# Asymmetric Shocks in a Monetary Union: Updated Evidence and Policy Implications for Europe*


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**Abstract**

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*We thank .

# 1 Introduction

Assessing the economic consequences of European Monetary Union (EMU) is high on the agenda of economists and policy makers around the world. A major concern is that asymmetric (idiosyncratic) shocks to the economies of individual members of the union will destabilize it by generating incentives for secession in order to regain monetary independence.[1] To deal with this danger, mechanisms for achieving international income insurance and consumption smoothing ("risk sharing") are essential. Indeed, without such mechanisms, countries in recession might have an incentive to leave the union. These mechanisms include central fiscal institutions that provide cross-country income insurance via a tax-transfer system and through grants to the governments of specific countries.[2] Market institutions also provide risk sharing. The members of a union can share risk via cross-ownership of productive assets, facilitated by a developed capital market, and may smooth their consumption by adjusting the composition and size of their asset portfolio in response to shocks, through adjustment of the saving rate or via lending and borrowing on international credit markets.

Asdrubali, Sørensen, and Yosha (1996) found that in the United States, a successful monetary union, for the period 1964–1990, 39 percent of idiosyncratic (state-specific) shocks to the per capita gross product of individual states are smoothed on average through inter-state ownership patterns that generate capital income flows across state borders. As a result, state income is smoother than state output (gross product). They also found that 13 percent of shocks are smoothed by the federal tax-transfer and grant system, 23 percent via saving or borrowing and lending, and 25 percent of shocks are not smoothed. Therefore, although perfect insurance is not achieved, there is considerable risk sharing among U.S. states.[3] They further found that the amount of insurance through inter-state capital income flows has been rising over time. These regularities can serve as a useful benchmark for the EMU countries—indeed there is by now a fairly substantial literature studying U.S. states as an example of a

[1] See De Grauwe and Vanhaverbeke (1993) for an exposition of the main issues. The debate is inspired by Mundell's (1961) classic analysis of Optimum Currency Areas.

[2] Among the first to stress this point were Sala-i-Martin and Sachs (1992), von Hagen (1992), Atkeson and Bayoumi (1993), and Goodhart and Smith (1993).

[3] Asdrubali, Sørensen, and Yosha (1996) measure, e.g., consumption as smoother than income if the elasticity of consumption with respect to output is lower than the elasticity of income with respect to output, when aggregate shocks are controlled for. The method for estimating these elasticities is based on a variance decomposition of shocks to output.

successful currency union.[4]

Sørensen, and Yosha (1998) explored risk sharing patterns among European Community (EC) countries and among OECD countries during the period 1966–1990, finding that factor income flows do not smooth income across countries. This is true for the entire OECD group as well as for EC members, for the entire period as well as for two subperiods. This suggests that European capital markets have been less integrated than U.S. capital markets, at least until a decade ago.

In this paper, we update some of the above empirical results through the end of the 1990s, focusing on income insurance from factor income flows. Two major findings emerge. First, the amount of insurance through inter-state capital income flows in the United States has been rising further. Second, in the latter part of the 1990s there is non-negligible insurance through international capital income flows in Europe—about 10 percent of idiosyncratic (country-specific) shocks to the per capita gross product of individual countries are smoothed on average through this channel. In this respect, the EMU is beginning to converge towards the United States. This result seems to be the first that actually corroborates empirically that unified Europe is becoming more similar to the union of U.S. states in terms of integration at the macroeconomic level!

The implications for the stability of EMU are encouraging as this indicates that the *income* (and hence also consumption) of EMU members is slowly becoming buffered against country-specific shocks to the Gross Domestic Product (GDP) of these countries. In terms of the debate on the consequences and desirability of economic and monetary integration this result suggest that the degree of synchronization (symmetry) of income (and consumption) fluctuations across countries may become larger than the degree of synchronization of output (GDP) across these countries, lowering the cost of joining a monetary union and giving up independent monetary policy.

It has been noted that the process of economic and monetary integration itself will affect the symmetry of GDP fluctuations, and it is of interest to explore this issue in the European context. There are several channels through which integration might affect the asymmetry of shocks, emphasized by different authors in the literature; see, for example, Krugman (1993)

[4]Eichengreen (1990) and Krugman (1993) are some early papers.

and Frankel and Rose (1998). Kalemli-Ozcan, Sørensen, and Yosha (2001) draw attention to the following mechanism: economic integration will lead to better income insurance through greater capital market integration which will, *ceteris paribus,* induce higher specialization in production and more trade rendering GDP fluctuations less symmetric across countries. The claim that economic integration induces higher specialization in production through better cross-country income insurance has been substantiated empirically by Kalemli-Ozcan, Sørensen, and Yosha (2003a). They established that capital market integration leads to higher specialization in production. Kalemli-Ozcan, Sørensen, and Yosha (2001) establish empirically that higher specialization in production translates into more asymmetry of GDP fluctuations. Together, these findings substantiate an effect of income insurance on industrial specialization which, other things equal, results in less symmetric output fluctuations.

In this paper, we update the empirical analysis of specialization and GDP asymmetry, asking specifically whether specialization and GDP asymmetry have risen in Europe as a result of better risk sharing. We find that country-level specialization in Europe has been clearly increasing during the 1990s; however, GDP asymmetry has declined in the 1990s relative to the 1980s. At least for this sample period, the effect of specialization on asymmetry has been overwhelmed by other forces, which we do not attempt to identify in the present article.

