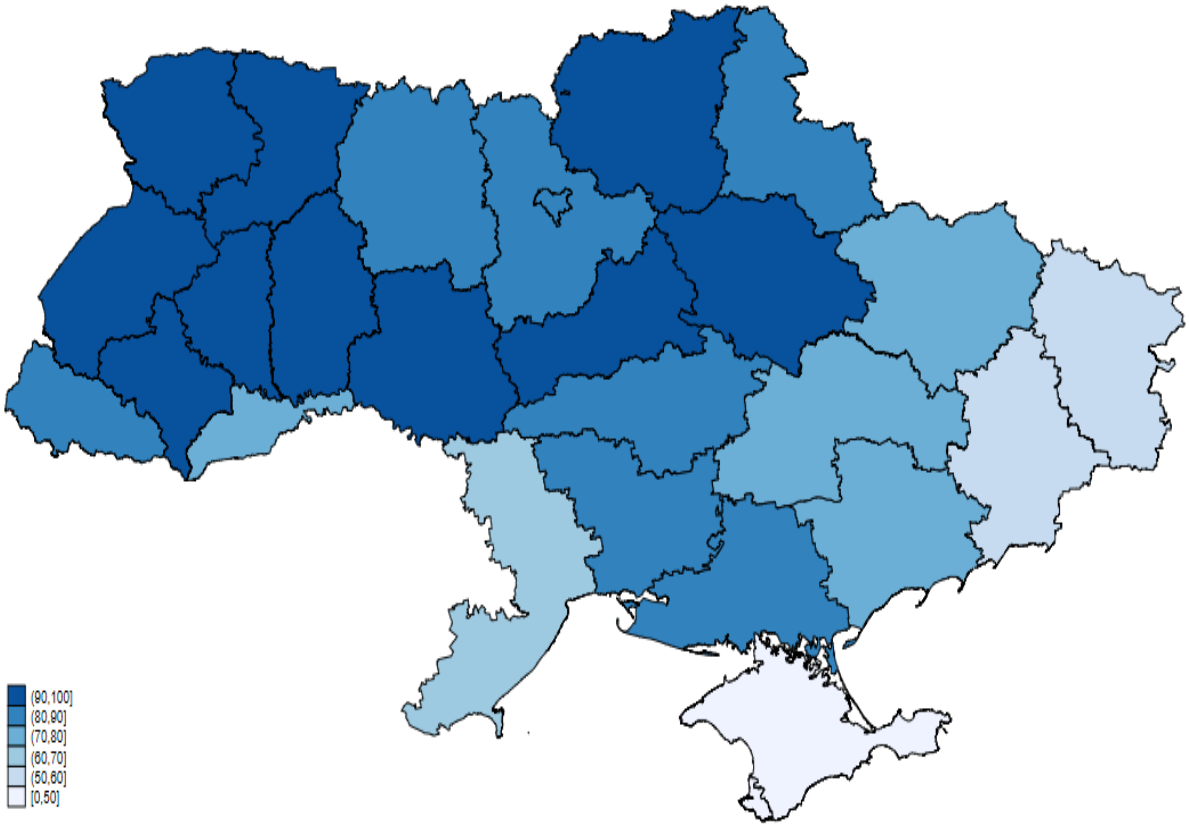
Source: See the source in column three of this table, own compilation.

