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Working Paper

Barriers to Diversification and Regional Allocation of Capital

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Barriers to Diversification and Regional Allocation of Capital

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Abstract:

In order to evaluate the allocational effectiveness of regional policy when harmonizing regional economic conditions firms' preferences play a pivot role. If harmonization hinders risk diversification of the firm, then instead of regional diversification of capital agglomeration of capital occurs. Hence, regional policy will not achieve its objective to equal the spatial allocation of capital.

1. Introduction

There is a growing interest towards the harmonization of economic conditions and standard of living in different regions of a country or an economic union. The question of the appropriate regional policy approach in this direction is most important. Political reasoning often argues that the market solution promotes the concentration of capital to some regions. Therefore, regional policy is urged to provide a higher degree of economic integration leading to a more equal spatial allocation of capital.

The literature in regional economics has developed a fundamental interest in the spatial allocation of resources and the role of their agglomeration to some regions (Porter, 1990; Krugman, 1991; Fujita, Krugman, and Venables, 1999). In particular, welfare aspects of capital agglomeration (Pflüger and Südekum, 2007), the location decisions of firms (Pontes, 2005; Pontes/Parr 2005) and the economics of the induction of a clustering process (Raines, 2001) have been subject to thorough investigation stressing, among other things, the importance of spatial economies of scale and scope.

Our paper concentrates on the interaction between the spatial allocation of capital and the regional policy approach of harmonization. In a two-region country we study the optimal regional share of investment of a risk averse firm. Regional policy affects the firm's decision-making. When harmonizing regional economic conditions through political activities optimum regional investments of the firm reacts according to its risk preferences. A higher correlation of risky regional business costs, for example, causes barriers to diversification. As a result agglomeration of capital to one region may occur

although the regional policy approach focuses on the diversification of capital across the regions.

We formulate a model to demonstrate our claim that whether or not harmonizing regional economic conditions in terms of a higher similarity of risky regional business costs will make capital allocation regionally more dispersed than concentrated depends crucially upon the firm's prudence or risk aversion elasticity. The remainder of the paper is structured as follows: Section 2 provides the model and section 3 derives a symmetry result of regional investments. Section 4 presents the main results about the impact of risk preferences upon the asymmetry of regional investments. Section 5 concludes.

2. Optimum regional investment

A firm, located in a two-region country, has I units of capital endowment which would earn a riskless return R from investment in either region. Let $\tilde{t}_1$ and $\tilde{t}_2$ be random costs of doing business in region 1 and 2, respectively, in this two-region country. Random cost differences are based, for example, on different productivities, business environment, industrial policy, regulations, fiscal and tax policies which lead to random differences in the rates of return of the regions. Let us model the business costs of the firm such that $(1 - \tilde{t}_i)$ is retained as the uncertain net return per unit of investment in region i ($i = 1, 2$).

Consider a risk averse firm. The stochastic income of the firm, $\tilde{Y}$, comes from doing business in both regions, where x denotes the share of investment

3

capital that goes to region 1. Hence

$$\tilde{Y} = [(1 - \tilde{t}_1)x + (1 - \tilde{t}_2)(1 - x)]RI. \tag{1}$$

The firm maximizes expected utility of income, $U(Y)$, with respect to capital share x invested in region 1:

$$\max_x EU(\tilde{Y}), \tag{2}$$

where E represents the expectation operator and positive marginal utility of income, $U'(Y) > 0$, is strictly decreasing, $-U''(Y) > 0$. Capital share $(1 - x)$ goes to region 2.

The first-order condition for the optimum capital share x to region 1 in the investment problem (2) reads:

$$EU'(\tilde{Y})(\tilde{t}_2 - \tilde{t}_1) = 0. \tag{3}$$

We assume the optimum share to satisfy $0 < x \leq 1$.

First, we study the impact of differences in expected business costs across regions upon equal capital allocation to both regions. Second, we investigate the effect of the correlation of business costs upon regional investment allocation. Suppose, regional policy of the government is intended to have regional business costs moving in a more similar fashion, i.e. some kind of harmonization of economic conditions of location. Does this lead to more integration or to more specialization of the regions? In other words, do we have more diversification or more agglomeration of capital in the country? We will show that policy outcomes depend upon the risk aversion elasticity of risky business costs differences.

3. Symmetry of regional investments

As an illustration of the aim of our investigation consider former Western and Eastern Germany and today's federal and local governments' regional economic policy. We observe many political initiatives intending to harmonize regional standard of living. What are the conditions under which firms have an incentive to diversify investments across regions?

In our study, we will argue that most important are regional differences in the costs from doing business. Therefore, we disregard the magnitude of regional transactions costs and introduce the following constraint.

Assumption (A1).   Be $\text{Prob}\left(\frac{\tilde{t}_1 + \tilde{t}_2}{2} \leq \epsilon\right) = 1$.

