Gains from Financial Integration in the European Union: Evidence for New and Old Members*

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Abstract

We estimate the benefits of financial integration resulting from international risk sharing among the twenty-five EU countries. Under full risk sharing, country-specific output shocks are diversified across the EU members and output volatility of an individual country is not reflected in its consumption. The gains from risk sharing are expressed as the utility equivalent of a permanent increase in consumption. We report positive potential welfare gains for all the EU countries if they move toward full risk sharing. Ten country-members who joined the Union in 2004 would obtain much higher potential gains than the longer-standing fifteen members.

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1 Introduction

In 2004, ten Central and Eastern European countries became members of the European Union (the EU).[1] In addition to political unification, the EU member-countries are moving toward a larger unified market with a joint economic policy and possibly a single currency, the euro. In general, the EU enlargement is considered a welcome development. Still, the entry of new, mostly emerging-market, economies with the history of relatively high macroeconomic volatility sometimes raises concerns among policy-makers and the general public. We estimate potential gains from *financial integration* for the twenty-five current European Union member-countries. Our criterion of integration is the degree of insurance against the country-specific output shocks known in economic literature as "risk sharing." In case of full risk sharing, all country-specific output shocks are completely diversified so that output volatility of an individual country is not reflected in that country's income (full income risk sharing) or consumption (full consumption risk sharing).

Our empirical results show that if the EU country-members move towards full risk sharing, all of them would gain from insurance of country-specific risks.[2] Ten new members would have much higher potential gains compared to the fifteen original EU countries; still, the EU enlargement would not reduce the welfare of the EU-15 members.

Unrestricted international trade is widely believed to be one of the most beneficial aspects of economic integration.[3] The merits of greater financial openness and larger cross-border flows of capital are often disputed because of the recent financial crises and instability they brought to a number of the emerging markets.[4] Further enlargement of the eurozone

[1] The pre-2004 EU included Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and United Kingdom; we call them "the EU-15 members" throughout the paper. Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, and Slovenia joined the EU in May 2004. We call them "the new EU members."

[2] A number of papers starting from van Wincoop (1994) demonstrate that theoretical welfare gains from risk sharing might be quite substantial (Prasad et al. 2003 summarize the utility gain estimates in the literature). We follow the literature and use the term "welfare gains" to represent the gains in utility (in percent) to a representative consumer (or, by extension, a country) from a permanent increase in consumption which are equal to the *potential* expected utility gains when an economy moves to the prefect risk sharing consumption allocation.

[3] See, among others, Sachs and Warner (1995); Frankel and Romer (1999); Rodriguez and Rodrik (2002).

[4] See Rodrik (1998); Bhagwati (1998); Stiglitz (2002). Prasad et al. (2003) survey the empirical evidence on the matter and show that developing countries have not fully attained potential benefits of financial

has additional implications. While country-specific output shocks are undesirable for any economy, the inability of individual members of the eurozone to reduce the impact of the adverse shocks by monetary policy instruments is a major concern for the current and prospective members of the monetary union. If country-specific shocks are prevalent, the lack of independent monetary policy and, in general, the absence of the mechanisms for achieving international risk sharing may lead to a significant loss of welfare.[5]

We compare potential welfare gains resulting from international risk sharing among the EU members and ignore other potential benefits of financial integration.[6] Our analysis is based on two scenarios. Under the first scenario, we estimate "total" potential welfare gains the EU countries can obtain when they move from financial autarky to full risk sharing. The gains are estimated as in Kalemli-Ozcan, Sorensen and Yosha (2001) using the aggregate output (GDP per capita) data under the assumption that in autarky a country consumes its own GDP and under full risk sharing it consumes a portion of pooled group-wide GDP. Under the second scenario, we take into account our finding that the countries have already achieved non-negligible amount of international risk sharing and are not in financial autarky.[7] Therefore we calculate "unexploited" gains from risk sharing when a country moves from the level of consumption observed in the data to the perfect risk

integration and were subject to higher vulnerability to crises.

[5]International risk sharing may materialize through central fiscal institutions and market institutions (see Sorensen and Yosha 1998). *Fiscal institutions* (or a tax-transfer system) provide inter-country income insurance by lowering taxes and increasing transfers to individuals and grants to governments of countries that experience economic hardships. *Market institutions* include developed capital markets through which the members of a union can share risk by smoothing their income via cross-ownership of productive assets (portfolio diversification). Alternatively, consumers may smooth their consumption (given their income) by adjusting their savings rate; i.e., adjusting the size of their asset portfolio in response to shocks.

[6]The other benefits of financial integration can work through several channels. Directly, countries can finance domestic investment beyond domestic saving constraints, obtain capital at lower cost because of a more efficient allocation of world savings (Henry 2003; Stulz 1999), and access new technology (Grossman and Helpman 1991). Indirectly, financial openness can stimulate domestic financial development (Levine 2005; Bekaert, Harvey, and Lundblad 2005), impose discipline on macroeconomic policies, and improve domestic institutions (Rajan and Zingales 2003). Some argue that the indirect (or "collateral") benefits of financial integration might be even more important for growth and welfare than direct benefits (Gourinchas and Jeanne 2006; see Kose et al. 2006 for a recent survey).

[7]We employ the measure of Asdrubali, Sorensen and Yosha (1996) that reflects the sensitivity of national income (GNI per capita) or consumption (private and government consumption) to idiosyncratic output (GDP per capita) fluctuations. It potentially varies from 0 (no risk sharing as in autarky) to 100% (full risk sharing) and represents a percentage of insured idiosyncratic risk to GDP (compared to perfect risk sharing).

sharing consumption allocation. In this case we estimate the measure of Kalemli-Ozcan, Sorensen and Yosha (2001) and a measure proposed by van Wincoop (1994) using total per capita consumption data. The calculation of unexploited gains is important; if countries are already financially integrated to some extent, the total gains relying on the autarky assumption might overstate the unexploited welfare gains.

We find a larger average gain for the new EU member-countries than for the original EU members. The average total gain, in terms of permanent increase of consumption, is 5.2% for the new EU members and 1.2% for the EU-15 members. The consumption-based measure of unexploited welfare gains has the similar pattern: the gains are larger for the new EU members (average of 6.6%) compared to the EU-15 members group (average of 0.9%). In both cases the larger value of the gain is primarily attributed to the output or consumption spending being more volatile or sometimes negatively correlated with the EU-wide output or consumption.