Table A.2 List of Ukrainian regions with selected ethnic minorities

Region	Ukrainian (%)	Russian (%)	Tatars (%)	Other (%)
Cherkasy	93.054	5.405	0.035	1.507
Chernihiv	93.470	5.033	0.031	1.466
Chernivtsi	74.977	4.122	0.016	20.885
Crimea and Sevastopol	24.015	60.403	10.782	4.801
Dnipropetrovsk	79.349	17.621	0.108	2.922
Donetsk	56.867	38.221	0.397	4.514
Ivano-Frankivsk	97.519	1.773	0.011	0.697
Kharkiv	70.747	25.624	0.144	3.485
Kherson	81.998	14.088	0.630	3.283
Khmelnytskiy	93.880	3.553	0.029	2.539
Kirovohrad	90.132	7.456	0.042	2.371
Kyiv region & city	86.499	10.179	0.076	3.247
Luhansk	57.963	39.045	0.336	2.656
Lviv	94.823	3.552	0.023	1.603
Mykolayiv	81.910	14.057	0.098	3.935
Odesa	62.807	20.709	0.105	16.379
Poltava	91.362	7.221	0.047	1.3698
Rivne	95.899	2.572	0.011	1.5181
Sumy	88.839	9.381	0.028	1.751
Ternopil	97.806	1.247	0.007	0.941
Vinnytsya	94.909	3.827	0.023	1.241
Volyn	96.949	2.377	0.018	0.656
Zakarpattya	80.513	2.470	0.017	17.000
Zaporizhzhya	70.796	24.743	0.295	4.167
Zhytomyr	90.323	4.956	0.030	4.691

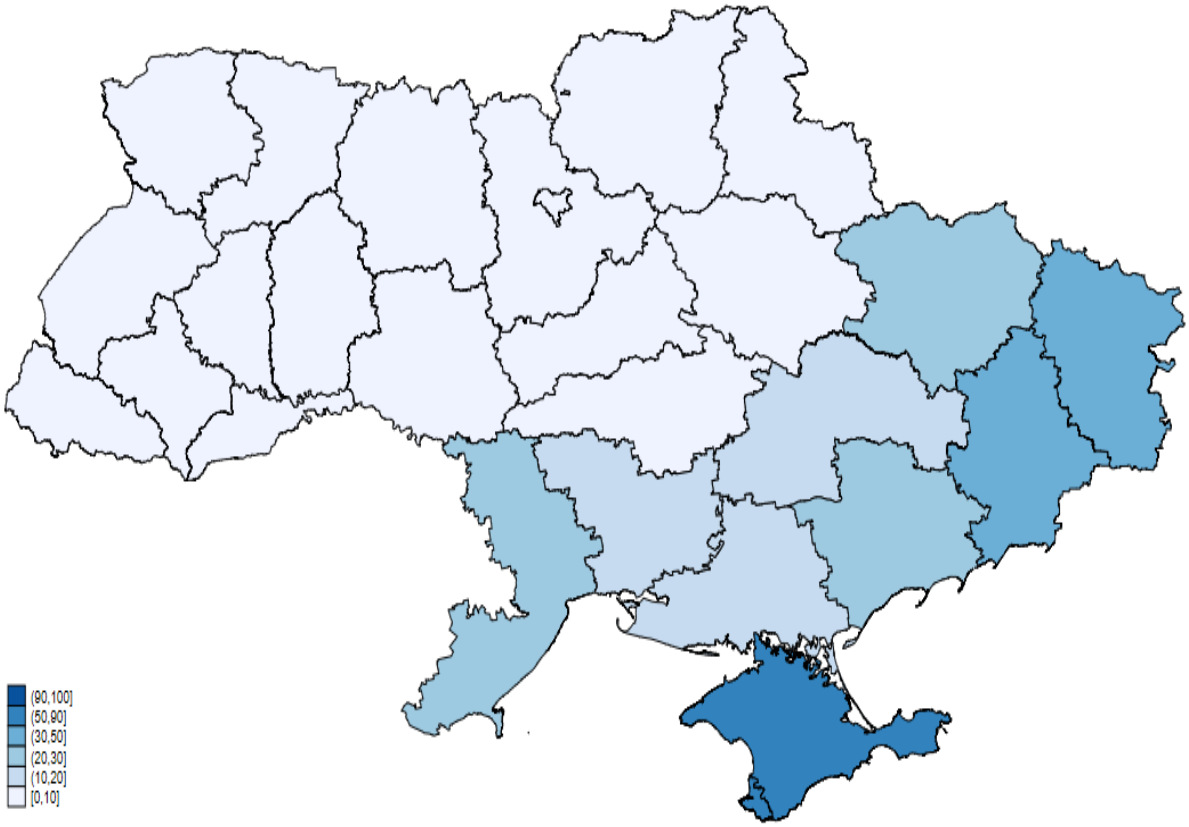
Source: own compilation, http://database.ukrcensus.gov.ua/MULT/Database/Census/databasetree_en.asp.

