Output Smoothing between Regions in Sweden

Linda Andersson*
Department of Economics, Umeå University,
SE-901 87 Umeå, Sweden

Abstract

The objective of this paper is to analyze the amount of risk sharing of output that takes place between regions in Sweden. Using the approach by Asdrubali et al. (1996), further developed by Mélitz and Zumer (2002), we find that the capital market is the largest source of risk sharing of gross regional product in Sweden. Still, roughly 12 percent of a change in regional output is smoothed among the regions through the fiscal system. Taking a closer look at the fiscal component, the results suggest that national taxes play a larger role in the smoothing process than transfer payments do. There is also some evidence that there are regional differences in the sense that regions located in the south rely more on the capital market as a source of insurance against shocks in output, while the tax and transfer systems provide a larger extent of risk sharing for regions located in the north.

JEL classification: H11, H20, H77, E62, R50
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1 Introduction

The objective of this paper is to analyze the channels and extent of risk sharing (or stabilization, which we will use interchangeably) in regional output in Sweden. Economic activity does to a large extent take place under uncertainty where regions may be hit by asymmetric shocks, i.e. some regions are positively affected by the shocks while others are negatively affected. One way to mitigate the effect of such shocks is to share the risk within a group of regions, containing regions which are asymmetrically affected. The empirical literature has mainly approached the topic of risk sharing from two different angles.[1] The first approach considers the possibility of individuals and consumers to diversify regional risk via their consumption behavior. The other approach considers the presence of a monetary union, which precludes the use of flexible exchange rates as an instrument for stabilizing economic fluctuations and, thus, leaves it up to fiscal mechanisms and possibly other market institutions to smooth output and consumption variations. The less integrated the capital market is, the more important will be the fiscal system in providing risk sharing. There is, however, not necessarily a trade off between the two. Regardless of which approach we consider more relevant, it is important to trace the extent of risk sharing.

In modern economies there are usually a wide range of alternatives to choose between when to insure risk, from regular insurance or insurance via forward markets where agents act in order to buy and sell commodities at a fixed price for future delivery. Using US data, Asdrubali et al. (1996) and Athanasoulis and van Wincoop (2001) find that the main channel for spreading risk across regions is via the capital market, by diversifying ownership through ex ante investments. Another important mechanism for risk sharing is provided through national taxes and transfers of the fiscal system. Most of the empirical literature has, usually due to access to data, focused on the fiscal system as shock absorber. Sala-i-Martin and Sachs (1992) present results that are similar to those by Asdrubali et al. (1996),

[1] See von Hagen (1998) for a more thorough overview of the different strands of literature.

while according to von Hagen (1992), the fiscal system plays a more modest role. Going beyond US borders, Decressin (2002) analyzes redistribution and risk sharing in Italy, while Buettner (2002) and von Hagen and Hepp (2001) apply a variant of the approach developed by Asdrubali et al. (1996) on German data. Mélitz and Zumer (1999) compare results on data from the US and Canada with results on data from the UK and Italy, and in a recent study, Mélitz and Zumer (2002) also include France. According to these studies, the stabilization effects in Germany, France and the UK are approximately at the same level as in the US, whereas there is comparatively less risk sharing in Italy and Canada. These results are interesting, especially considering the fact that both, e.g., Germany and Canada have extensive transfer systems with the aim to reduce disparities between states and provinces, i.e., nations with a relatively large extent of redistribution have a lower extent of risk sharing provided by the fiscal system.[2]

The differences in results have been debated, and one factor that has been addressed as underlying these differences concern the use of levels as opposed to first differences in order to distinguish between risk sharing and redistribution. Another factor concerns the accounting of data, especially transfers. Hence, the debate and the fact that there is still no consensus in the results, makes risk sharing a highly interesting topic. Since previous work has found that international risk sharing is limited (Sørensen and Yosha, 1998), it is especially interesting to analyze various types of national institutional systems. This paper contributes with empirical evidence on output risk sharing in the somewhat different institutional structure of Scandinavian fiscal federalism, here represented by Sweden.[3] In line with, e.g., Germany and Canada, Sweden has an extensive system of intergovern-

[2]Evaluating the equalization system in Canada, Boadway and Hayashi (2004) find that the system contains destabilizing elements, which may generate more variability in revenue of the provinces than would be the case in the absence of the equalization system.