Asymmetry of *output* (GDP) may not be important for the stability of a monetary union if there is substantial risk sharing between members of the union. Rather, the potential welfare losses from income and consumption asymmetry are, arguably, the relevant indicators of stability. Kalemli-Ozcan, Sørensen, and Yosha (2003b) demonstrate that asymmetry of *personal income* across U.S. states is substantially lower than asymmetry of *output* corroborating the empirical relevance of this observation. In this paper, we update the calculations for U.S. states and further estimate the level of Gross National Product (GNP) asymmetry for Europe.

We find that asymmetry of income remains much lower than the asymmetry of GDP for the U.S. states. Surprisingly, for EU countries, GNP is *more* asymmetric than GDP in spite of positive risk sharing in the 1990s. We conjecture that a further rise in risk sharing in Europe will reverse this result similarly to what we find for the U.S. states benchmark.

In the next section, we present the updated empirical analysis. We then discuss implica-

tions for policy in Europe.

# 2 Measuring Risk Sharing, Specialization, and Fluctuations Asymmetry

## 2.1 Risk Sharing

Consider a group of countries, and the following cross-sectional regression (for year $t$):

$$\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t \;=\; \text{constant} \;+\; \beta_{K,t} \;(\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) \;+\; \epsilon_{it}\,, \qquad (1)$$

where $\text{GNP}_{it}$ and $\text{GDP}_{it}$ are country $i$'s year $t$ per capita GNP and GDP, respectively, and $\text{GNP}_t$ and $\text{GDP}_t$ are the year $t$ average per capita GNP and GDP for the group. The coefficient $\beta_{K,t}$ measures the average co-movement of the countries' idiosyncratic GNP growth with their idiosyncratic GDP growth in year $t$; *i.e.*, the co-movement of GNP and GDP growth-rates when aggregate growth rates have been subtracted. The smaller the co-movement, the more GNP is buffered against GDP fluctuations. Since GNP equals GDP plus net factor income flows, this regression provides a measure of the extent to which net factor income flows provide income insurance—the lower $\beta_{K,t}$, the higher is income insurance within the group in year $t$.[5] We use $1 - \beta_{K,t}$ as a measure of risk sharing through international factor income flows. If all country-specific risk is hedged in international capital markets we would expect to find $\beta_{K,t} = 0$.

Figure 1 displays a smoothed graph of the series $1-\beta_{K,t}$, against time. The $\beta_{K,t}$ values are estimated year-by-year for the sample of EU countries (except Luxembourg) and the values at neighboring time-periods are smoothed using a Normal kernel smoother. Surprisingly, the estimated risk-sharing is negative in the early 1990s. In order to examine if this was due to the banking crisis in Finland and Sweden during these years, and to the impact of the Soviet break-up on Finnish foreign trade, we also display the graph leaving out those two countries. Clearly, the Scandinavian crisis explains most of the negative risk sharing in those years: a negative shock to the GDP of one of these countries induced capital flight that generated

[5] See Asdrubali, Sørensen, and Yosha (1996), Sørensen, and Yosha (1998), and Mélitz and Zumer (1999).

an even larger negative shock to the country's GNP. At the time, the degree of financial integration in Europe was not large enough to compensate for this effect resulting in negative average risk sharing in Europe.

The main fact revealed by the graphs is that by the end of the 1990s international financial integration in Europe finally reached a level where GNP fluctuations are somewhat decoupled from GDP fluctuations. The increase in risk sharing from factor income flows is quite dramatic and seems much too steep to be driven by just sample variation.

Alternatively, we estimate the amount of risk sharing over several years using the panel data regression

$$\Delta \log \mathrm{GNP}_{it} - \Delta \log \mathrm{GNP}_{t} \;=\; \text{constant} \;+\; \beta_K \;\left(\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_{t}\right) \;+\; \epsilon_{it}\,. \qquad (2)$$

In Table 1, we show results for the periods 73–82, 83–92, 93–00.[6] We estimated the regressions for the group of 8 long-time EU countries.[7] This group of countries may have developed closer financial integration during our sample periods than the more recent entrants to the EU.[8] Alternatively, the results are also given for the full set of current EU members (minus Luxembourg). The results confirm the increase in risk sharing in the 1990s displayed in Figure 1. For the period 72–82 risk sharing was basically nil among the EU countries (borderline positive for the smaller group), while risk sharing was significantly negative for the larger group as discussed previously. For the period since 1993, risk sharing is positive and clearly statistically significant in both groups of EU countries.

In Table 2, we display numbers for "capital market" (factor income flows) risk sharing among U.S. states. The numbers have a slightly different interpretation than the numbers for the EU because GNP numbers are not available at the state level. Instead, numbers for income are used.[9] Some of the results differ slightly from those presented in Asdrubali,

[6]The regression is similar to the one estimated by Asdrubali, Sørensen, and Yosha (1996). They included time-fixed effects (a dummy-variable for each year) rather than subtracting aggregate growth, but this makes little difference to the results so we choose the slightly more transparent form here.

[7]Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, and the United Kingdom (Luxembourg is left out because she is small and atypical).

[8]Sørensen and Yosha (1998) consider risk sharing among this group of EU countries. The results here will differ slightly for identical time-periods due to revisions of the national accounts.