Figure A.1 Population structure, share of Ukrainians



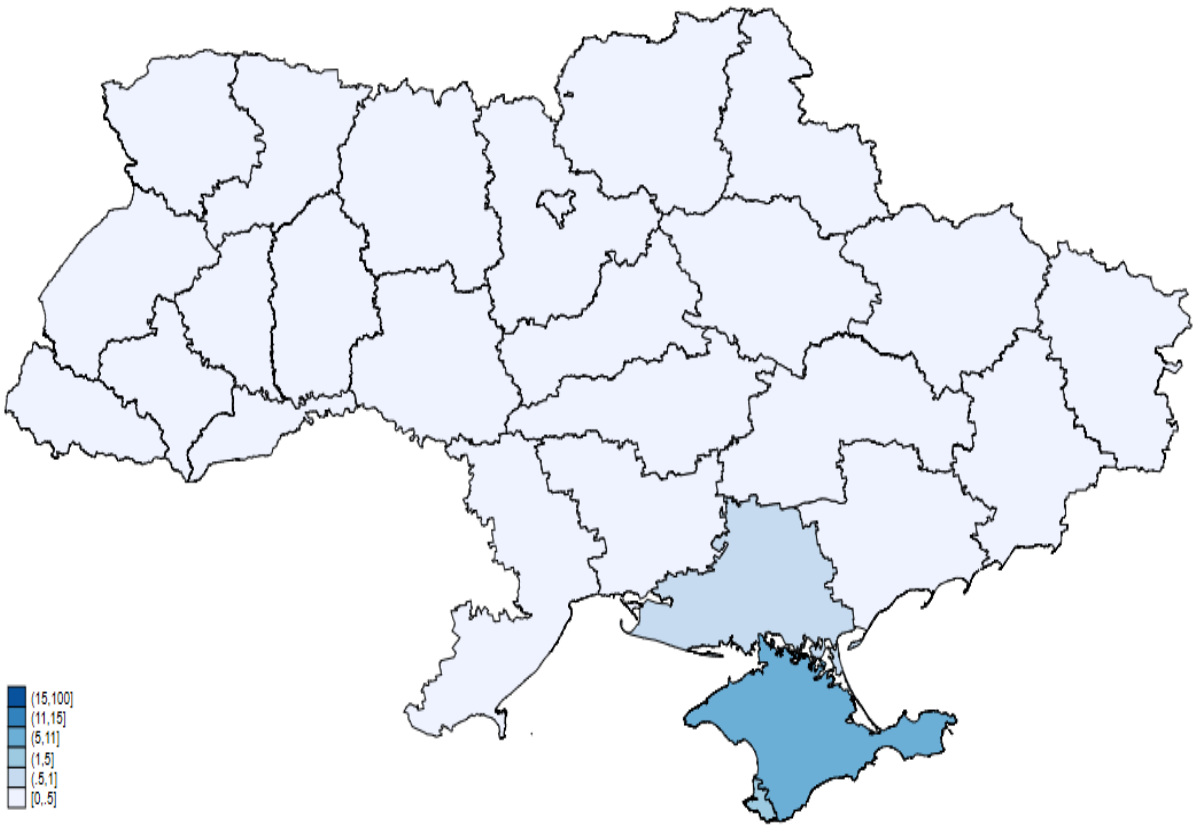
Source: Own compilation.

Figure A.2 Population structure, share of Russians



Source: Own compilation.

Figure A.3 Population structure, share of Tatars



Source: Own compilation.