[3]In Sweden, the size of the public sector is, in an international comparison, very large. The provision of many services, such as child care, education and health care, has been decentralized to the subnational level. The national government tries to monitor the lower levels of government via legislation as well as via the intergovernmental transfer system. The main source of revenue for the local governments is income taxation.

mental transfers aimed at equalizing fiscal disparities between counties and municipalities, respectively. In addition, our data set allows us to estimate smoothing due to agents holding assets on the financial markets. Hence, we are able to conduct a broader analysis of the importance of the institutional platform. During the time period of study, the tax and transfer systems were subject to major changes and the financial markets were deregulated, which makes it possible to analyze whether these reforms have had any impact on the extent to which the capital market and the fiscal system stabilize output variation among regions. Further, we also test for the possibility that Swedish regions belong to different risk sharing groups, which previous results on Swedish income data suggest is the case (Andersson, 2004).

The paper proceeds as follows. Section 2 presents the empirical model. The scope is to combine the empirical specifications suggested by Asdrubali et al. (1996) and Mélitz and Zumer (2002), which facilitates a way to measure the extent to which the capital market and the fiscal system, respectively, mitigate the influence of a shock to output. This is done by estimating the correlation between the variation in gross regional product and net factor income and net taxes, respectively. The analysis is carried out on a panel of Swedish regions for the period 1985-2000. Section 3 contains a description of the data set. The results are also presented in Section 3. The paper concludes with Section 4.

2 The empirical model

In the empirical literature there are several suggestions regarding how to capture the risk-sharing components of changes in regional income. By further developing the approach by Asdrubali et al. (1996), Mélitz and Zumer (2002) assume the general specification

$$Y_{it} = \alpha^r + \beta^r \overline{X}_i + \beta^s (X_{it} - \overline{X}_i) + \omega_{it}$$

where X is gross regional product, while Y is gross product minus income. This can be decomposed into one part which captures redistribution effects

$$\overline{Y}_i = \alpha^r + \beta^r \overline{X}_i + \eta_i \tag{1}$$

and another part

$$Y_{it} = \alpha_i + \beta^s X_{it} + \mu_{it} \tag{2}$$

which refers to stabilization effects; $\alpha_i = \overline{Y}_i - \beta^s \overline{X}_i$. Focusing on equation (2), $\beta^s = 1$ indicates that there is full risk sharing, since the variation in gross product is fully reflected in Y, and not in income itself. This means that a change in gross regional product is fully absorbed by capital and/or fiscal institutions, which leaves income after risk sharing unaffected. However, if $\beta^s = 0$, there is no pass-through in the system, i.e. the variation in gross product is reflected in income and not in Y, which suggests that there is no risk sharing. In other words, β^s indicates the extent of risk sharing. Taking the first difference of equation (2) gives us

$$\Delta Y_{it} = \delta_i + \beta^s \Delta X_{it} + \mu_{it} \tag{3}$$

where we allow for a regional term δ_i, which captures possible drift elements of the disturbance term (Mélitz and Zumer, 2002).

In this paper we are interested in decomposing equation (3) into risk sharing that takes place via the capital market and the fiscal system, respectively. Asdrubali et al. (1996) shows that this is feasible by realizing that according to standard accounting, regional product (X) minus personal income (PI) is net factor income, i.e. net income received from other regions by for instance holding assets. In turn, personal income (PI) minus disposable income (DPI) is net taxes, i.e. net contribution to the fiscal system. Hence, the correlation between the variation in gross regional product and net factor income, β^s_K, indicates to what extent the capital market is involved in stabilizing a shock to output. In the same manner, the correlation between the variation in gross regional product and net taxes, β^s_F, indicates the amount of risk sharing that is provided by the fiscal system. Estimates of β^s_K and β^s_F are obtained by estimating the following equations

$$\begin{aligned} \Delta(X_{it} - PI_{it}) &= d_{K,i} + \beta^s_K \Delta X_{it} + \epsilon_{it} \\ \Delta(PI_{it} - DPI_{it}) &= d_{F,i} + \beta^s_F \Delta X_{it} + \varepsilon_{it} \end{aligned} \tag{4}$$