[9]More precisely, we use updated measures of "state income" as constructed for 1963–90 in Asdrubali, Sørensen, and Yosha (1996). State income consists of personal income after subtracting out all federal transfers

Sørensen, and Yosha (1996) due to revisions of the state-level GDP data, but their finding of increasing capital market risk sharing in the U.S. still holds, with the amount of risk sharing through this channel further rising during the 1990s.

As an alternative measure of risk sharing, we calculated (for the EU sample) simple correlations of country-level GDP and GNP with EU-wide GDP and GNP, respectively. (Backus, Kehoe, and Kydland (1992) popularized the use of such correlations as indicators of risk sharing.) We find that the correlation of country-level GNP with EU-wide GNP falls to a level lower than the correlation of the corresponding GNP numbers in the late 1990s. This is consistent with the results from our risk sharing regression.

## 2.2 Specialization

We calculate a specialization index for manufacturing sectors at the 1-digit and 2-digit International Standard Industrial Classification (ISIC) levels. The degree of specialization at the 1-digit level is likely to be more important for overall diversification of shocks to the economy, but in order to examine if financial integration generated more specialization—as Kalemli-Ozcan, Sørensen, and Yosha (2003a) found using cross-sectional regressions—we may get a clearer picture looking at the manufacturing sub-sectors which respond mainly to market forces, while the level of output in 1-digit sectors like agriculture and mining is determined primarily by endowments of fertile soil and extractable minerals, or the activities of agricultural lobbyists. The size of the government (1-digit) sector is primarily determined by social and political factors.

The specialization index for manufacturing is computed (for each country) for the relevant sample years as follows. Let $\text{GDP}_i^s$ denote the GDP of manufacturing sub-sector $s$ in country $i$, and $\text{GDP}_i^M$ the total manufacturing GDP of this country. We measure the distance between the vector of sector shares in country $i$, $\text{GDP}_i^s \,/\, \text{GDP}_i^M$, and the vector of average sector shares

and allocating all non-personal federal taxes to income (attempting to approximate what personal income would be without any federal taxes and transfers). Further, income of state governments that is not derived from personal taxes, like corporate- and severance-taxes, which is available to residents of states via the state governments, is also added.

in the EU-countries other than $i$:

$$\text{SPEC}_i = \sum_{s=1}^{S} \left( \frac{\text{GDP}_i^s}{\text{GDP}_i^M} - \frac{1}{J-1} \sum_{j \neq i} \frac{\text{GDP}_j^s}{\text{GDP}_j^M} \right)^2 , \tag{3}$$

where $S$ is the number of sectors and $J$ is the number of in the group of countries considered (the subset of the EU for which we were able to find the relevant data). Notice that $\text{SPEC}_i$ measures how the composition of manufacturing in country $i$ differs from the composition of manufacturing in the other countries of the EU. The index of 1-digit specialization is computed similarly using total country-level GDP rather than manufacturing GDP and 1-digit sectors rather than manufacturing sub-sectors.

The results are displayed in Figure 2 and Figure 3 for the period 1991–2000. (We have data for few countries before 1991 and Belgium and the Netherlands are left out since our data source only included data for these countries from 1995 onwards.) The degree of specialization has increased significantly at both the 1-digit and 2-digit manufacturing levels. We will not attempt to sort out if this is due to lower trade-barriers (Krugman (1993) or higher financial integration (Kalemli-Ozcan, Sørensen, and Yosha (2003a)), but since barriers to within-EU trade has been low for some time now, one might conjecture that the rise in financial integration in the late 1990s, as documented above, might have played an important role in the recent rise in country-level specialization.

### 2.3 GDP Asymmetry

This follows Kalemli-Ozcan, Sørensen, and Yosha (2001). The proposed measure of GDP asymmetry builds on the following counter-factual thought experiment. Consider a group of countries each inhabited by a representative risk averse consumer who derives utility from consumption of a homogeneous non-storable good. This group constitutes a "stochastic endowment economy" in the sense that the GDP of these countries is regarded by consumers as exogenous and stochastic.

It is well known that under commonly used assumptions—symmetric information, no transaction costs, CRRA utility, identical rate of time preference for all countries—perfect risk sharing among the countries in the group implies that $c_t^i = k^i gdp_t$. Here $c_t^i$ is the per capita consumption in country $i$, $gdp_t$ is the aggregate per capita GDP of the group of

countries under consideration, and $k^i$ is a country-specific constant that does not vary across "states of the world" or over time.

For each country, we compare the expected utility of consuming $k^i gdp_t$ with that of consuming the endowment, $gdp_t^i$. The difference represents *potential* gains from risk sharing that is regarded as a measure of fluctuations asymmetry. The logic is that the more a country can gain from sharing risk with other countries in a group, the more asymmetric are its GDP shocks relative to the group. (An analogous reasoning holds for U.S. states.)