Table A.3 Migration by duration of stay abroad in selected countries, thousand persons

Country	duration of stay abroad				
	until 1 month	1–3 months	3–6 months	6–12 months	more than 12 months
2005–2008					
Russian Federation	76.7	330.3	125.0	120.8	57.5
Poland	20.8	65.5	20.5	7.1	4.2
Italy	3.2	19.8	15.7	81.9	77.7
Czech Republic	27.3	51.8	57.1	22.6	16.3
Other countries	25.5	81.7	41.5	42.2	83.4
Total	153.5	549.1	259.8	274.6	239.1
2010–2012					
Russian Federation	61.3	256.0	99.6	49.6	44.5
Poland	52.7	76.6	31.7	3.5	3.9
Italy		2.8	37.4	46.8	69.0
Czech Republic	6.0	19.3	83.2	30.8	13.7
Other countries	25.3	18.7	23.4	52.4	73.4
Total	145.3	373.4	275.3	183.1	204.5
2015–2017					
Russian Federation	16.4	206.1	76.4	35.6	7.9
Italy	2.8	9.1	23.2	49.7	61.9
Poland	112.9	238.1	120.5	17.7	17.3
Czech Republic	8.0	65.7	34.3	11.1	3.4
Other countries	31.9	47.9	37.5	26.7	41.2
Total	172.0	566.9	291.9	140.8	131.7

Source: authors' own calculations based on the data of Ukrainian Center for Social Reforms, State Statistics Committee of Ukraine (2009), ILO, State Statistics Service of Ukraine, Ptoukha Institute for Demography and Social Studies of the National Academy of Sciences of Ukraine (2013), State Statistics Service of Ukraine (2017).

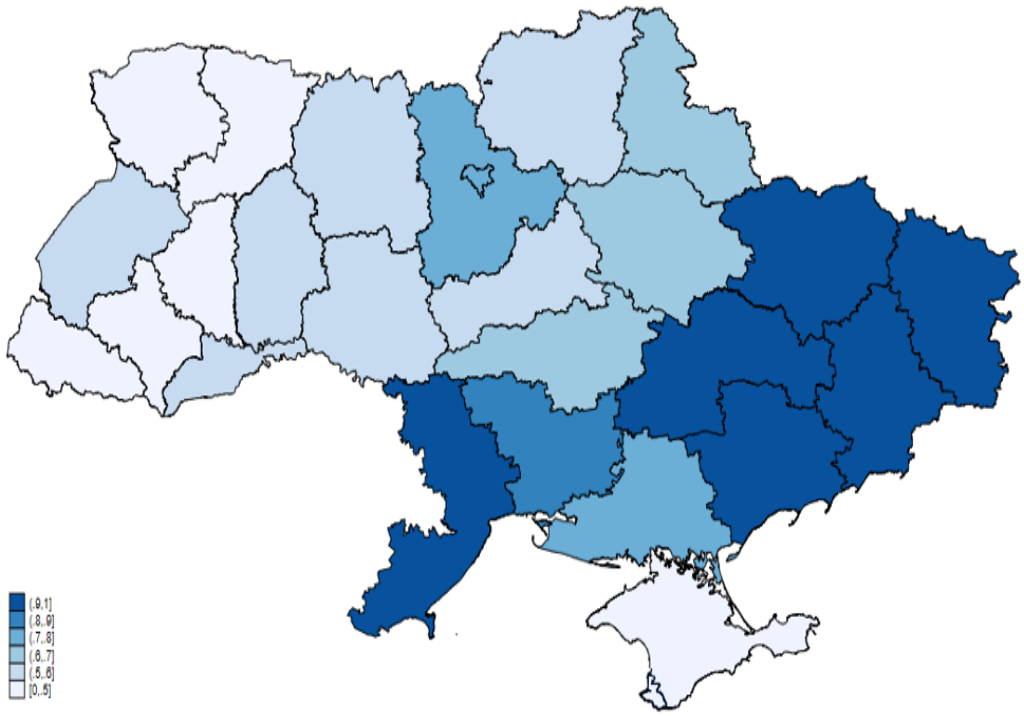
Table A.4 Risk-sharing within Ukraine, first difference regression with FE, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.036 (0.071)	–0.239 (0.145)	–0.119 (0.101)	0.116 (0.121)	–0.180 (0.179)	–0.183 (0.182)	0.115 (0.128)
$\tilde{Y}_{it} \times rus$				–0.005 (0.005)	–0.004 (0.003)	–0.004 (0.004)	–0.005 (0.006)
$\tilde{Y}_{it} \times tat$						–0.007 (0.023)	–0.003 (0.029)
$\tilde{Y}_{it} \times deposits$ [a]		0.960** (0.410)			0.986 (0.744)	0.992 (0.745)	
$\tilde{Y}_{it} \times loans$ [a]			0.350* (0.175)		–0.026 (0.282)	–0.029 (0.282)	
$deposits$		–0.130 (0.099)			–0.065 (0.111)	–0.065 (0.111)	
$loans$ [a]			–0.078 (0.059)		–0.070 (0.060)	–0.070 (0.061)	
No of obs.	250	250	250	250	250	250	250
No of regions	25	25	25	25	25	25	25
R^2_o	0.0122	0.0255	0.0313	0.0253	0.0335	0.0334	0.0252
Risk-Sharing	insig.	insig.	insig.	insig.	insig.	insig.	insig.