We also discovered that for the most of the new EU members the consumption-based unexploited gains are strictly larger than the GDP-based total gains. If countries have already obtained a non-negligible amount of risk sharing, we would expect the opposite ranking. We speculate that transition from planned to market economies and possible taste shocks (broadly defined) caused dis-smoothing of consumption in the new EU members. It is also possible that the new EU members pursued other goals besides hedging their idiosyncratic output risk. For the EU-15 members as a group, consumption-based estimates of unexploited welfare gains are smaller than the GDP-based total gains. These countries apparently achieved some consumption insurance compared to the autarky case.

The rest of the paper is organized as follows. In Section 2 we describe the basic stylized facts about the data. In Section 3 we evaluate the current extent of financial integration among the EU members based on the degree of international risk sharing at the country level. Section 4 presents the welfare gain estimates. Section 5 concludes.

2 First Look at the Data

2.1 Data description

We work with yearly gross domestic product (GDP) and final consumption expenditures data on the country level and their corresponding aggregates for the twenty-five EU members during the period 1994–2003. All the variables are converted into purchasing power parity adjusted (PPP) US dollars using official exchange rates between a domestic currency and US dollar in the year 1995, deflated by the Consumer Price Index (CPI) with the base year 1995, and expressed in per capita terms.[8] Growth rates of real per capita variables are calculated as first differences of natural log of real per capita level values. Local currency data for *Gross Domestic Product* and *Final Consumption Expenditures* come from the World Development Indicators (WDI) database of the World Bank (2006). Final Consumption Expenditures consists of household final consumption expenditure (formerly private consumption) and general government final consumption expenditure (formerly general government consumption). For several the new EU members the consumption data are not available for the initial several years of our sample period; we linearly extrapolated the data to make up for the missing data points. *Nominal Exchange Rate* data between local currency unit and US dollar in 1995 is taken from the Eurostat database. For calculating per capita measures we use the WDI data for total population, which counts all residents regardless of legal status or citizenship.

2.2 Output and consumption growth rates: Basic stylized facts

Table 1 reports the summary statistics for GDP and total consumption expenditures per capita growth rates of individual countries for the period 1994-2003.[9] The new EU members

[8] When using a utility based measure of fluctuations asymmetry, output must be measured in consumption-equivalent terms. Kalemli-Ozcan, Sorensen, and Yosha (2001) recommend deflating by the CPI rather than by a GDP-deflator. Since our measure is utility based, we want measured output to reflect consumption in autarky (with countries consuming the *value* of their GDP). We want to translate GDP to the amount of consumption that it can buy, therefore, we follow the above recommendation and deflate by CPI.

[9] We concentrate on the total consumption expenditures, which consists of private consumption and government expenditures, since potentially consumption risk sharing may be achieved through an international

group consists of the developing economies with higher and more volatile growth rates than those of the original the EU-15 members . This may have some important implications for the stability of the enlarged Union. Overall, the growth rate for the new EU members is on average 4.2% per annum versus 2.5% for the EU-15 members (median growth rates are 4.2% and 2.1% correspondingly). The standard deviation of output growth is three times larger for the new EU members than for the EU-15 members . Based on the t-test, the differences in means and variances are statistically significant at conventional levels. Both the rate of per capita consumption growth and its variability are statistically and economically larger for the new EU members countries than for the EU-15 members. The average growth rate for the first group is 4.3% versus 1.7% for the latter (median growth rates are 4.1% and 1.7%); the average standard deviations are 5.0% and 1.6%. The more volatile a country's output and consumption are, other things being equal, the larger the gain it receives from and provides to other countries in the group. Judging from the volatility, the new EU members might have larger benefits from joining the Union than the original the EU-15 members.

In standard consumption theory people are risk-averse and therefore prefer to smooth their consumption in the face of idiosyncratic fluctuations in income or output. International and domestic risk sharing should potentially result in smoother income and eventually consumption relative to output. The ratio of the volatility of total consumption to that of output can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to output volatility. The last column of Table 1 reports the ratio of the standard deviation of total consumption per capita growth to that of GDP per capita growth. Despite some within-group exceptions, average volatility of consumption is larger than that of output for the new EU members , but smaller for the EU-15 members; the ratio is equal to 1.3 for the new EU members and 0.9 for the EU-15 members. Prasad et al. (2003) explains this ratio being larger than one as the lack of consumption risk sharing. The caveat

tax-transfer system and saving as discussed in Sorensen and Yosha (1998) for example. Kose, Prasad and Terrones (2003) show that total consumption of emerging markets and OECD countries is on average less volatile than private consumption in the period 1960–1999, the evidence of additional smoothing achieved by government taxes and transfers.

in this interpretation lies in the fact that the consumption data are often affected by taste shocks (broadly defined to include inter alia fiscal or monetary policy, consumer sentiment, etc.).[10] If the taste shocks (and other noise in consumption) are large, they might increase the volatility of consumption despite the possible non-negligible amount of risk sharing. With this caveat in mind we observe that the EU-15 members have achieved significantly better consumption smoothing (relative to output) than the new EU members.[11] At the first approximation, more integrated the EU-15 members have obtained some consumption smoothing in line with Prasad et al. (2003). In contrast, for the new EU members the ratio is greater than unity—evidence of potential room for further consumption insurance that might be facilitated by economic integration.

3 Extent of risk sharing

Asdrubali, Sorensen and Yosha (1996) come up with a measure of the actual amount of risk sharing compared to full risk sharing at a country level. This is a more formal method than the casual exploration of consumption and output volatilities. From the national accounting identity GNI=GDP+NFI if cross-border net factor income flows (NFI) are counter-cyclical they would partially insulate national income (GNI) from idiosyncratic fluctuations in national output (GDP). Further, total consumption may be stabilized relative to GNI because pro-cyclical saving helps insulate consumption from shocks to national income by virtue of the identity CONS=GNI–GROSS NATIONAL SAVING.[12]

We estimate extent of income and consumption risk sharing as the coefficient from the individual country regressions $\widetilde{gdp}_{it} - \widetilde{z}_{it} = \nu_i + \beta\widetilde{gdp}_{it} + \varepsilon_{it}$, where $\widetilde{gdp}$ is the growth rate of per capita output measured at a country level by per capita GDP. When $\widetilde{z}_t$ stands

[10] Stockman and Tesar (1995) show that taste shocks in consumption potentially explain the finding of Backus, Kydland and Kehoe (1992) that, contrary to the theory, the international consumption correlations are low. The low international consumption correlations is a manifestation of low financial integration.