Due to the decomposition, note that $1 = \beta^s_K + \beta^s_F + \beta^s_U$, i.e. the total shock

can be stabilized by the capital market (β_K^s) and/or the fiscal system (β_F^s), while β_U^s represents the part of the shock that remains unexplained by our model and which may be unsmoothed. It is important to realize that even in the case of full risk sharing, regions may be affected by national shocks. We deal with this by dividing the variables by the aggregate (national) per capita value for the respective variables.

3 Empirical analysis

3.1 Data

The Swedish public sector is structured into three levels of government; local governments (municipalities), regional governments (counties) and the central or national government. The municipalities provide a variety of services such as child care, education and care of the elderly, while the counties' main responsibility is health care. The central government is mainly responsible for the provision of national public goods, such as the defense, and redistribution.

The data set is a panel covering the period 1985-2001 and 21 regions. The 21 regions consist of a total of 289 municipalities, where the number of municipalities in the regions vary between 1, since the county and municipality of Gotland coincide, and 51 in the county of Västra Götaland. We also note that there is a large difference in density between regions, where the county of Stockholm has a density of 240.5 inhabitants per square kilometer while the density in Norrbotten county is 2.5. Data originate from national accounts data and the income-tax returns filed by individuals, which have been aggregated to regional level. All monetary values have been deflated by the consumer price index (1980 = 100), and are divided by population to calculate per capita values.

The income variable used in the analysis is the average real income among all municipal residents, including legal persons, assessable for national tax measured as total personal income (employment income and income of business), minus general deductions and deductions for loss. Similarly, the tax

payment variable is measured as the real per capita personal tax payment to the national government by residents in the municipality, including employment income tax, capital income tax, property tax, tax on real estate, and social security.

The central government distributes transfers to the lower levels of governments in the form of grant-in-aid, operating grants and investment grants. National transfers to the households made up about 20 percent of the national budget in the beginning of the 1980s and about 30 percent at the end of the 1990s. These transfers consist of child allowances, housing allowances, pension, sickness benefits, study allowances, unemployment benefits, and social allowances. The transfer variable used in the analysis is measured as the real per capita transfer payments distributed by the central government to the municipalities, counties, and the households as listed above.

Gross regional product is not available prior to 1985, which puts a limiting constraint on the length of the time period. In addition, the national account system was subject to a major change in 1993. According to Statistics Sweden, it is not possible to link data for the entire time period. For the year 1993, gross regional product has been calculated according to both the old and new account systems. We therefore estimate the equations using the time periods 1985-1993 and 1993-2001, respectively.

Table 1 presents summary statistics of the variables used in the analysis. Generally, there is larger variation between regions in the later period 1993-2001 compared to the period 1985-1993. The county of Stockholm reports the highest output and income per capita, while we note that the lowest value of gross regional product and income per capita are registered for the counties of Södermanland and Gotland, respectively. The highest value of national tax payments per capita is registered for Stockholm, which also receives the least transfer payments per capita. This pattern applies to both time periods. The island of Gotland has the lowest tax payment per capita in both time periods. The counties of Jämtland and Gotland have received highest amounts of transfer payments.

TABLE 1 ABOUT HERE

3.2 Results

We present the results of panel data estimation methods using regional fixed effects (FE; within estimator) and generalized least squares (GLS).[4] All estimations assume a common AR1 process for all regions.[5] In the GLS estimations we allow for a heteroskedastic error structure, but no cross-sectional correlation.[6] Since the literature has argued both in favor of using levels and first differences to estimate the extent of risk sharing, we will show results of both procedures in order to to see whether the results differ. Tables 2 and 3 present the results when using levels and first differences, respectively, to estimate (4).