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.
Source: Own computation.

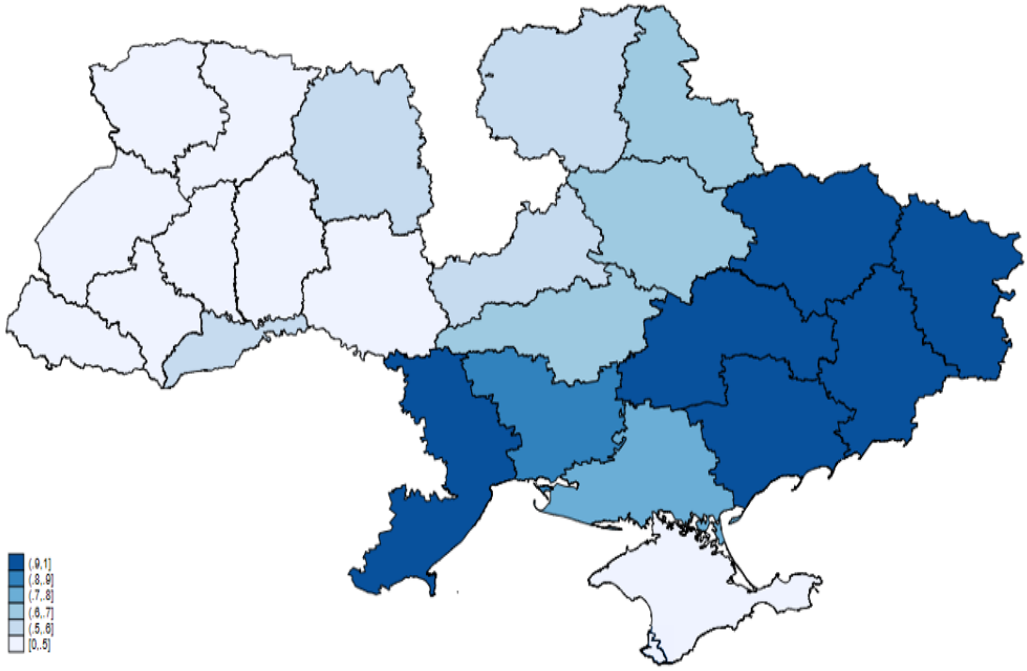
Appendix B Figures – Risk-sharing by oblast

Figure B.1 Risk-sharing by oblast, spatial lagged dependent variable regression, 2003–2013



Source: Own compilation.

Figure B.2 Risk-sharing by oblast, FE regression without Kyiv region & city, 2003–2013



Note: Kyiv region and city are excluded on purpose.

Source: Own compilation.