[11] t-statistics in the test that the variable Relative Volatility in Table 1 has the same mean within the two groups is 1.97. We reject the null in favor of alternative that the new EU members has larger mean at 3%.

[12] Asdrubali et al. and Sorensen and Yosha (1998) determine several intermediate channels or risk sharing which are not essential for our analysis. For example, if risk is not fully insured by cross-border net factor income flows, further insurance may be achieved as the result of government international grants and transfers; this is reflected as the difference between National Income and Disposable National Income.

for the growth rate of per capita income measured by per capita GNI, β represents a percentage of idiosyncratic risk to GDP insured through net factor income flows (compared to perfect risk sharing); denoted as $\widehat{\beta}^i$. When $\widetilde{z}_t$ stands for the growth rate of per capita total consumption, β represents a percentage of idiosyncratic risk to GDP insured through net factor income flows, capital depreciation, government international grants and transfers, and saving in credit markets; denoted $\widehat{\beta}^c$. Each variable with tilde ($\widetilde{\cdot}$) represents the growth rate of the variable for an individual country i in time period t minus growth rate of the variable for the empirical world in time period t (e.g, $\widetilde{gdp}_{it} = \Delta \log gdp_{it} - \Delta \log gdp_t^{\text{World}}$). Intuitively income risk sharing β^i shows the sensitivity of national income (GNI per capita) to idiosyncratic output (GDP per capita) fluctuations consumption risk sharing β^c the sensitivity of total (government and private) consumption per capita to idiosyncratic output (GDP per capita) fluctuations.[13] With full income (consumption) risk sharing national income (consumption) grows at the same rate across countries and are independent of idiosyncratic shocks to national output, and $\widehat{\beta} = 100\%$.

Table 2 reports estimated income and consumption risk sharing in percentage points; 100% means full risk sharing. Income risk sharing gives insight on how a country is integrated into international asset markets and how effectively these markets are used to insure national income (measured by Gross National Income per capita) against idiosyncratic shocks to national output (GDP per capita). Notice that on average the new EU members seem to obtain a larger degree of income risk sharing than the EU-15 members; the average extent of income risk sharing is 26% for the new EU members and 9% for the EU-15 members (medians are 21% and 7%). This does not mean that the new EU members are more open to capital flows or have deeper capital markets. Remember that the numbers in Table 2 report the extent of risk sharing among the enlarged 25-member European Union and ignore additional insurance with the rest of the world. Therefore, the evidence shows that the new EU members mostly share risk within the EU whereas the

[13] Obstfeld (1994a) tests for full consumption risk sharing by such time-series regression for individual countries. Asdrubali et al. are the first to estimate the average *amount* of consumption and income risk sharing for a group of regions. They run the panel regression over the states of the United States.

EU-15 members may engage in risk sharing with the rest of the world, including investing in America and Asia. Negative numbers (for Hungary, Slovakia in the new EU members group and France, Germany, the Netherlands, Spain and the U.K. among the EU-15 members) imply some dis-smoothing at corresponding level of risk sharing and can also be due to risk sharing outside of the EU.[14]

In case of consumption risk sharing achieved at all levels of smoothing, the EU-15 members (with the average of 47% and the median of 42%) are ahead of the new EU members (the average 15%, the median 28%). This evidence implies that a lot of consumption smoothing within the original European Union is achieved through international transfers (if the net transfers to a country are larger during recessions), national government budget deficits and corporate (and possibly private) saving.[15] The evidence shows that the new EU members did not obtain as much total consumption risk sharing as the original EU members; with several exceptions (Finland, Luxembourg, Sweden), the EU-15 members members are still pretty far from perfect risk sharing situation.[16] Therefore, EU enlargement should produce welfare gains for all the member-countries of the larger union.

[14]Negative income risk sharing implies that idiosyncratic GNI responds more than one-to-one to idiosyncratic GDP shocks—there is "dis-smoothing" of income relative to output. We are sympathetic to the view of Kalemli-Ozcan, Sorensen and Yosha (2004) that the negative income risk sharing may be due to the excessive volatility of financial returns. If foreign assets are purchased not hedging domestic output risk (such as foreign direct investment) they do not provide returns that are negatively correlated with the output of the home economy.

[15]Corporate saving affects patterns of earnings retention: a larger share of profits is distributed to shareholders during recessions. Capital depreciation—typically counter-cyclical—brings the gap between National Income and Disposable National Income and may result in dis-smoothing. See Sorensen and Yosha (1998) for details. They study income and consumption smoothing patterns among European Community during the period 19661990. The European Community structural funds are an example of an international tax-transfer system that may contribute to risk sharing, although Sorensen and Yosha emphasize that the motivation for having a tax-transfer system may have nothing to do with risk sharing.

[16]We do not study the reasons for cross-country differences in the extent of risk sharing. See Volosovych (2006) for the recent paper on this topic.

4 Potential gains from international risk sharing

4.1 Total welfare gains from risk sharing

Kalemli-Ozcan, Sorensen and Yosha (2001) (henceforth, KSY) use standard assumptions—symmetric information, no transaction costs, identical logarithmic utility $u(c_t^i) = log(c_t^i)$ and rate of time preference for all countries—and consider a group of N infinite horizon endowment economies inhabited by a representative risk averse individuals consuming a homogeneous non-storable good. For each country i, they compare the expected utility of consuming country's own per capita endowment (gdp_t^i) under autarky and consuming a country-specific portion k^i of the world endowment gdp_t under perfect risk sharing. The difference represents *potential* utility gains coming from a permanent increase in consumption when an economy moves from full autarky to the prefect risk sharing within the group. If countries achieve perfect risk sharing, the potential welfare gains are naturally zero. With assumption of iid normally distributed growth rates, KSY derive closed form solutions for the potential gains from risk sharing for identical logarithmic utility (expressed in percent):[17]

