

Grossmann, Volker; Steger, Thomas M.

Working Paper

Optimal growth policy: The role of skill heterogeneity

Working Paper, No. 117

Provided in Cooperation with:

University of Leipzig, Faculty of Economics and Management Science

Suggested Citation: Grossmann, Volker; Steger, Thomas M. (2012) : Optimal growth policy: The role of skill heterogeneity, Working Paper, No. 117, Universität Leipzig, Wirtschaftswissenschaftliche Fakultät, Leipzig

This Version is available at:

<https://hdl.handle.net/10419/70918>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

UNIVERSITÄT LEIPZIG

Wirtschaftswissenschaftliche Fakultät
Faculty of Economics and Management Science

Working Paper, No. 117

Volker Grossmann / Thomas M. Steger

**Optimal Growth Policy: the Role of Skill
Heterogeneity**

März 2012

ISSN 1437-9384

Optimal Growth Policy: the Role of Skill Heterogeneity

forthcoming in: *Journal of Economics and Control*

Volker Grossmann* and Thomas M. Steger†

March 6, 2012

Abstract

A simple semi-endogenous growth model is employed to show that optimal subsidization of both R&D and capital costs is independent of the distribution of R&D skills in the workforce. This holds despite the empirically supported fact that a higher R&D subsidy rate raises wages of R&D workers.

Key words: Optimal growth policy; R&D skills; R&D subsidy; Semi-endogenous growth, Heterogeneity.

JEL classification: O30; O40; H20.

*University of Fribourg; CESifo, Munich; Institute for the Study of Labor (IZA), Bonn. Address: University of Fribourg, Department of Economics, Bd. de Pérolles 90, 1700 Fribourg, Switzerland. E-mail: volker.grossmann@unifr.ch.

†University of Leipzig; CESifo, Munich. Address: Institute for Theoretical Economics, Grimmais-
che Strasse 12, 04109 Leipzig, Germany, Email: steger@wifa.uni-leipzig.de.

1 Introduction

Empirical evidence suggests that the social return to R&D significantly exceeds the private return (e.g. Grilichis and Lichtenberg, 1984; Jones and Williams, 1998). Likewise, calibrated R&D-based growth models find a substantial R&D underinvestment gap (e.g. Jones and Williams, 2000). These results seem to call for large R&D subsidies (Grossmann, Steger and Trimborn, 2010a,b).

However, a frequent critique of raising R&D subsidies is that R&D skills are in limited supply and those with high R&D skills may already be allocated to R&D occupations. It has been argued that, therefore, stimulating demand for R&D workers primarily raises wages of R&D personnel rather than fostering innovation. In fact, Goolsbee (1998) shows that remuneration of R&D workers is positively affected by public policies to support R&D. It therefore seems that the distribution of R&D skills affects the optimal R&D policy: more limited R&D skills should imply lower optimal R&D subsidies.

We introduce R&D skill heterogeneity in a standard semi-endogenous growth model à la Jones (1995) and show analytically that, surprisingly, the optimal R&D policy is in fact *independent* of the distribution of R&D skills. The wedge between R&D investment in market equilibrium and social planning optimum is solely driven by positive R&D externalities. This holds despite a positive relationship between R&D subsidies and wages of R&D workers. Moreover, the optimal capital subsidy is also independent of the skill distribution.

2 The Model

Time is continuous and indexed by t . The time index is omitted whenever this does not lead to confusion. Homogenous final output is produced according to

$$Y = (L^Y)^{1-\alpha} \int_0^A x(i)^\alpha di, \quad (1)$$

$0 < \alpha < 1$, where L^Y denotes labor in manufacturing, A the “number” of intermediate goods and $x(i)$ the quantity of intermediate good i . The final goods sector is perfectly competitive and the output price is normalized to unity.

There is perfect competition in the R&D sector. The number of ideas evolves according to

$$\dot{A} = \nu A^\phi L^A, \quad (2)$$

where L^A is R&D labor input (in efficiency units), $\nu > 0$, $\phi < 1$. The price mark-up charged by each firm cannot exceed $\kappa \in (1, 1/\alpha]$, due to the existence of a competitive fringe (e.g. Aghion and Howitt, 2005). Parameter κ captures the degree of imperfection of goods market competition. The capital stock, $K = \int_0^A x(i)di$, depreciates at rate $\delta \geq 0$. Both the capital and labor market are perfect. Initial levels of state variables, K_0 and A_0 , are given.