TABLE 2 ABOUT HERE
TABLE 3 ABOUT HERE

According to Table 2, and the FE estimations, the capital market smoothing amounts to approximately 82 percent, while the GLS estimations suggest a more moderate absorption of 59 percent in the earlier period, 1985-1993. Further, the smoothing is about 20 percentage points lower in the latter period 1993-2001, which is true for both estimation methods. Using fixed effects we find that the fiscal system picks up about 7 percent of a shock to gross regional product, while the GLS estimations put more weight on the fiscal system in providing risk sharing.

Turning to the results of first differences in Table 3, we see that the results for the capital market are more stable over time. The difference

[4]The model has also been estimated with random effects, where the results are similar to those obtained using GLS. A Hausman specification test shows that the fixed effects model is preferred to the random effects model.

[5]The econometric software STATA is used to estimate the parameters. The following estimator of ρ is used: $\rho_{tscorr} = \boldsymbol{\epsilon}'\boldsymbol{\epsilon}_{t-1}/\boldsymbol{\epsilon}'\boldsymbol{\epsilon}$, where $\boldsymbol{\epsilon}$ is the vector of residuals and $\boldsymbol{\epsilon}_{t-1}$ the vector of lagged residuals. Testing for serial correlation, we find evidence of an AR1 structure in the disturbances in both time periods using first differenced data, but only in the second time period when using levels.

[6]Since the time-series dimension is rather short in comparison with the number of cross-sections (each panel contains 9 years and 21 counties), it is not possible to correct for potential cross-sectional correlation.

between the two estimation methods as well as the difference between using levels or first differences is most pronounced for smoothing provided by the capital market. In the fixed effects estimation, we find that the share of the capital market has increased from 73 percent to 86 percent between the two time periods, while the GLS estimation suggests a more moderate increase in absorption of approximately 1.5 percentage points to a high of 76 percent in the later time period. In the second part or the 1980s, the Swedish capital and currency markets were deregulated. Since it usually takes time before a previously regulated market becomes fully integrated, it is reasonable to expect the importance of the capital market in providing risk sharing to increase with time. The results in Table 3 support this expectation.

Looking at the extent of risk sharing provided by the fiscal system, the fixed effects estimates show that it picks up approximately 12 percent of a shock to output. The tax and transfer systems were subject to major changes in the beginning of the 1990s. In 1991 a major tax reform was implemented, and then in 1993 the transfer system underwent major changes. According to the results using fixed effects presented in Table 3, β_F^s is not significant in the second time period, which suggests that the fiscal system does not provide any insurance against a shock to output after the implementation of the new tax and transfer systems. Though, the GLS estimates indicate that there still is a small extent of smoothing even though it is somewhat smaller than before the reforms.

In line with Mèlitz and Zumer (2002), Swedish county level data for the period 1985-2001, show that using personal income data put much more weight on the fiscal system than the gross regional product data do. In this case, 21 percent of a change in personal income is smoothed by the fiscal system, which may be compared to the results presented in Tables 2 and 3.

The smoothing provided by the central government can be decomposed into effects of tax payments and transfer payments.[7] The results presented in Table 4 indicate that taxes play a larger role in the smoothing process

[7]Using equation (1), the redistributional effect between regions of the tax and transfer systems is approximately 32 percent for the period 1985-1993 and 34 percent for the period 1993-2001.

than transfers do. This is consistent for both time periods, regardless of estimation model.

TABLE 4 ABOUT HERE

Experiments with personal income data by Mélitz and Zumer (2002) show that the estimation results on the extent of stabilization tend to be biased towards one when the time-series is short. In order to check the sensitivity of the results with respect to this matter, we re-run the regressions treating the periods 1985-1993 and 1993-2001 as one time period, i.e. 1985-2001, and thereby neglecting the re-classification of the national account system discussed in the previous section, as well as neglecting any potential parameter instability due to the reforms of the tax and transfer systems.[8] The FE estimates of β_F^s shows statistical differences between treating data as two separate panels or as one, when using first differences. This is also true for the estimation of β_K^s when using levels. All GLS estimates in levels are statistically different when treating data as originating from one time-series compared to dividing data into two separate time periods. In all other cases, the length of the time-series does not effect the estimated parameter values. However, it is important to keep in mind that this exercise is only made for expositional purpose and is not a rigorous test of the importance of the length of the time-series.