$$G_i^{\text{KSY}} = 100 \times \frac{1}{\delta}\left(\frac{1}{2}\,\sigma^2 \,+\, \frac{1}{2}\,\sigma_i^2 \,-\, \text{cov}^i\right), \tag{1}$$

where δ is the intertemporal discount rate; σ^2 is the variance of the group-wide per capita endowment growth rate; σ_i^2 is the variance of a country's per capita endowment growth rate; and cov^i is the covariance of a country's endowment with the group-wide endowment. The intuition for this formula is straightforward. First, the gain from sharing risk is higher for countries with a lower covariance, cov^i, because countries with counter-cyclical output provide insurance to other countries by stabilizing aggregate output and are compensated in the risk sharing agreement. Second, the higher the variance of country i's GDP, σ_i^2, other things equal, the more it will benefit from sharing risk with other countries. Third, the higher the variance of the aggregate gross product of the group, keeping the variance of country i's GDP constant, the more other countries would be willing to "pay" a country i

[17] KSY derive the utility gain measure for general CRRA utility $u(c) = (1/1-\gamma)c^{1-\gamma}$ ($\gamma \neq 1$) and show that the empirical results are not very different for general CRRA utility.

for joining the risk sharing arrangement.

We estimate the expression (1) using the output data to directly match the theoretical concept of "total" welfare gains as in the original KSY paper. The results, presented in the first column of Table 3, corroborate our assertion of between-group differences in potential welfare gains. The *total* potential utility gains generated by moving from autarky consumption to consuming a part of the overall group's output (full risk sharing consumption) are much larger for the new EU members as the group in general, and for two Baltic countries (Lithuania and Estonia), Malta, Czech Republic, Poland, and Slovak Republic in particular.[18] These are the countries that would gain the most from joining the European Union and from the risk-sharing opportunities it offers. The estimate of the gains for the other the new EU members (Cyprus, Hungary, Latvia, and Slovenia) are comparable to the values of the original EU members. The gains for the EU-15 members are much smaller.[19] We find that the EU-15 members would still gain from risk sharing, especially Ireland, Luxembourg, Finland, and Sweden.

An explanation for the discovered differences in potential welfare gains is beyond the scope of this paper. We can try to reveal some forces driving the results by looking at the components of the asymmetry measure (1). Columns two and three in Table 3 report the variance of real per capita GDP growth, σ_i^2, and its covariance with aggregate 25-country EU GDP growth, cov^i. Consistent with the discussion of the summary statistics presented earlier in this section, our findings show that the welfare gains for new member-countries are primarily driven by a higher volatility of their GDP growth rates. Countries with the highest values of asymmetry measure also have the largest variance of output growth; therefore, they would contribute the most to the smoothing shocks in other countries. The two Baltic countries (Estonia and Lithuania) have also a highly counter-cyclical output as measured

[18]The estimate of average welfare gain for the ten the new EU members is equal to 5.2% versus 1.2 for the EU-15 members.

[19]These findings are consistent with the results of Kalemli-Ozcan, Sorensen and Yosha (2004) and Sorensen et al. (2006) who report a significant decline in estimates of welfare gains for European countries in the late 1990s compared to the previous periods. For example, Kalemli-Ozcan et al. calculate the same GDP-based welfare gains measure as in this paper for 14 EU economies (excluding Luxembourg) and report its decline from 1.2% in the 1983–1991 to 0.6% in the 1991–1999.

by the covariances cov^i. These economies should be "compensated" most in the risk sharing agreement since they provide insurance to the rest of countries in the Union by stabilizing aggregate output. The other members of the new EU members group have either lower variance or positive covariance of individual output growth with total output growth—the pattern generally observed in the group of older EU members. Their covariances and variances are generally smaller and have approximately the same order of magnitude. This explains the lower potential gains from risk sharing for these countries. The exceptions are Finland, Ireland and Luxembourg which have high GDP growth volatility.

The average gains for each of the two groups, both unweighted and population- or GDP-weighted, mimic the general pattern of the in-group economies. The average gain for the new EU members (5.2%) is larger than that for the original the EU-15 members (1.2%). Table 3 shows that welfare gains are normally larger for the smaller economies. When we control for the size of economies the average gain decreases for all countries, but the difference in the gains between the original and new EU members still remains. On average, the *total* potential benefit for the new EU members is about four-five times higher than that for the EU-15 members. This does not, however, imply that the EU-15 members will be worse off in case of enlargement. If the EU-15 members move toward full risk sharing conditions, their potential welfare gains after enlargement would virtually be the same as without it.[20]

4.2 Unexploited welfare gains from risk sharing

So far, we reported estimates of potential welfare gains that EU countries can obtain if they move from theoretically asserted autarky consumption (which equals to each country's per capita GDP, gdp_t^i) to full risk sharing consumption (which equals to a portion of the pooled GDP, $k^i gdp_t$). KSY note that their utility-based measure is general enough to evaluate the *unexploited* welfare gains a representative consumer would achieve due to moving from the

[20] According to our calculations (not reported), the average potential welfare gains for the EU-15 members if they were to remain in EU-15 is equal to 1.17%. In Table 3 we see that this number is almost equal to welfare gains calculated for EU-15 in enlarged 25-country European Union (1.22%).

actual consumption level c_t^i (which is normally different from the autarky consumption) to the same final point, i.e., the full risk sharing consumption level $k^i gdp_t$. We estimate the expression (1) using the actual consumption data. If countries have already made some risk sharing efforts toward full risk sharing, the unattained gains would be smaller than those reported in Table 3. There is a caveat that makes such interpretation somewhat problematic. The welfare gains measure calculated over the observed consumption data may be subject to the influence of other factors affecting the diversification process. One example is taste shocks to consumption pointed out by Stockman and Tesar (1995).

We report the estimated consumption-based KSY measure in Table 4. In general, the pattern discovered in the measure based on GDP per capita growth is also observed in the consumption-based measure: welfare gains are larger for the new EU members (average of 6.6%) compared to the EU-15 members group (average of 0.9%). The larger value of the gain is primarily attributed to the large volatility of consumption spending. Lithuania and Malta in the new EU members group have also highly counter-cyclical consumption. An unexpected finding concerns the relative magnitude of total welfare gains in Table 3 compared to the unexploited gains in Table 4. For the EU-15 members as a group, the consumption-based estimates of welfare gains are smaller than output-based reported in Table 3. These countries apparently attained some consumption insurance compared to the autarky case.