Appendix C Results with dummy variable (Russian minority above 14 percent)

Table C.1 Risk-sharing within Ukraine, FE regression with dummy variable, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.089 (0.116)	0.148 (0.128)	0.078 (0.122)	0.578*** (0.147)	0.566*** (0.136)	0.567*** (0.136)	0.577*** (0.147)
$\tilde{Y}_{it} \times Drus$				–0.932*** (0.216)	–0.892*** (0.208)	–0.897*** (0.210)	–0.937*** (0.219)
$\tilde{Y}_{it} \times Dtat$						0.844*** (0.175)	0.841*** (0.181)
$\tilde{Y}_{it} \times deposits$ [a]		–0.103 (0.160)			–0.015 (0.165)	–0.019 (0.166)	
$\tilde{Y}_{it} \times loans$ [a]			0.004 (0.071)		0.032 (0.050)	0.033 (0.050)	
$deposits$ [a]		0.206 (0.288)			0.203 (0.274)	0.206 (0.273)	
$loans$ [a]			–0.088 (0.079)		–0.118 (0.085)	–0.118 (0.086)	
No of obs.	275	275	275	275	275	275	275
No of regions	25	25	25	25	25	25	25
R^2_o	0.575	0.664	0.144	0.471	0.478	0.463	0.455
Risk-Sharing	insig.	insig.	insig.	0.758	0.755	0.723	0.727

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.
Source: Own computation.

Table C.2 Risk-sharing within Ukraine spatial lagged dependent variable regression with dummy variable, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.092 (0.063)	0.171** (0.074)	0.123* (0.068)	0.509*** (0.099)	0.515*** (0.103)	0.515*** (0.103)	0.508*** (0.099)
$\tilde{Y}_{it} \times Drus$				–0.796*** (0.149)	–0.741*** (0.150)	–0.746*** (0.150)	–0.801*** (0.149)
$\tilde{Y}_{it} \times Dtat$						0.801 (0.939)	0.786 (0.957)
$\tilde{Y}_{it} \times deposits$ [a]		–0.194 (0.122)			–0.059 (0.157)	–0.063 (0.157)	
$\tilde{Y}_{it} \times loans$ [a]			–0.045 (0.040)		0.006 (0.056)	0.007 (0.056)	
$deposits$ [a]		0.201 (0.126)			0.207 (0.127)	0.210* (0.127)	
$loans$ [a]			–0.012 (0.027)		–0.100** (0.048)	–0.100** 0.515***	
$W \times \tilde{C}_{it}$	–1.136*** (0.225)	–1.188*** (0.227)	–0.936*** (0.216)	–0.967*** (0.223)	–1.019*** (0.225)	–1.019*** (0.225)	–0.966*** (0.223)
No of obs.	275	275	275	275	275	275	275
No of regions	25	25	25	25	25	25	25
Risk-Sharing	0.908	0.829	0.877	0.778	0.752	0.722	0.749

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. a – percentage of GRP.
Source: Own computation.

Table C.3 Risk-sharing within Ukraine without Kyiv region & city, FE regression with dummy variable, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\tilde{Y}_{it}$	0.090 (0.113)	0.155 (0.170)	0.125 (0.145)	0.555*** (0.150)	0.614*** (0.158)	0.615*** (0.158)	0.554*** (0.150)
$\tilde{Y}_{it} \times rus$				–0.875*** (0.216)	–0.922*** (0.237)	–0.928*** (0.241)	–0.881*** (0.219)
$\tilde{Y}_{it} \times Dtat$						0.958*** (0.178)	0.902*** (0.172)
$\tilde{Y}_{it} \times deposits$ [a]		–0.258 (0.671)			–0.437 (0.458)	–0.452 (0.458)	
$\tilde{Y}_{it} \times loans$ [a]			–0.108 (0.185)		0.108 (0.143)	0.111 (0.144)	
$deposits$ [a]		0.064 (0.370)			–0.041 (0.325)	–0.040 (0.325)	
$loans$ [a]			–0.053 (0.063)		–0.054 (0.056)	–0.053 (0.056)	
No of obs.	264	264	264	264	264	264	264
No of regions	24	24	24	24	24	24	24
R^2_o	0.274	0.306	0.157	0.0568	0.0216	0.00696	0.0325
Risk-Sharing	insig.	insig.	insig.	11.99	0.717	0.680	0.727

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.
Source: Own computation.