Remark: In order to motivate and to describe the meaning of assumption (A1) for our analysis, let us consider the following restatement of the firm's income equation (1):

$$\tilde{Y} = \left[(x - 1/2)(\tilde{t}_2 - \tilde{t}_1) + \left(1 - \frac{\tilde{t}_1 + \tilde{t}_2}{2} \right) \right] RI. \qquad (4)$$

By using equation (4), let us differentiate expected utility of income $EU(\tilde{Y}) \equiv Z$ with respect to capital share x to region 1. If we evaluate the result at point $x = \frac{1}{2}$ by including assumption (A1) we get

$$
\begin{aligned}
\left. \frac{\partial Z}{\partial x} \right|_{x = \frac{1}{2}} &= EU'\left[\left(1 - \frac{\tilde{t}_1 + \tilde{t}_2}{2} \right) RI \right] (\tilde{t}_2 - \tilde{t}_1) \\
&\approx U'(RI)(\mu_2 - \mu_1),
\end{aligned}
\qquad (5)
$$

$\mu_i = E\tilde{t}_i\, (i = 1, 2)$. Hence regional investments are symmetric if and only if expected business costs across regions do not differ.

The following result reveals the importance of the costs differential between regions.

PROPOSITION 1.   Assume condition (A1) to hold. If expected business costs are identical between regions, then optimum regional investment allocation is symmetric, i.e. $x = 1/2$. If expected business costs differ between regions, than the region with the lower expected costs gets the higher capital share.

PROOF.   From the first-order condition (3) we obtain

$$EU'(\tilde{Y})(\mu_2 - \mu_1) = -\text{cov}(U'(\tilde{Y}), \tilde{t}_2 - \tilde{t}_1). \tag{6}$$

Observe that under condition (A1), the definition of the firm's income (4) and the fact that marginal utility of income U' is continuously differentiable we obtain $\text{sign}(x - 1/2) = \text{sign}(\mu_2 - \mu_1)$. And the claim follows.

Expected business costs μ_i can be interpreted as reflecting some sort of regional differences or comparative disadvantages of region i. For example, $\mu_1 < \mu_2$ implies that there is an intrinsic bias in favor of investing in region 1. Given the impact of the costs differential between regions, the magnitude of the asymmetry of optimum capital allocation to both regions also depends upon the degree of firm's risk aversion and the firm's assessment of the probability distribution of its business costs.

4. Diversification vs. agglomeration of capital

In what follows we investigate on the interaction between the degree of asymmetry of regional capital allocation and the harmonization of regional economic conditions by government policy. If political activities are such that risky business costs behave more similar, i.e. are more correlated, does this

support capital diversification across regions? Or, does such policy encourage regional agglomeration of capital?

Suppose regional policy induces harmonization of the economic environment such that risky regional business costs are more correlated. Other things being equal, this implies that the variance of the business costs differential $\tilde{t}_2 - \tilde{t}_1$ is decreasing. More generally, let us consider a mean preserving shrink of risky regional business costs, in order to study the effect of the degree of stochastic similarity between regional business costs upon optimum regional investments. We introduce the following definitions.

Definition (D1).   Let $\tilde{\Delta} \equiv \tilde{t}_2 - \tilde{t}_1$ denote the risky business costs differential between regions 2 and 1 and let $\Delta = \mu_2 - \mu_1$ indicate its expected value. Be $\tilde{\Delta}_s$ a mean preserving shrink of risky costs differential $\tilde{\Delta}$.

Definition (D2).   Let $P(Y) = \frac{U'''(Y)}{-U''(Y)} Y$ denote relative prudence (Kimball, 1990).

The following result reports the relationsship between the degree of allocational asymmetry and the harmonization of regional economic conditions.

PROPOSITION 2.   Be $\Delta > 0$, i.e. $x > 1/2$. A mean preserving shrink in the risky regional business costs differential leads to less asymmetry of regional investments, i.e. x decreases, if and only if relative prudence exceeds 2.

Remark: One may consider as a benchmark of the firm's utility function the generalized logarithmic utility function $U(Y) = Y + \gamma \log(Y)$, $\gamma > 0$. This utility function exhibits $P(Y) = 2$ (Battermann, Broll, and Wahl, 2007).

PROOF.   From Proposition 1 we have $\text{sign}(x - 1/2) = \text{sign}\Delta$. Let $f(z) = zU'(z)$. By using definition (D2) we get $\text{sign}f''(z) = \text{sign}(P(z) - 2)$. Hence,

7

from the first-order condition (3) and definition (D1) we obtain $\text{sign}(P(Y) - 2) = -\text{sign}EU'(\tilde{Y})\tilde{\Delta}_s$. In order to satisfy the first-order condition optimum capital share x invested in region 1 before the shrink must be adjusted. x declines as result of a mean preserving shrink if and only if $P(Y) > 2$. And the claim follows.