In the case of the new EU members, the consumption-based estimates are strictly larger than those based on GDP, with the exception of Lithuania and the Czech Republic. We speculate that taste shocks and other factors do influence these results and make them hard to interpret. Further research is needed to provide a deeper insight of the influence of taste shocks on the gains from risk sharing. It is possible that the transition from planned to market economies in central and eastern European countries actually caused some dis-smoothing of consumption—possibly because the state provided a great deal of smoothing under the previous system. It is also possible that these countries pursue other goals than hedging their idiosyncratic output risk. The main finding of the previous section

is still apparent: if countries in the enlarged European Union move further toward financial integration, the gains to the new EU members would be large and to the EU-15 members be smaller, but non-nil.

4.3 Robustness

Table 5 reports the results of robustness checks. van Wincoop (1994) calculates the gains from risk sharing in a setup similar to KSY (N endowment economies of equal size, representative agents maximizing expected CRRA utility over the time horizon H, perfect markets). van Wincoop concentrates on *unexploited* gains and compares the expected utility of actual consumption c_t^i to the utility of consuming the per capita world endowment gdp_t under perfect risk sharing.[21] As in case of KSY, the measure of the welfare gain is the utility equivalent of a permanent increase in expected level of consumption that produces the same improvement in welfare as movement from current consumption to the prefect risk sharing consumption (expressed in percent):

$$G_i^{\mathrm{W}} = -100 \times \frac{0.5\gamma d\sigma_i^2}{r_i - \overline{\mu}_i} \left(1 - H(r_i - \overline{\mu}_i) \frac{e^{-H(r_i - \overline{\mu}_i)}}{1 - e^{-H(r_i - \overline{\mu}_i)}} \right), \tag{2}$$

where $\overline{\mu}_i = \mu_i - 0.5\gamma\sigma_i^2$ is the risk-adjusted endowment growth rate; $d\sigma_i^2 = \sigma^2 - \sigma_i^2$ the change in variance of endowment growth between the perfect risk sharing and current situation; r_i is the risk-free interest rate; σ^2 is the variance of the group-wide per capita endowment; σ_i^2 is the variance of a country's per capita endowment; and γ is the coefficient of relative risk aversion.

As a benchmark, we estimate the unexploited gains from risk sharing for the case of log utility, similar to the KSY's basic measure, and the other free parameters taken from van Wincoop (1999).[22] In column (1) of Table 5 r is a "theoretical" risk-free interest rate

[21] Note that van Wincoop assumes that all the economies have identical size, so a country-specific portions k^i in the global endowment are the same for all countries (=1). This simplification ignores the fact that countries with negative output covariance with the rest of the group gets a larger share of aggregate output reflecting a higher risk sharing value this country brings to the rest of the group (such country would have a larger k^i, all else equal; see KSY for details). Naturally, the metric by van Wincoop would underestimate the gains from risk sharing. We regard them as a lower bound of the true gains.

[22] The estimates of welfare gains based on this metric depend on a larger number of parameters than in

as in van Wincoop (1994) estimated by the formula $\hat{r}_i = \delta - \gamma\overline{\mu}_i$, the the risk-adjusted consumption growth rate $\overline{\mu}_i$ is from the data, and time horizon corresponds to our time period 1994–2003 (10 years).[23] The average gains for the new EU members are about 0.7% and less than 0.1% for the EU-15 members over the chosen short horizon of 10 years. The countries with the largest gains are again Hungary, Lithuania, and Malta among the new EU members , and Ireland, Portugal, and Sweden among the EU-15 members.

Alternative risk-free rate. In column (2) we follow van Wincoop (1999) and calculate the real interest rate as the average difference between money market rates and consumer price inflation over 1994–2003 obtaining similar but larger welfare gain estimates.[24] *Longer time horizon.* Observe that the estimates of unexploited gains by van Wincoop method are smaller than by KSY method by an order of magnitude. The reason is the different time horizon. The longer the horizon, the larger the gains.[25] In column (3) we use the same CRRA=1 and the risk-free rate from the data, but set the time horizon to 100 years. The estimates of welfare gains closely match the numbers from column (1) in Table 4 based on KSY method: average gains are about 5% for the new EU members and 1% for the EU-15 members .[26] *Larger risk-aversion coefficient.* In column (4) the parametrization of G_i^{W} is similar to column (2) but a "consensus" value of the coefficient of relative risk aversion $\gamma = 3$ used by van Wincoop (1999) and in a survey by Kose, Prasad and Terrones (2003). The estimated gains are still lager than in column (1)–(2) but less than in column (3). The average gains are about 2.3% for the new EU members and 0.3% for the EU-15 members over

case of KSY. The sensitivity analysis by van Wincoop (1999) shows that the welfare gains is larger the longer the time horizon H; and also the larger the volatility of a country's endowment σ_i^2; the smaller the risk-free rate r; and the larger the risk aversion coefficient γ.

[23]We pick the intertemporal discount rate $\delta = 0.02$ as in KSY. The risk-free rate estimated by this formula is about 3–4% for the new EU members and about 9–10% for the EU-15 members.

[24]We use the data from the IMF's International Financial Statistics to calculate the real money market interest rates. For each country and year we adjust the interest rate for the CPI inflation from the World Bank (2006) and average the real interest rate for each country over the sample time period. Several the EU-15 members lack the data for the years 1999-2003, after adoption of the euro; missing values were substituted with the eurozone rates. The risk-free rate estimated by this formula is smaller than in column (1): it is about –5% for the new EU members and about 2% for the EU-15 members . Our finding of larger gains with lower risk-free rate is qualitatively consistent with van Wincoop (1999).

[25]KSY measure assumes infinite time horizon to attain the prefect risk sharing, whereas in van Wincoop metric the horizon comes in as a parameter H.

[26]When CRRA=3 and the gains are even larger, about 25% for the new EU members and 2.3%. The results are not reported.

the horizon of 10 years.