To quantify these gains we must make distributional assumptions. Let the natural logarithm of the per capita GDP of the group and the per capita GDP of each country be random walks with drift. Further suppose that, conditional on $gdp_0^i$ and $gdp_0$, the joint distribution of the log-differences of these processes is stationary, iid, Normal: $\Delta \log gdp_t \sim N(\mu, \sigma^2)$, $\Delta \log gdp_t^i \sim N(\mu^i, \sigma_i^2)$, and $\text{cov}(\Delta \log gsp_t^i\,, \Delta \log gdp_t) = \text{cov}^i$ for all $t$.[10] With these assumptions Kalemli-Ozcan, Sørensen, and Yosha (2001) derived closed form solutions for the gains from risk sharing assuming identical CRRA utility functions for all countries. We will here use the solution for log-utility which yields simple and intuitive expressions.[11]

The gains from risk sharing are expressed in terms of consumption certainty equivalence. We do so by calculating the permanent percentage increase in the level of consumption that would generate an equivalent increase in expected utility. More precisely, the gain in utility (of moving from autarky to perfect risk sharing) equals the gain in utility that would be achieved by increasing consumption permanently from $\text{GDP}_{i0}$ to $\text{GDP}_{i0} * (1 + G_i)$. $G_i$ is our country-by-country measure of fluctuations asymmetry and, for log-utility, is given by the simple expression:[12]

$$G^i = \frac{1}{\delta}\left(\frac{1}{2}\,\sigma^2 \;+\; \frac{1}{2}\,\sigma_i^2 \;-\; \text{cov}^i\right). \tag{4}$$

[10] This assumption involves an approximation since the aggregate GDP cannot, in general, be strictly log-normally distributed if each country's GDP is log-normally distributed.

[11] The empirical results are not very different for general CRRA utility.

[12] The intuition for this formula is straightforward. First, the gain from sharing risk is higher for countries with a lower covariance between $\Delta \log gdp_t^i$ and $\Delta \log gdp_t$. The interpretation is that countries with "counter-cyclical" output provide insurance to other countries by stabilizing aggregate output, and are compensated accordingly in the risk sharing agreement. Second, the higher the variance of country $i$'s GDP, other things equal, the more it contributes to smoothing shocks in other countries and the more it receives in exchange for this service. 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" country $i$ for joining the risk sharing arrangement.

In the empirical implementation, the parameters $\sigma^2$, $\sigma_i^2$, and $\text{cov}^i$ are estimated using country-level (or state-level) and aggregate GDP data. $\delta$ is the discount rate and we use a value of 2 percent. A natural measure of output is GDP deflated by the Consumer Price Index (CPI).[13]

We calculate the asymmetry measure for EU countries and for U.S. states for the 1980s and the 1990s. We also calculate the measure using GNP data rather than GDP data. Note that if risk sharing from factor income flow is perfect, such that the GNP all countries (states) shows identical growth, the GNP-based measure of asymmetry will be zero, as no further gains from risk sharing are possible.

We show the results in Table 3. For both U.S. states and European countries the level of asymmetry has declined dramatically from the 1980s to the 1990s. It seems that country-level and regional-level business cycles have become more correlated. We will not try to conjecture what lies behind this observation, and whether this is a "structural" more permanent pattern, or is due to the type of shocks driving GDP variation in the 1980s versus the 1990s (the early 1980s saw much turmoil in financial markets).

For the U.S. states, high risk sharing is reflected in much lower asymmetry of income than of state-level GDP. Surprisingly, for the EU countries GNP is *more* asymmetric than GDP.[14]

## 3 Concluding Thoughts: Implications for Europe

We structure our discussion around Figure 4, adapted from Kalemli-Ozcan, Sørensen, and Yosha (2001), which outlines main channels through which economic integration may affect asymmetry of output and income. (The unlabelled arrow indicates that we do not claim to have identified all possible channels.) To start with one point that seems to have been somewhat ignored in the literature: asymmetry of output shocks is not likely to create strains

[13] We stress the logic of 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). Thus, we want to translate GDP to the amount of consumption that it can buy which is obtained by deflating using the CPI.

[14] The welfare gain is proportional to the variance of $\Delta \log gdp_t^i - \Delta \log gdp_t$ (for GDP and similarly for GNP) so, in a mechanical sense, we are finding that the variance of the idiosyncratic component of GNP is higher than the variance of the idiosyncratic component of GDP.

in a currency union unless it creates high asymmetry of *income*.[15] Asymmetry of output is obviously a determinant of income asymmetry, but this asymmetry is directly mitigated if inter-country risk sharing in significant. Our measure of risk sharing has the simple interpretation of measuring the percent of a country-specific shock to output (in percent growth terms) that is passed on to income. In the U.S. we find that less than 50 percent of output shocks are reflected in income shocks (which are further smoothed through federal taxes and transfers). We expect countries in EU to reach similar levels of risk sharing and our results indicate that this process is currently gaining momentum. The U.S. results are not directly comparable since they also include in-state income smoothing through earning retention (dividend payout) patterns, but it is noticeable that the degree of risk sharing in the U.S. still is increasing in spite of having already reached high levels.

The impact of trade on asymmetry, stressed by Krugman (1993), has received much attention. Frankel and Rose (1998) argued that demand spill-overs and (in particular) more intra-industry trade might dominate the effect from specialization and shows that this holds true empirically. Their work, focusing on trade barriers, does not take into account the direct effect of risk sharing on specialization documented by Kalemli-Ozcan, Sørensen, and Yosha (2003a) and the resulting effect on asymmetry documented by Kalemli-Ozcan, Sørensen, and Yosha (2001) and Imbs (2003).

The current paper does not directly re-test the findings of these earlier papers, but rather looks at the time-series patterns which seem highly consistent with these earlier results. Risk sharing is increasing and so is industrial specialization. We conjecture that risk sharing is playing an important causal effect, because trade barriers have been low within the EU for a long period of time, and the effect of lower trade barriers may to some extent have played itself out. More empirical work will be needed in order to be more precise.