Previous results on Swedish income data show that are are regional differences regarding the extent of smoothing of a change in personal income that is provided by the fiscal system in Sweden (Andersson, 2004). Unfortunately, we do not have access to output data on the local (municipality) level, which would facilitate a full analysis of regional differences. However, it is often considered the case that the behavior of the regions in the north and

[8]The following estimates (standard deviations are given within parentheses) of β_K^s and β_F^s are obtained for the time period 1985-2001. Using fixed effects and levels, $\beta_K^s = 0.705(0.045)$, $\beta_F^s = 0.069(0.015)$, while taking first differences produce the following estimates: $\beta_K^s = 0.784(0.056)$, $\beta_F^s = 0.060(0.019)$. In the same manner we find the following results using GLS. In the case of levels $\beta_K^s = 0.538(0.041)$, $\beta_F^s = 0.107(0.017)$, and in the case of first differences $\beta_K^s = 0.752(0.043)$, $\beta_F^s = 0.040(0.013)$.

south part of Sweden is different, and, therefore, we test for the possibility that they belong to different risk sharing groups.[9]

Concentrating on the use of first differences, the results are presented in Table 5. Both the FE and the GLS estimates show that the capital market is more dominant in smoothing a shock to output in regions located in the south than in northern regions. The south part of Sweden is an economically larger region with a more diversified business structure than the north. If all regions are well integrated in the sense that capital is equally mobile across Sweden, then the capital market would also be equally important as a source of stabilization for both the north and the south. Apparently this is not the case in practise. One possible explanation for this result is that a large share of the production that is carried out in the northern regions have their headquarters and stock owners located in the south, while the opposite is rarely the case. So, this, in combination with a more diversified business structure in the south, could explain why the capital market is more dominant as a smoothing component for the south than for the north. Further, the results indicate that the fiscal system is a more important source of stabilization for northern regions than regions in the south. This supports the notion that if access to well-integrated capital markets is limited, the importance of the fiscal system as a source of stabilization becomes more pronounced.

TABLE 5 ABOUT HERE

So, how does the Swedish institutional system compare with institutional systems of other countries? Using data on the US and Canada, Mélitz and Zumer (2002) are able to compare the importance of the tax-transfer systems in stabilizing a shock to gross output. The authors find that stabilization amounts to approximately 13 percent in Canada and 12 percent in the US, which is in the neighborhood of the results presented in this paper, at least

[9]Northern regions include the counties of Gävleborg, Västernorrland, Jämtland, Västerbotten and Norrbotten, while southern regions include the counties of Stockholm, Uppsala, Södermanland, Östergötland, Jönköping, Kronoberg, Kalmar, Gotland, Blekinge, Skåne, Västra Götaland, Värmland, Örebro, Västmanland, and Dalarna.

for the period 1985-1993. However, allowing for regional differences, it appears as if fiscal stabilization varies between approximately 8 and 25 percent in Sweden. Further, and interestingly enough, the results presented in this paper indicate that the capital market partakes to a greater extent in stabilizing a shock to output in Sweden than is the case in the US (see results by Asdrubali et al., 1996; Athanasoulis and van Wincoop, 2001). Thus, it appears as if the institutional system does play a role for the amount of stabilization that the regions can rely upon in the case of an asymmetric shock to output.

4 Concluding remarks

The objective of this paper is to analyze the amount of risk sharing of output that takes place between regions in Sweden. Using the approach by Asdrubali et al. (1996), further developed by Mélitz and Zumer (2002), we find that the capital market is the largest source of risk sharing of gross regional product in Sweden. Still, roughly 12 percent of a change in regional output is smoothed among the regions through the fiscal system. Taking a closer look at the fiscal component, the results suggest that national taxes play a larger role in the smoothing process than transfer payments do. There is also some evidence that there are regional differences in the sense that regions located in the south rely more on the capital market as a source of insurance against shocks in output while the tax and transfer systems provide a larger extent of risk sharing for regions located in the north. The results also suggest that the changes made in the tax and transfer systems in the beginning of the 1990s and the deregulation of the financial markets have shifted towards an even larger extent of stabilization through the capital market as opposed to the fiscal system (the overall amount of risk sharing is relatively stable over time).