Despite some differences in the value of welfare gain estimates, which depend on the parametrization, the ranking of countries according to potential gains based on the van Wincoop (1994) measure is consistent with the ranking from the Kalemli-Ozcan, Sorensen and Yosha (2001) measure found in Section 4.2.[27]

5 Concluding remarks

We estimate potential welfare gains that European Union countries may obtain if financial integration between them deepens. In particular, we estimate the *total* potential gains in expected utility if each of the twenty-five EU countries achieve full risk sharing (consuming a portion of the Union's GDP) compared to a financial autarky situation (where each country consumes only its own GDP). We also estimate the *unexploited* welfare gains, i.e., gains in each country's expected utility if it moves from its actual per capita consumption level (which is normally different from the autarky consumption) to the same final point, i.e., a full risk sharing consumption level. For the estimation, we use measures developed by Kalemli-Ozcan, Sorensen and Yosha (2001) and van Wincoop (1994).

We compare gains for the original fifteen EU countries and ten countries that joined the Union in 2004. We find that full and unexploited gains for the new EU members are much larger than those for the EU-15 members. Total potential welfare gains are especially large for the two Baltic countries (Lithuania and Estonia), Malta, Czech Republic, and Slovak Republic. It is the higher volatility and sometimes the counter-cyclical pattern of their output that creates large potential gains from risk sharing for the countries entering the European Union. We find that the new EU members and the EU-15 members also have some unexploited gains from insuring their output risks in a larger Union; the benefits for the EU-15 members are generally smaller than those for the new EU members, however

[27] We also estimate the measure of van Wincoop (1994) based on GDP data following the original intuition of KSY that such metric would show the total welfare gains from moving from financial autarky to full risk sharing. The results are similar to those in Section 4.2: gains for the EU-15 members are smaller than in Table 5 (evidence of risk sharing) and larger for the new EU members (dis-smoothing of consumption). The results are available.

they are non-nil.

We emphasize that the utility gains reported here are *potential* gains a country can obtain if it moves from consumption under autarky or current consumption to full risk sharing consumption. We find that the current extent of risk sharing—estimated by the method of Astrubali, Sorensen, and Yosha (1996)—is substantial for the most of countries in the larger European Union, but well below full risk sharing (except for Luxembourg, Sweden, and Finland, who are very close). The further process of integration within the enlarged European Union would most likely lead to further synchronization of macroeconomic fluctuations across member-countries with further depletion of risk-sharing opportunities.[28] At the moment, if economic integration continues and the twenty-five EU economies successfully move toward full risk sharing, we find the substantial welfare gains for *all* members of the European Union. The potential gains from risk sharing is one of the benefits that the future EU members should consider.[29]

The methodology of this paper allows estimating the *direct* potential welfare gains from elimination of country-specific shocks to output. Risk sharing can bring additional *indirect* welfare-improving benefits. In theory, with better risk sharing people can specialize and safely engage in riskier but high-return investment projects and guarantee higher expected consumption growth and welfare, speed up capital accumulation and financial deepening, and reduce uncertainty in the growth process (Acemoglu and Zilibotti 1997; Obstfeld 1994b; Kalemli-Ozcan, Sorensen and Yosha 2003; Imbs and Wacziarg 2003). Evaluation and comparison of direct and indirect welfare gains stemming from better risk sharing within the European Union is an interesting topic for further research.

[28]The fact that integration process itself affects the degree of output asymmetry was emphasized by Frankel and Rose (1998), Alesina, Barro and Tenreyro (2002), Kalemli-Ozcan, Sorensen and Yosha (2001), and Imbs (2004), among others. Increase in international risk sharing shall result in income and consumption synchronization even though, as Kalemli-Ozcan, Sorensen and Yosha (2001 and 2003) demonstrate, economic integration and better risk sharing may result in less correlated *output* growth because of larger specialization in production. The net effect on the business cycle of the EU member-countries is hard to predict.

[29]Among the newest members, Bulgaria and Romania officially joined the EU in January 2007. The EU continues membership talks with Turkey and Croatia and is about to start the accession talks with Serbia and other Balkan countries.

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Table 1: **Summary statistics: GDP and total consumption per capita growth, 1994-2003**

	GDP		Consumption		Relative
	Mean	St.dev.	Mean	St.dev.	Volatility
			the new EU members		
Cyprus	2.93	2.54	3.93	4.23	1.66
Czech Rep.	3.91	4.12	4.29	3.87	0.94
Estonia	5.82	4.59	5.44	2.93	0.64
Hungary	3.58	2.20	2.57	5.57	2.53
Latvia	5.73	2.46	7.11	3.10	1.26
Lithuania	4.49	8.49	3.80	8.22	0.97
Malta	2.11	5.99	2.86	7.14	1.19
Poland	5.11	4.31	5.97	4.91	1.14
Slovak Rep.	3.61	4.42	3.19	4.89	1.11
Slovenia	2.92	0.97	2.25	1.26	1.18
Average	4.20	4.32	4.34	4.97	1.26
Median	4.20	4.21	4.08	4.87	1.16
			the EU-15 members		
Austria	1.73	1.31	1.30	1.48	1.13
Belgium	1.73	1.23	1.83	0.66	0.53
Denmark	1.87	1.31	1.52	1.57	1.20
Finland	3.21	3.11	2.67	1.72	0.55
France	1.57	1.07	1.38	0.92	0.87
Germany	1.08	1.62	1.17	1.31	0.81
Greece	2.74	1.53	2.24	1.58	1.03
Ireland	6.52	4.82	4.38	3.47	0.72
Italy	1.38	1.62	1.58	1.65	1.02
Luxembourg	3.85	3.57	–3.24	0.78	0.22
Netherlands	1.66	2.08	1.69	1.62	0.78
Portugal	2.52	2.45	2.30	2.27	0.93
Spain	2.92	0.97	2.25	1.26	1.29
Sweden	2.11	3.51	1.58	3.03	0.86
UK	2.52	0.83	2.67	1.28	1.54
Average	2.49	2.07	1.69	1.64	0.90
Median	2.11	1.62	1.69	1.57	0.87
Average 25	3.18	2.97	2.75	2.97	1.04
Median 25	2.92	2.46	2.57	2.27	1.02

Notes: Relative Volatility is the ratio of the standard deviation of total consumption per capita growth to that of GDP per capita growth. All numbers are multiplied by 100, except for Relative Volatility. Lines Average 25 and Median 25 report statistics for all 25 countries.