Surprisingly, output asymmetry has declined steeply over the last two decades. We cannot tell which of the channels we identify in Figure 4 would be the cause of this result. It maybe be due to more similar policy as countries were adjusting fiscal policy in order to meet the

[15] Ultimately, welfare depends on the (level and) variance of consumption. Governments can smooth disposable income and consumers can further smooth consumption through borrowing and lending as discussed in detail in Asdrubali, Sørensen, and Yosha (1996). Our view is, however, that consumption variation often seems to be caused by taste shocks making empirical measures of consumption asymmetry suspect for evaluating potential welfare gains from risk sharing.

Maastricht criteria, but a similar result was found for U.S. states so the finding may be simply due to a different nature of the shocks to the world economy in the 1990s (inflation being conquered in the 90s, the "new economy," ...).

We found higher asymmetry of GNP than of GDP among EU countries. One component of net factor income flows are returns from international equity investment. An active recent literature has documented that developed country stock and bond market returns recently have been highly correlated diminishing the stabilizing impact of diversification; see, for example, Goetzman, Li, and Rouwenhorst (2002) and Mauro, Sussman, and Yafeh (2002). We conjecture that these findings from financial markets may have the same roots as our findings of declining GDP asymmetry although we leave further corroboration of this conjecture for future research. A higher correlation between the GDP and asset market returns does not, however, rule out lower correlation of income and consumption; it merely implies that an even higher level of international portfolio diversification is needed. Our conjecture is that as financial integration further progresses and cross-border investments become further diversified, the variance of factor income flows will decline and GNP will become less asymmetric than GDP. This conjecture is, of course, highly influenced by the observation that risk sharing among U.S. states has led to sharply lower asymmetry of income growth relative to state-level GDP growth.

All in all, we expect to see risk sharing between EU countries to keep increasing. We expect this to lead to more specialization, and we expect the resulting increase in asymmetry to be minor and have small welfare costs as increasing risk sharing lowers the asymmetry of *income* fluctuations.

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**Appendix: Data**

Data for U.S. states are collected from various sources (state level GDP data are from the Bureau of Economic Analysis) documented in Asdrubali, Sørensen, and Yosha (1996). National Account data for the EU are from the **OECD National Accounts Volume 1, Revision 2002**. To calculate the specialization index, we use data from the **OECD National Accounts Volume 2, Revision 2002** in current prices. 15 GDP by 1-digit ISIC sectors and 14 manufacturing GDP by 2-digit ISIC sectors are shown below.

**1-digit ISIC sectors**

1. Agriculture, hunting and forestry
2. Fishing
3. Mining and quarrying
4. Manufacturing
5. Electricity, gas and water supply
6. Construction
7. Wholesale and retail trade; repair of motor vehicles and household goods
8. Hotels and restaurants
9. Transport, storage and communication
10. Financial intermediation
11. Real estate, renting and business activities
12. Public administration and defence; compulsory social security
13. Education
14. Health and social work
15. Other community, social and personal service activities

**2-digit Manufacturing ISIC sectors**

1. Manufacture of food products, beverages and tobacco
2. Manufacture of textiles and textile products
3. Manufacture of leather and leather products
4. Manufacture of wood and wood products
5. Manufacture of pulp, paper and paper products; publishing and printing
6. Manufacture of coke, refined petroleum products and nuclear fuel
7. Manufacture of chemicals, chemical products and man.made fibres
8. Manufacture of rubber and plastic products
9. Manufacture of other non.metallic mineral products
10. Manufacture of basic metals and fabricated metal products
11. Manufacture of machinery and equipment n.e.c.
12. Manufacture of electrical and optical equipment
13. Manufacture of transport equipment
14. Manufacturing n.e.c.

Table 1: Risk Sharing through international factor income flows: EU

| Sample | | 1972–1982 | 1983–1992 | 1993–2000 |
|---|---|---|---|---|
| EU14 | | | | |
| | Risk Sharing | 1 | –7 | 6 |
| | t-stat. | (0) | (4) | (2) |
| EU8 | | | | |
| | Risk Sharing | 4 | 2 | 11 |
| | t-stat. | (2) | (1) | (3) |

Notes: The entry for Risk Sharing is the percentage of a county-specific shock to output that is not reflected in GNP. EU8: Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, and the United Kingdom. EU14: EU8 plus Austria, Finland, Greece, Portugal, Spain, and Sweden.

Table 2: Risk Sharing through capital markets: U.S. states

| Sample | | 1964–1970 | 1971–1980 | 1981–1990 | 1991–1998 |
|---|---|---|---|---|---|
| | Risk Sharing | 29 | 42 | 48 | 55 |
| | t-stat. | (7) | (8) | (10) | (14) |

Notes: The entry for Risk Sharing is the percentage of a state-specific shock to output that is not reflected in state income (more precisely "state income" constructed as in Asdrubali, Sørensen, and Yosha (1996)). The difference between GDP and state income includes inter-state factor income flows, depreciation, and corporate saving.

Table 3: Asymmetry of GDP and GNP (income)

| Sample | | 1983–1991 | 1991–1999 |
|---|---|---|---|
| U.S. | | | |
| | Asymmetry (GDP) | 2.99 | 0.89 |
| | Asymmetry (Income) | 0.82 | 0.42 |
| Sample | | 1983–1991 | 1991–2000 |
| OECD | | | |
| | Asymmetry (GDP) | 1.23 | 0.61 |
| | Asymmetry (GNP) | 1.49 | 0.79 |

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Notes: The entry for Asymmetry is interpreted as the welfare gain a state/country would obtain from fully diversifying any state/country-specific variance in output/GNP/Personal Income expressed in terms of the percent permanent increase in GDP that would result in the same utility gain.