There is mass one of identical households indexed by $j \in [0, 1]$. The size of each household grows with constant exponential rate, $n \geq 0$. Normalizing $N_0 = 1$, household size and population size at time t are both equal to $N_t = e^{nt}$. In contrast to standard R&D-based growth models, we allow for R&D skill heterogeneity. Each household j inelastically supplies either one unit of labor to the final goods sector or $h(j)$ efficiency units to the R&D sector. R&D skills are the same within each household. The probability density function of h is denoted by $f(h)$, which is continuous with support $[\underline{h}, \bar{h}]$, $0 \leq \underline{h} < \bar{h}$. In equilibrium, the workers with the highest R&D skills are allocated to the R&D sector. That is, there will be a threshold skill level \tilde{h} at which workers are indifferent in which sector to work. R&D workers with $h > \tilde{h}$ will earn a wage premium compared to workers in final good production. The amount of efficiency units of R&D labor is given by $L^A = N \int_{\tilde{h}}^{\bar{h}} h f(h) dh$. Consequently, the ratio of R&D workers in efficiency units to the size of the overall workforce $l^A \equiv \frac{L^A}{N}$ is

$$l^A = \int_{\tilde{h}}^{\bar{h}} h f(h) dh. \quad (3)$$

The labor resource constraint reads $L^Y + N^A = N$, where $N^A \equiv N \int_{\tilde{h}}^{\bar{h}} f(h)dh$ is the number of workers allocated to R&D.

The government may subsidize both R&D costs (R&D sector) and capital costs (intermediate goods sector), at time-invariant rates s_A and s_K . Subsidies are financed by a lump-sum tax (T) on households and the government budget is balanced each period.

Preferences of household $j \in [0, 1]$ are given by

$$U(j) = \int_0^{\infty} \frac{(c_t(j))^{1-\sigma} - 1}{1-\sigma} e^{-(\rho-n)t} dt, \quad (4)$$

$\sigma > 0$, where $c(j)$ is consumption per member of household j . Households take factor prices as given. Let w^A and w^Y denote wage rates per efficiency unit of R&D labor and for a worker in final production. Moreover, let $I(j)$ be the wage income of a member of household j . We will have

$$I(j) = \begin{cases} w^A h(j) & \text{if } h(j) \geq \tilde{h}, \\ w^Y & \text{otherwise.} \end{cases} \quad (5)$$

Financial wealth of individual j , $a(j)$, accumulates according to

$$\dot{a}(j) = (r - n)a(j) + I(j) - c(j) - T, \quad (6)$$

where r denotes the interest rate and $a_0(j) > 0$. For the transversality conditions to hold and the value of utility streams to be finite, we impose

$$\rho - n + (\sigma - 1)g > 0 \text{ with } g \equiv \frac{n}{1 - \phi}. \quad (\text{A1})$$

3 Analysis

We first analyze the decentralized equilibrium and then the social planner solution. This allows us to derive the optimal growth policy mix.

3.1 Market Equilibrium

As one unit of capital is required for one unit of output and capital costs are subsidized according to s_K , producer i has profits

$$\pi(i) = [p(i) - (1 - s_K)(r + \delta)] x(i), \quad (7)$$

where $p(i)$ is the price of good $x(i)$. Given that the mark-up is constrained by $\kappa \in (1, 1/\alpha]$, the optimal supply price of each firm i reads (see Grossmann et al., 2010b)

$$p(i) = \kappa(1 - s_K)(r + \delta). \quad (8)$$

According to (1), the inverse demand function for intermediate good i is given by $p(i) = \alpha(L^Y/x(i))^{1-\alpha}$. Combining this inverse demand function with (8) and solving for $x(i)$ we obtain

$$x(i) = x = \left(\frac{\alpha}{\kappa(1 - s_K)(r + \delta)} \right)^{\frac{1}{1-\alpha}} L^Y. \quad (9)$$

Using (9) in (7), we see that $\pi(i) = \pi \forall i$. Using (1) for aggregate income and $K = Ax$ for the capital stock, (9) also implies

$$Y = A \left(\frac{\alpha}{\kappa(1 - s_K)(r + \delta)} \right)^{\frac{\alpha}{1-\alpha}} L^Y, \quad (10)$$

$$\frac{K}{Y} = \frac{\alpha}{\kappa(1 - s_K)(r + \delta)}. \quad (11)$$

For a given interest rate (which is policy-independent in the long run), an increase in s_K raises capital-output ratio K/Y , whereas a higher mark-up (κ) reduces it.