Table 2: **Extent of income and consumption risk sharing within 25-member Union (% of full risk sharing), 1994-2003**

	the new EU members			**the EU-15 members**	
	Income RS β^i	Consum. RS β^c		Income RS β^i	Consum. RS β^c
Cyprus	16.34	12.18	Austria	56.47	1.05
Czech Rep.	36.44	28.95	Belgium	2.44	50.05
Estonia	28.99	62.98	Denmark	40.03	31.88
Hungary	–20.85	–73.97	Finland	7.37	89.59
Latvia	22.54	50.07	France	–12.67	66.50
Lithuania	13.47	7.80	Germany	–13.74	15.86
Malta	69.26	–44.04	Greece	0.20	16.31
Poland	76.90	41.15	Ireland	19.09	46.71
Slovak Rep.	–1.81	27.12	Italy	8.59	67.83
Slovenia	19.90	39.47	Luxembourg	34.88	144.10
			Netherlands	–65.14	42.20
			Portugal	17.81	16.42
			Spain	–8.36	13.00
			Sweden	59.07	95.69
			UK	–15.19	9.74
Average	26.12	15.17	Average	8.72	47.13
Median	21.22	28.04	Median	7.37	42.20

	EU-25 Members	
	Income RS β^i	Consum. RS β^c
Average	15.68	34.35
Median	16.34	31.88

Notes: Table reports the estimates of risk sharing obtained by countries over the period 1994–2003 by the method of Asdrubali, Sorensen, and Yosha (1996). The estimates evaluate the extent of risk sharing only within the enlarged 25-member EU. Numbers reported in percent; 100% means full risk sharing. Extent of risk sharing is calculated as the coefficient from the individual country regressions $\widetilde{gdp}_{it} - \widetilde{z}_{it} = \nu_i + \beta \widetilde{gdp}_{it} + \varepsilon_{it}$, where $\widetilde{gdp}$ is the growth rate of per capita output measured at a country level by per capita GDP. When $\widetilde{z}_t$ stands for the growth rate of per capita income measured by per capita GNI, β represents a percentage of idiosyncratic risk to GDP insured through net factor income flows (compared to perfect risk sharing); denoted as β^i. When $\widetilde{z}_t$ stands for the growth rate of per capita total consumption, β represents a percentage of idiosyncratic risk to GDP insured through net factor income flows, capital depreciation, government international grants and transfers, and saving (compared to perfect risk sharing); denoted β^c. Each variable with tilde ($\widetilde{\cdot}$) represents the growth rate of the variable for an individual country i in time period t minus growth rate of the variable for the "world" in time period t (e.g, $\widetilde{gdp}_{it} = \Delta \log gdp_{it} - \Delta \log gdp_t^{\text{World}}$). The "world" includes 25 members of the enlarged European Union.

Table 3: **Total potential welfare gains from risk sharing for individual the new EU members and the EU-15 members (KSY), 1994-2003**

	Welfare Gains G^{KSY}	Variance σ_i^2	Covariance cov^i
the new EU members			
Cyprus	1.20	6.45	1.08
Czech Republic	4.06	16.94	0.60
Estonia	5.98	21.09	–1.15
Hungary	1.62	4.83	–0.56
Latvia	1.97	6.07	–0.65
Lithuania	19.68	72.07	–3.07
Malta	8.47	35.84	1.24
Poland	3.90	18.59	1.75
Slovak Republic	4.88	19.53	0.27
Slovenia	0.31	0.95	0.11
Arithmetic Mean	5.21	–	–
Weighted (pop)Average	2.96	–	–
Weighted (gdp)Average	3.93	–	–
the EU-15 members			
Austria	0.27	1.75	0.57
Belgium	0.24	1.24	0.53
Denmark	0.28	2.06	0.55
Finland	2.02	5.87	1.05
France	0.27	0.57	0.28
Germany	0.47	1.47	0.63
Greece	0.91	3.24	–0.39
Ireland	4.99	10.26	1.89
Italy	0.60	1.98	0.37
Luxembourg	2.92	10.77	0.77
Netherlands	0.88	2.02	0.67
Portugal	1.13	4.15	1.01
Spain	0.31	0.62	0.11
Sweden	2.67	1.79	1.07
United Kingdom	0.27	0.50	0.07
Arithmetic Mean	1.22	–	–
Weighted (pop)Average	0.57	–	–
Weighted (gdp)Average	0.72	–	–

Notes: First column is the welfare gains measure G^{KSY}, calculated over the period of 1994–2003 by the method of Kalemli-Ozcan, Sorensen and Yosha (2001) as $100 \times \frac{1}{\delta}\left(\frac{1}{2}\sigma^2 + \frac{1}{2}\sigma_i^2 - \text{cov}^i\right)$, where $\sigma_i^2 = \text{var}(\Delta \log \text{gdp}^i)$, $\text{cov}^i = \text{cov}^i\left(\Delta \log \text{gdp}^i, \Delta \log \text{gdp}\right)$, σ^2 is the variance of the aggregate EU-25 GDP growth ($10^4 \cdot \sigma^2 = 0.51\,[var(100 \cdot \Delta \log \text{gdp})]$), and $\delta = 0.02$. G^{KSY} is interpreted as *total* potential welfare gain that a country would obtain from fully diversifying any country-specific variance in output expressed in terms of the percent permanent increase in autarkic consumption (= to per capita GDP) that would result in the same utility gain. Column 2 is $10^4 \cdot \sigma_i^2$, and Column 3 is $10^4 \cdot \text{cov}^i$. Column 4 is a correlation of each country's GDP growth with the total EU-25 GDP growth, i.e., $corr^i = corr(\Delta \log \text{gdp}^i, \Delta \log \text{gdp})$. Weighted averages are population-weighted and GDP-weighted.