## Figure 1: Risk Sharing in EU

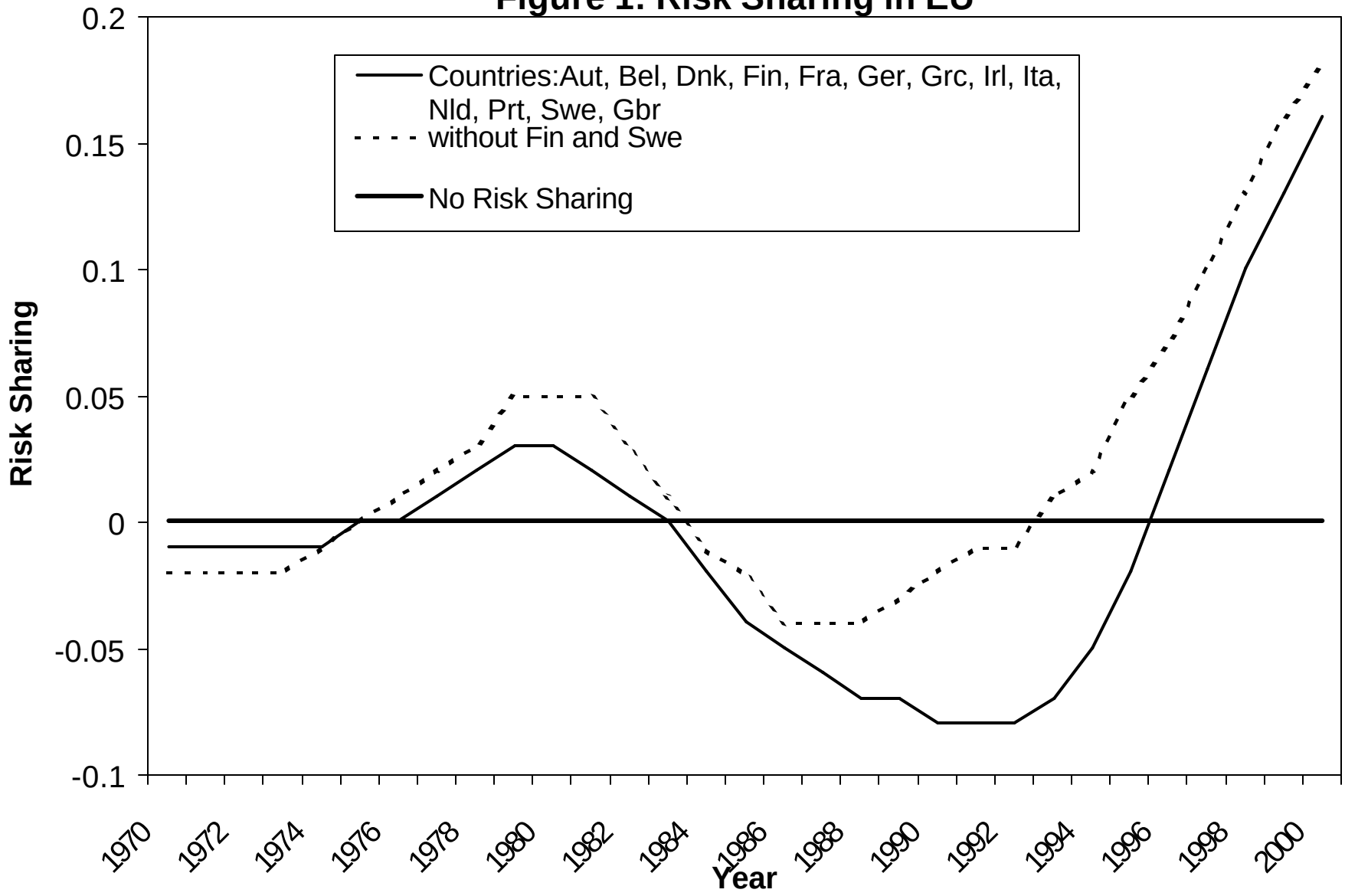


**Figure 2: Average Specialization