Let P^A denote the value of an intermediate good firm. The usual capital market equilibrium condition reads

$$\frac{\dot{P}^A}{P^A} + \frac{\pi}{P^A} = r. \quad (12)$$

The representative R&D firm maximizes profits as given by

$$\Pi \equiv P^A \underbrace{\nu A^\phi L^A}_{=A} - (1 - s_A)w^A L^A. \quad (13)$$

Definition 1. A market equilibrium consists of time paths for the quantities $\{L_t^A, L_t^Y, \{c_t(j), a_t(j)\}_{j \in [0,1]}, \{x_t(i)\}_{i \in [0, A_t]}, Y_t, K_t, A_t\}_{t=0}^\infty$, threshold skill level $\{\tilde{h}_t\}_{t=0}^\infty$, lump-sum tax $\{T_t\}_{t=0}^\infty$ and prices $\{P_t^A, \{p_t(i)\}_{i \in [0, A_t]}, w_t^A, w_t^Y, r_t\}_{t=0}^\infty$ such that final goods producers, intermediate goods producers and R&D firms maximize profits, each household j chooses the consumption path to maximize (4) s.t. (6) and supplies labor to the R&D sector if and only if $w^A h(j) \geq w^Y$ (i.e. $\tilde{h} = \frac{w^Y}{w^A}$), the capital resource constraint $\int_0^A x(i) di = K$ holds, the labor market clears,

$$l^Y \equiv \frac{L^Y}{N} = 1 - \int_{\tilde{h}}^{\bar{h}} f(h) dh, \quad (14)$$

the capital market equilibrium condition (12) holds, the goods markets clear, the financial market clears (i.e. $\int_0^N a(j) dj = K + P^A A$), and the lump-sum tax T balances the government budget each period.

Let us denote values of stationary variables in balanced growth equilibrium (BGE) with superscript (*). Proofs are relegated to an online-appendix.

Proposition 1. *There exists a unique BGE such that:*

(i) *The number of ideas A grows at rate $g = \frac{n}{1-\phi}$. Consumption and asset levels, $c(j)$, $a(j)$, also grow at rate $g \forall j$. Aggregate final output, Y , and the capital stock, K , grow at rate $g + n$. The value of an innovation, P^A , grows at rate n .*

(ii) *There is a unique stationary long-run threshold skill level, \tilde{h}^* , which determines if a worker j is allocated to final goods production (for $h(j) < \tilde{h}$) or R&D (for $h(j) \geq \tilde{h}$); \tilde{h}^* is decreasing in the R&D subsidy rate, s_A , and independent of the capital subsidy rate, s_K .*

Proposition 1 suggests that subsidizing physical capital does not affect the long run

allocation of labor, whereas an increase in the R&D subsidy rate stimulates the R&D activity of firms (i.e., l^{A*} increases and l^{Y*} decreases).

An important variable in the innovation literature is the fraction of workers allocated to R&D, $d \equiv \int_{\tilde{h}}^{\bar{h}} f(h)dh$.

Corollary 1. *The long run fraction of labor allocated to R&D, d^* , is (i) increasing in the R&D subsidy rate, s_A , and (ii) not systematically affected by the distribution of R&D skills.*

Part (i) is straightforward since threshold level \tilde{h}^* in BGE is decreasing in s_A . The intuition for part (ii) is discussed below.

4 Social Planning Optimum and Optimal Policy

The social planner chooses a symmetric capital allocation across intermediate good production sites, i.e., $x(i) = K/A \forall i$. From (1) one then gets $Y = K^\alpha(Al^Y)^{1-\alpha}$. The aggregate capital stock evolves according to $\dot{K} = Y - Nc - \delta K$, where c denotes per capita consumption. Hence, in per capita terms we have

$$\dot{k} = k^\alpha(Al^Y)^{1-\alpha} - c - (\delta + n)k. \quad (15)$$

As preferences are homothetic, there exists a representative consumer (Mas-Colell, Whinston and Green, 1995). The social planner's problem thus reads

$$\max_{\{c_t\}} \int_0^\infty \frac{(c_t)^{1-\sigma} - 1}{1-\sigma} e^{-(\rho-n)t} dt \quad \text{s.t. (2), (3), (14), (15),} \quad (16)$$

and non-negativity constraints. c, \tilde{h} are control variables and k, A are state variables. We focus on the BGE when comparing the first best solution with the market outcome.

Proposition 2. *In the long-run social planning optimum:*

(i) *The number of ideas A and per capita consumption c grow at rate g , whereas Y and K both grow at rate $g + n$.*

(ii) There exists a unique socially optimal long-run threshold skill level, \tilde{h}^{opt} , which is stationary. For $s_A = 0$ (no R&D subsidy) and $\phi \geq 0$, we have $\tilde{h}^{opt} < \tilde{h}^*$, i.e., there is R&D underinvestment.