Table 4: **Unexploited potential welfare gains from risk sharing for individual the new EU members and the EU-15 members (KSY), 1994–2003**

	Welfare Gains G^{KSY}	Variance σ_i^2	Covariance cov^i
the new EU members			
Cyprus	4.79	17.87	–0.42
Czech Republic	3.82	14.96	0.07
Estonia	2.58	8.61	–0.63
Hungary	7.72	31.05	0.31
Latvia	2.86	9.63	–0.67
Lithuania	18.16	67.63	–2.27
Malta	13.37	50.94	–1.04
Poland	5.88	24.11	0.52
Slovak Republic	6.11	23.96	–0.02
Slovenia	0.37	1.58	0.28
Arithmetic Mean	6.57	–	–
Weighted (pop)Average	4.22	–	–
Weighted (gdp)Average	6.03	–	–
the EU-15 members			
Austria	0.37	2.20	0.60
Belgium	0.21	0.43	0.02
Denmark	0.67	2.46	0.12
Finland	1.06	2.97	–0.41
France	0.18	0.85	0.30
Germany	0.23	1.72	0.63
Greece	1.01	2.50	–0.54
Ireland	3.00	12.08	0.27
Italy	0.89	2.73	–0.19
Luxembourg	0.17	0.61	0.18
Netherlands	0.68	2.64	0.19
Portugal	1.20	5.16	0.40
Spain	0.37	1.58	0.28
Sweden	2.44	9.15	–0.07
United Kingdom	0.20	1.65	0.65
Arithmetic Mean	0.85	–	–
Weighted (pop)Average	0.50	–	–
Weighted (gdp)Average	0.50	–	–

Notes: First column is the welfare gains measure G^{KSY}, calculated over the period of 1994–2003 by the method of Kalemli-Ozcan, Sorensen and Yosha (2001) as $100 \times \frac{1}{\delta}\left(\frac{1}{2}\sigma^2 + \frac{1}{2}\sigma_i^2 - \text{cov}^i\right)$, where $\sigma_i^2 = \text{var}(\Delta \log \text{cons}^i)$, $\text{cov}^i = \text{cov}^i\left(\Delta \log \text{cons}^i, \Delta \log \text{cons}\right)$, σ^2 is the variance of the aggregate EU-25 total consumption growth ($10^4 \cdot \sigma^2 = 0.46\ [var(100 \cdot \Delta \log \text{cons})]$), and $\delta = 0.02$. G^{KSY} is interpreted as *unexploited* potential welfare gain that a country would obtain from fully diversifying any country-specific variance in output expressed in terms of the percent permanent increase in current consumption (observed in the data) that would result in the same utility gain. Column 2 is $10^4 \cdot \sigma_i^2$, and Column 3 is $10^4 \cdot \text{cov}^i$. Column 4 is a correlation of each country's GDP growth with the total EU-25 GDP growth, i.e., $corr^i = corr(\Delta \log \text{cons}^i, \Delta \log \text{cons})$. Weighted averages are population-weighted and GDP-weighted.

Table 5: **Robustness: Unexploited potential welfare gains from risk sharing for individual the new EU members and the EU-15 members (van Wincoop), 1994–2003**

	(1)	(2)	(3)	(4)
	CRRA=1			CRRA=3
	$r = \hat{r}_i$ $H = 10$	$r = \bar{r}_i$ $H = 10$	$r = \bar{r}_i$ $H = 100$	$r = \bar{r}_i$ $H = 10$
	the new EU members			
Cyprus	0.46	0.50	5.62	1.48
Czech Republic	0.38	0.42	4.87	1.24
Estonia	0.22	0.24	3.02	0.71
Hungary	0.81	0.83	6.91	2.48
Latvia	0.24	0.28	3.71	0.83
Lithuania	1.78	2.49	31.95	7.41
Malta	1.34	1.40	13.88	4.17
Poland	0.63	0.70	9.01	2.08
Slovak Republic	0.62	0.66	6.91	1.97
Slovenia	0.03	0.03	0.25	0.09
Arithmetic Mean	0.65	0.75	8.61	2.25
Weighted (pop)Average	0.43	0.49	5.76	1.46
Weighted (gdp)Average	0.63	0.69	8.01	2.07
	the EU-15 members			
Austria	0.05	0.05	0.39	0.14
Belgium	0.00	0.00	0.00	0.00
Denmark	0.05	0.05	0.46	0.16
Finland	0.07	0.07	0.59	0.21
France	0.01	0.01	0.09	0.03
Germany	0.03	0.05	0.60	0.14
Greece	0.05	0.06	0.53	0.17
Ireland	0.31	0.33	3.94	1.00
Italy	0.06	0.06	0.53	0.19
Luxembourg	0.00	0.00	0.01	0.01
Netherlands	0.06	0.06	0.43	0.18
Portugal	0.13	0.13	1.42	0.40
Spain	0.03	0.03	0.29	0.09
Sweden	0.23	0.29	4.00	0.88
United Kingdom	0.03	0.05	0.58	0.16
Arithmetic Mean	0.07	0.08	0.92	0.25
Weighted (pop)Average	0.05	0.05	0.57	0.16
Weighted (gdp)Average	0.06	0.07	0.87	0.22

Notes: Table reports the welfare gains measure G^{W}, calculated over the period of 1994–2003 by the method of van Wincoop (1994) as $-100 \times \frac{0.5\gamma\, d\sigma_i^2}{r_i - \overline{\mu}_i} \left(1 - H(r_i - \overline{\mu}_i)\frac{e^{-H(r_i-\overline{\mu}_i)}}{1-e^{-H(r_i-\overline{\mu}_i)}}\right)$. Here γ is coefficient of relative risk aversion; $\overline{\mu}_i = \mu_i - 0.5\gamma\sigma_i^2$ is risk-adjusted per capita consumption growth rate; $d\sigma_i^2 = \sigma^2 - \sigma_i^2$ and σ^2 is the variance of the group-wide per capita consumption, σ_i^2 the variance of a country's per capita consumption; H is the length of time horizon. In column (1) $\gamma = 1$, the risk-free interest rate r is calculated by formula $\hat{r}_i = \delta - \gamma\overline{\mu}_i$ and δ is the intertemporal discount rate is chosen to be 0.02, in column (2) $\bar{r}_i$ is the real interest rate calculated as the difference between money market rates (from the IMF IFS) and consumer price inflation (from the World Bank), average over 1994–2003; H is equal to 10 years corresponding to 1994–2003. In column (3) H is equal to 100 years. Parametrization in column (4) is similar to column (2) but $\gamma = 3$. Weighted averages are population-weighted and GDP-weighted.