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Table 1: Summary statistics, real per capita values in SEK, 1985-1993, 1993-2001

	1985-1993		1993-2001	
	Mean	Std.d	Mean	Std.d
Gross regional product	69,108	6,031	77,141	11,225
Income	46,022	5,458	50,834	8,073
Taxes	3,990	1,590	5,605	2,501
Transfers	3,358	1,212	5,826	1,198

Note: Real per capita values. In 1980-prices.

Table 2: Stabilization of gross regional product in Sweden; levels and logarithms

	FE				GLS			
	1985-1993		1993-2001		1985-1993		1993-2001	
	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s
Coefficient	0.823	0.066	0.605	0.067	0.586	0.115	0.354	0.187
Std.d	0.067	0.022	0.064	0.020	0.061	0.028	0.047	0.020
R^2	0.507	0.057	0.377	0.073				
ρ	0.370	0.132	0.276	0.352	0.675	0.737	0.553	0.683
Log L					457.99	595.56	407.08	575.34

Note: Regional constants are included in the regressions. Estimations include a common AR1 process for all panels.

Table 3: Stabilization of gross regional product in Sweden; 1st differences and logarithms

	FE				GLS			
	1985-1993		1993-2001		1985-1993		1993-2001	
	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s
Coefficient	0.732	0.123	0.858	0.014	0.736	0.048	0.760	0.034
Std.d	0.082	0.035	0.090	0.026	0.055	0.020	0.053	0.017
R^2	0.389	0.091	0.419	0.002				
ρ	-0.328	-0.476	-0.328	-0.426	-0.252	-0.361	-0.299	-0.331
Log L					453.12	617.37	408.68	607.12

Note: Regional constants are included in the regressions. Estimations include a common AR1 process for all panels.

Table 4: Components of stabilization of gross regional product in Sweden by the central government; logarithms

	FE				GLS			
	1985-1993		1993-2001		1985-1993		1993-2001	
	Coeff	Std.d	Coeff	Std.d	Coeff	Std.d	Coeff	Std.d
	Levels							
Transfers	0.024	0.012	0.009	0.010	0.023	0.011	0.071	0.011
Taxes	0.034	0.019	0.073	0.014	0.100	0.016	0.121	0.011
	1st differences							
Transfers	0.024	0.012	0.004	0.010	0.010	0.007	0.011	0.008
Taxes	0.105	0.030	0.010	0.020	0.031	0.018	0.036	0.012

Note: Regional constants are included in the regressions.
Estimations include a common AR1 process for all panels.

Table 5: Stabilization of gross regional product in Sweden allowing for different regional patterns; 1st differences and logarithms

	FE				GLS			
	1985-1993		1993-2001		1985-1993		1993-2001	
	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s	β_K^s	β_F^s
				North				
Coefficient	0.498	0.250	0.606	0.083	0.570	0.101	0.643	0.061
Std.d	0.126	0.077	0.200	0.038	0.094	0.041	0.116	0.033
R^2	0.352	0.267	0.241	0.071				
ρ	-0.162	-0.550	-0.412	-0.418	-0.160	-0.462	-0.358	-0.335
Log L					112.14	145.27	97.42	145.91
				South				
Coefficient	0.818	0.083	0.907	-0.00003	0.797	0.031	0.810	0.031
Std.d	0.100	0.038	0.102	0.029	0.066	0.023	0.060	0.019
R^2	0.415	0.048	0.455	0.000				
ρ	-0.353	-0.442	-0.305	-0.424	-0.268	-0.324	-0.284	-0.340
Log L					343.09	474.54	312.56	462.91

Note: Regional constants are included in the regressions. Estimations include a common AR1 process for all panels.