Proposition 2 reveals that preferences of the firm play a pivot role when one evaluates the effectiveness of regional policy upon capital allocation. Regarding the aim of harmonizing economic environments in different regions preferences determine whether or not diversification of capital occurs. Regional policy affects the probability distribution of regional business costs. If political measures turn out to destroy stochastic differences they also change incentives for regional investments. Given specific preferences of the firms such policy creates barriers to diversification. As a result regional agglomeration of capital will occur although the objective of regional policy is the opposite.

To work out the economic intuition behind Proposition 2 we relate our finding to the framework of two-moment decision models (Meyer, 1987). This allows us to apply the notion of elasticity.

COROLLARY. Suppose a mean preserving shrink in the costs differential. Then (in)elastic risk aversion leads to diversification (agglomeration) of regional investments. Capital allocation is unaffected if and only if preferences exhibit unit elastic risk aversion.

PROOF. $\text{sign}(P(Y) - 2) = \text{sign}(\varepsilon - 1)$, where ε denotes the elasticity of risk aversion (Broll, Wahl, and Wong, 2006).

It is common in the literature to study economic effects of policy measures under the presumption that important variables are related by a regression. To undertake such an investigation let us introduce the following relationship.

Assumption (A2). Suppose that regional business costs are correlated such that $\tilde{t}_1 = \alpha + \beta\tilde{t}_2 + \tilde{u}$, where $E(\tilde{u}|t_2) = 0$.

Remark: There exists a systematic relationship between risky regional business costs $\tilde{t}_1$ and $\tilde{t}_2$, although the linear relation is obscured by an uncorrelated noise $\tilde{u}$ with zero mean. Note that $E(\tilde{u}|t_2) = 0$ implies $\text{cov}(\tilde{t}_2, \tilde{u}) = 0$, since $E(\tilde{t}_2\tilde{u}) = E[\tilde{t}_2 E(\tilde{u}|t_2)]$.

The following result reports how a harmonization of regional economic conditions affects the degree of asymmetry of regional investments.

PROPOSITION 3. If the level of relative risk aversion of the firm's utility function does not exceed unity, then given regression (A2) the asymmetry of optimum regional capital allocation reduces when regional policy harmonizes business costs (i.e., β increases).

PROOF. Let $A(Y) = \frac{-U''(Y)}{U'(Y)}$ denote absolute risk aversion. Then implicit differentiation of the first-order condition (3) leads to:

$$\text{sign}\frac{dx}{d\beta} = \text{sign}E\{A(\tilde{Y})\tilde{Y} - 1 - A(\tilde{Y})(1 - \tilde{t}_2)RI\}U'(\tilde{Y})\tilde{t}_2. \qquad (7)$$

Since $A(\tilde{Y})(1 - \tilde{t}_2)RI > 0$, the overall term in brackets $\{...\}$ is negative if the level of relative risk aversion $A(Y)Y$ does not exceed unity. And the claim follows.

Under our regressional condition improving regional policy coordination brings the country closer to full diversification and, therefore, closer to sym-

metry of regional investments. The reason is that in the first place an increase in regression parameter β decreases the regional business costs differential. This makes region 1 less attractive compared with region 2. On the other hand, barriers to diversification evolve since business costs are more correlated. If preferences do not exceed a critical level of relative risk aversion the net effect of regional policy is in favor of the harmonization target.

Note, however, that according to empirical studies (see, e.g., Friend and Blume, 1975), coefficients of relative risk aversion are typically in excess of one. Hence, at some point, agglomeration of capital will occur although regional policy is aimed to harmonize economic conditions. The reason be that the advantage of a lower business costs differential is overcompensated by the disadvantage of reduced diversification opportunities of the firms.

4. Concluding remarks

An interesting question that has been raised in the context of economic integration is whether or not regional policy, for example, the cluster approach, will promote mobility of capital in order to achieve economic efficiency and stability in a country. Our paper shows that greater economic integration between regions induces only under specific conditions investment decisions of capital to be more geografically concentrated than diversified.

It is reasonable to argue that given historical conditions certain regions may have natural advantages in attracting capital investments. For example, lower expected transaction costs in doing business in one region can be interpreted as an intrinsic regional advantage to attract capital.

Our modelling starts with an economic setting in which there exists an initial attractiveness for capital investments to a specific region. Whether or not economic integration gets magnified by regional policy approaches like the harmonization of economic conditions depends primarily upon the firms' preferences. The intended symmetry of regional investments may not be achieved by regional policy because firms have an incentive to concentrate investments in one region as a reaction of harmonization measures. Therefore, the agglomeration of capital is endogenous. We argue that barriers to diversification hinder to equal the spatial allocation of capital.

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12

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