in EU - 1 Digit ISIC Level**

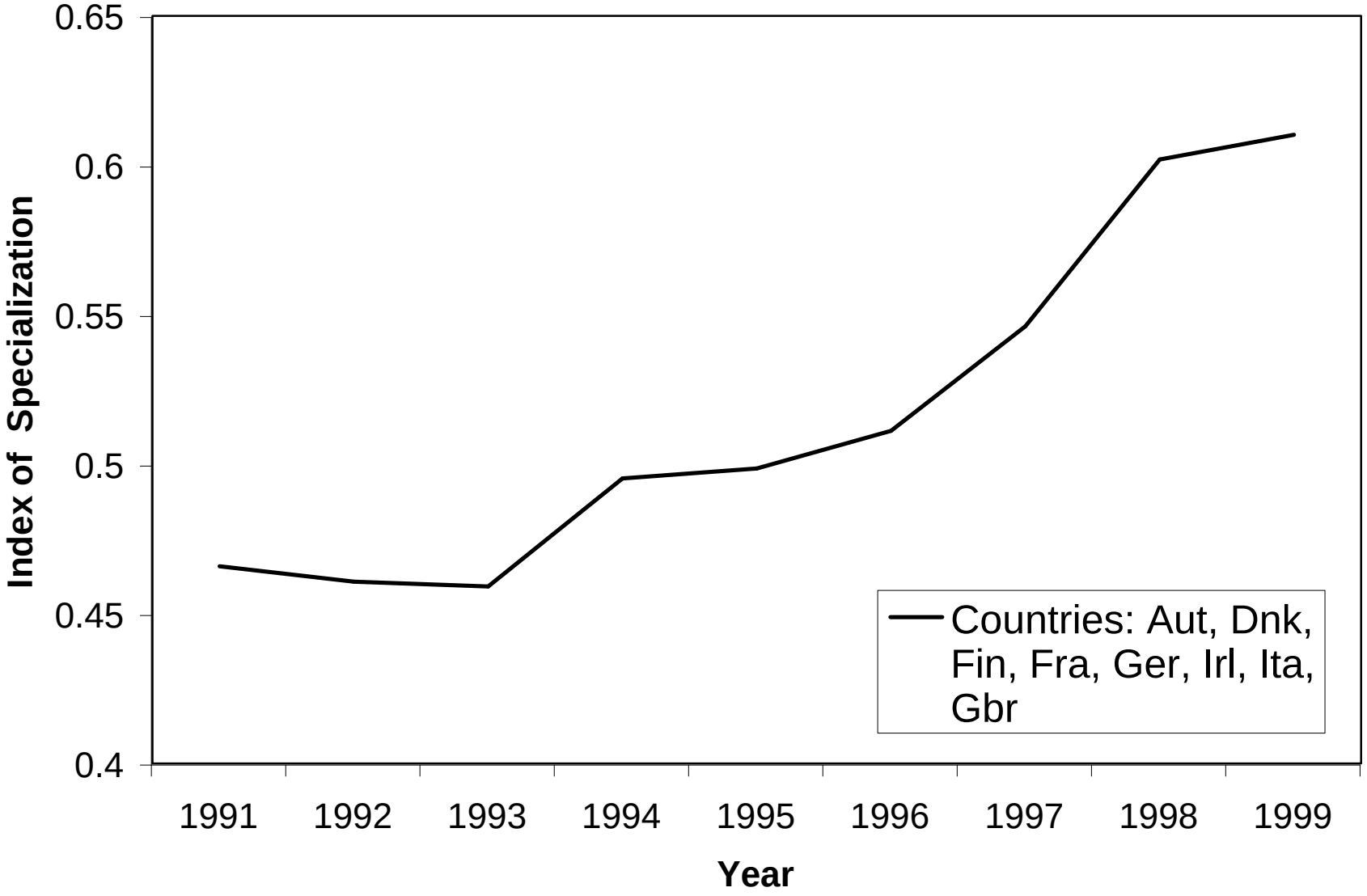
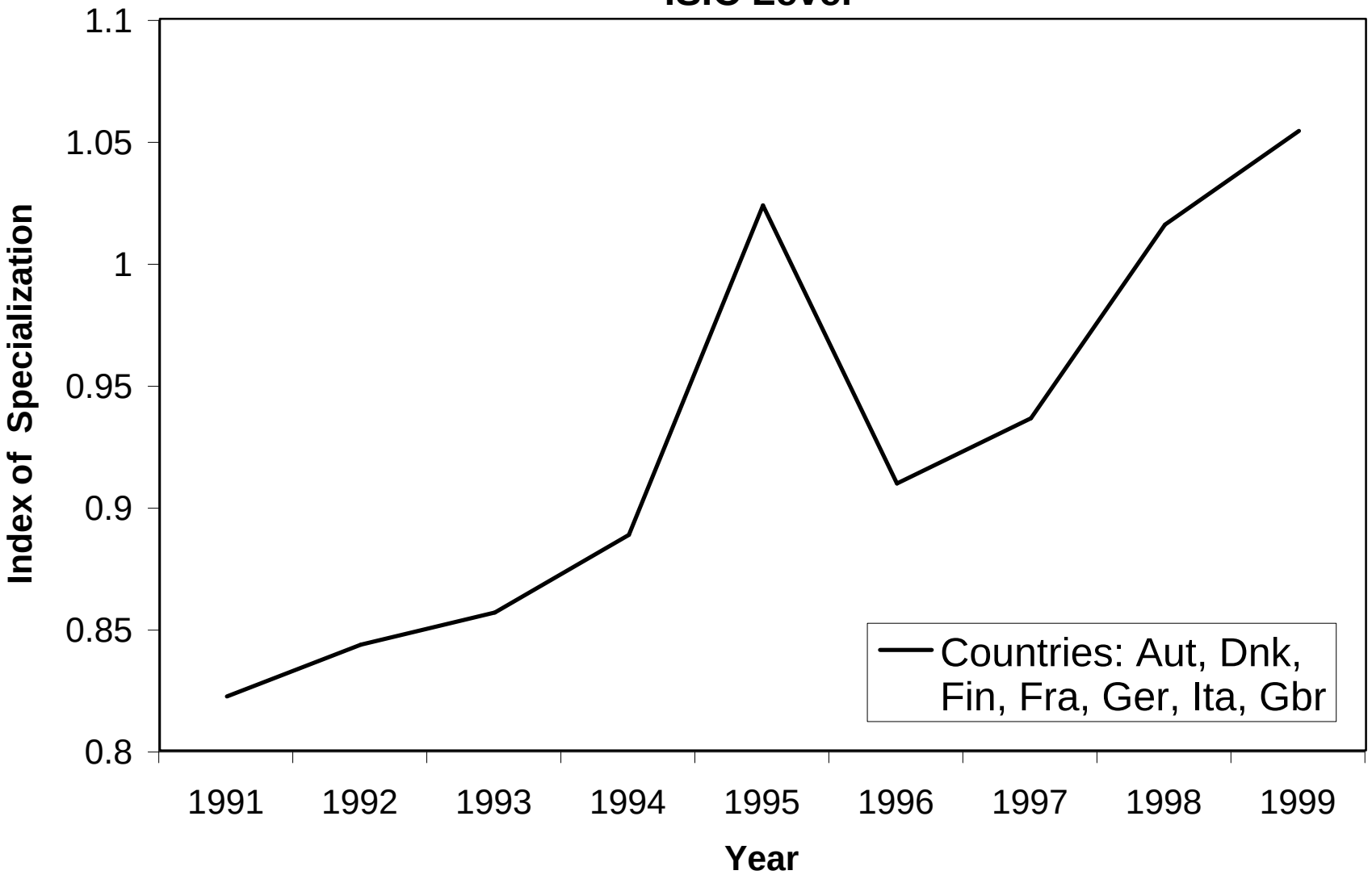