Table C.4 Risk-sharing within Ukraine, first difference regression with FE and dummy variable, 2003–2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta\tilde{Y}_{it}$	0.036 (0.071)	–0.239 (0.145)	–0.119 (0.101)	0.085 (0.119)	–0.184 (0.180)	–0.188 (0.180)	0.085 (0.119)
$\Delta\tilde{Y}_{it} \times rus$				–0.099 (0.158)	–0.105 (0.118)	–0.099 (0.120)	–0.094 (0.160)
$\tilde{Y}_{it} \times tat$						–0.162 (0.134)	–0.170 (0.146)
$\Delta\tilde{Y}_{it} \times deposits$ [a]		0.960** (0.410)			0.803 (0.754)	0.838 (0.759)	
$\Delta\tilde{Y}_{it} \times loans$ [a]			0.350* (0.175)		0.072 (0.278)	0.054 (0.282)	
$\Delta\, deposits$ [a]		–0.130 (0.099)			–0.065 (0.110)	–0.065 (0.111)	
$\Delta\, loans$ [a]			–0.078 (0.059)		–0.071 (0.060)	–0.072 (0.060)	
No of obs.	250	250	250	250	250	250	250
No of regions	25	25	25	25	25	25	25
R^2	0.0122	0.0255	0.0313	0.0204	0.0323	0.0325	0.0204
Risk-Sharing	insig.	insig.	insig.	insig.	insig.	insig.	insig.

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.
Source: Own computation.

Appendix D Further exploration of heterogeneity

As additional robustness check we perform further analysis of ethnic heterogeneity. Our results hold true, even when a much deeper analysis of ethnic composition is performed. Additionally, to Ukrainians and Russians, we include Tatars, people from other former Soviet Union countries (excluding Baltic States), as well as members of ethnic groups in West Europe and East Europe. Extreme values of homogeneity (i.e. 0 or 100% Ukrainians) are sparse. The share of Ukrainian nationality is at least 24% and never more than 98% and this value is also reported only in two regions, Ivano-Frankivsk and Ternopil. Furthermore, we also included quadratic terms for the main minorities (Russian and Tatars). Alternatively, we also included the Shannon index. This diversity index is defined as follows:

$$H' = -\sum_i p_i \times \ln(p_i) \quad \text{(D.1)}$$

Where p_i is the proportion of the aforementioned nationalities plus the remaining nationalities. The results are highly similar to our preferred estimations.

Table D.1 Shannon-index

	(1)	(2)	(3)	(4)
$\tilde{Y}_{it}$	0.676***	0.765***	0.911***	0.968***
	(0.159)	(0.173)	(0.246)	(0.208)
$\tilde{Y}_{it} \times rus$	–0.038***	–0.038***	–0.078**	
	(0.007)	(0.008)	(0.032)	
$\tilde{Y}_{it} \times tat$	0.198***	0.190***	0.177	
	(0.032)	(0.037)	(0.615)	
$\tilde{Y}_{it} \times fsu$		–4.465		
		(7.787)		
$\tilde{Y}_{it} \times EU\ West$		5.285		
		(8.837)		
$\tilde{Y}_{it} \times EU\ East$		–1.692		
		(8.267)		
$\tilde{Y}_{it} \times sq\ rus$			9.738	
			(6.671)	
$\tilde{Y}_{it} \times sq\ tat$			–101.624	
			(551.201)	
Shannon index				–1.605***
				(0.364)
No of obs.	275	275	275	275
No of regions	25	25	25	25
R^2_o	0.389	0.422	0.306	0.290

Note: Robust standard errors clustered at regions are reported in parentheses. ***, **, * significant at 1%, 5% and 10% levels, respectively. Time effects are not reported. [a] – percentage of GRP.
Source: Own computation.

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