**Figure 3: Average Specialization in EU - 2 Digit Manufacturing ISIC Level**



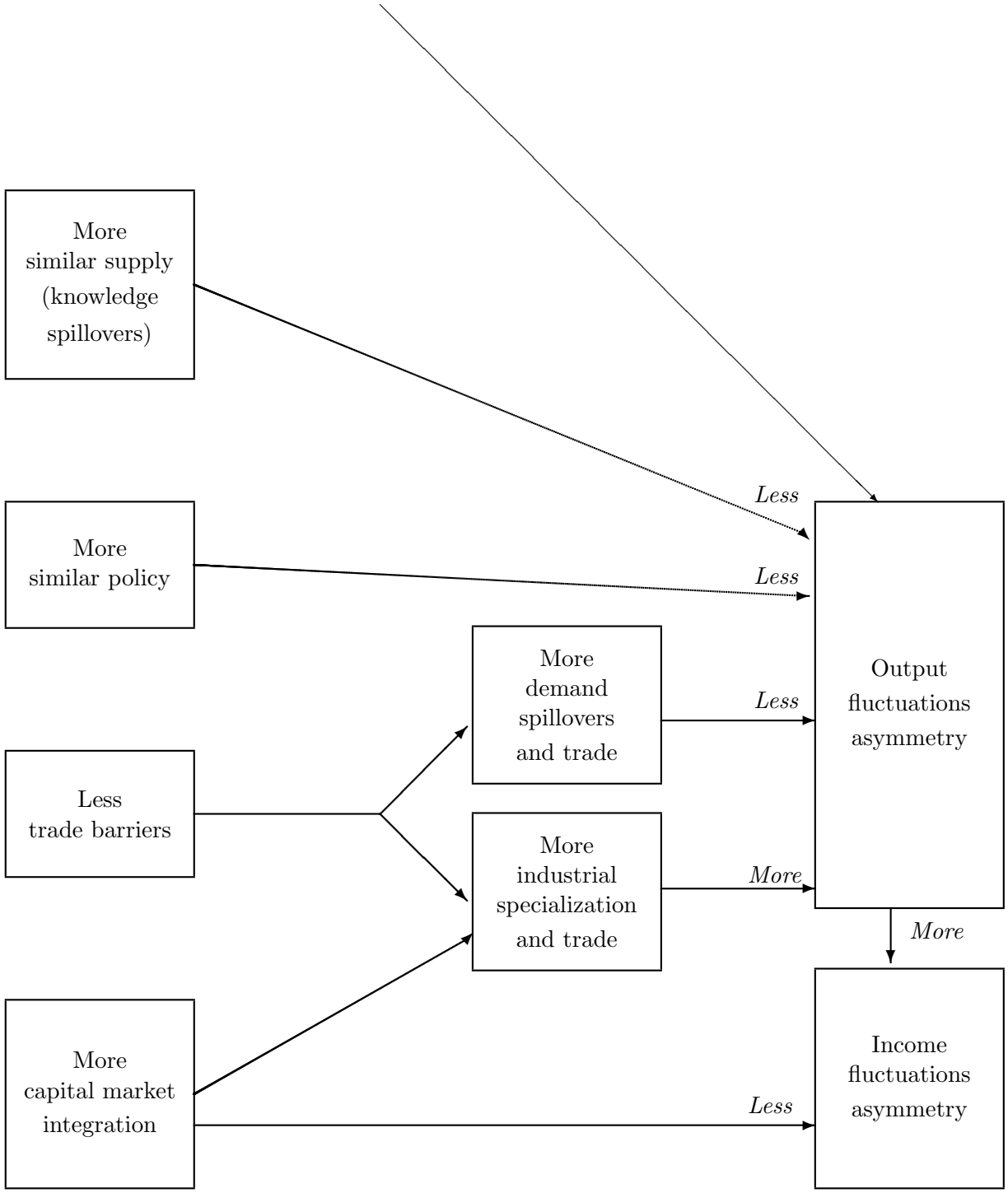



Figure 4: The Effects of Economic Integration on Fluctuations Asymmetry