Proposition 3. *The socially optimal, long-run R&D and capital cost subsidy rates are*

$$s_K^{opt} = 1 - \frac{1}{\kappa}, \quad (17)$$

$$s_A^{opt} = 1 - \frac{1 - 1/\kappa (\sigma - 1)g + \rho}{1/\alpha - 1 \sigma g + \rho - n}, \quad (18)$$

which are independent of the distribution of R&D skills.

There are two sources of inefficiency of R&D investments. First, if $\phi > 0$, there is a standing on shoulders effect, not taken into account by R&D firms, which promotes underinvestment. Second, innovators can only appropriate part of the economic surplus from raising the knowledge stock. To see this, first note that $x(i) = \frac{K}{A} = \frac{K}{Y} \frac{Y}{A} \forall i$. Substituting this into (7) and using (8) and (11) reveals that $\pi = \alpha(1 - \frac{1}{\kappa})\frac{Y}{A}$. According to (10), $\frac{\partial Y}{\partial A} = \frac{Y}{A}$. Since $\alpha(1 - \frac{1}{\kappa}) < 1$, the profit of an innovator π is lower than the contribution of an additional idea to output, $\frac{\partial Y}{\partial A}$. This ‘‘surplus appropriability problem’’ promotes underinvestment. Overall, decentralized R&D investment is suboptimally low, calling for $s_A > 0$, whenever $\phi \geq 0$.

Due to monopolistic competition, intermediate goods supply and therefore the demand for capital are inefficiently low as well. This implies suboptimally slow capital accumulation, which calls for a subsidy on capital costs.

The novel result is that both the R&D underinvestment gap and optimal growth policy are independent of the distribution of R&D skills. When raising demand for R&D workers by subsidizing R&D costs, more R&D workers enter R&D occupations. This is socially desirable although the additional R&D workers possess lower skills than the ones already active. All that matters for the R&D underinvestment gap are the market imperfections which bias the demand for R&D skills. The main assumptions which drive our ‘‘independence result’’ is the possibility of firms to discriminate wage payments according to skill and that all workers possess positive R&D skills in the

relevant upper end of the distribution of R&D skills. Less skilled R&D workers earn lower income than higher skilled ones. Thus, even if the additional R&D workers, which are employed after an increase in R&D subsidization, are of lower skill, the decision of firms to hire them is not affected by the skill distribution. The possibility of wage discrimination is also the reason why the distribution of skills does not systematically affect the allocation of labor (part (ii) of Corollary 1).

Our results are consistent with the finding of Goolsbee (1998) that R&D workers gain from higher R&D subsidies. To see this, note from $\tilde{h} = \frac{w^Y}{w^A}$ (Definition 1) that long-run wage income of a R&D worker j with skill $h(j) \geq \tilde{h}^*$, relative to a production worker, is equal to the ratio of his skill to the one of the marginal entrant into a R&D occupation:

$$\frac{w^A h(j)}{w^Y} = \frac{h(j)}{\tilde{h}^*}. \quad (19)$$

According to part (i) of Proposition 1, even in the long run an increase in R&D subsidy rate s^A , by reducing threshold skill level \tilde{h}^* , benefits those who would be R&D workers also without the subsidy. However, this does not mean that R&D subsidization is problematic. To the contrary, it is a possibility to lure additional workers into R&D occupations, which is socially desirable.

References

- [1] Aghion, Philippe and Peter Howitt (2005). Growth with Quality-improving Innovations: An Integrated Framework, in: P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, North-Holland, Amsterdam.
- [2] Goolsbee, Austan D. (1998). Does Government R&D policy Mainly Benefit Scientists and Engineers? *American Economic Review* 88, 298–302.
- [3] Griliches, Zvi and Frank R. Lichtenberg (1984). Interindustry Technology Flows and Productivity Growth: A Reexamination, *Review of Economics and Statistics* 66, 324-329.

- [4] Grossmann, Volker, Thomas M. Steger and Timo Trimborn (2010a). Quantifying Optimal Growth Policy, CESifo Working Paper No. 3092.
- [5] Grossmann, Volker, Thomas M. Steger and Timo Trimborn (2010b). Dynamically Optimal R&D Subsidization, CESifo Working Paper No. 3153.
- [6] Jones, Charles I. (1995). R&D-based Models of Economic Growth, *Journal of Political Economy* 103, 759–784.
- [7] Jones, Charles I. and John C. Williams (1998). Measuring the Social Return To R&D, *Quarterly Journal of Economics*, 113, 1119-1135.
- [8] Jones, Charles I. and John C. Williams (2000). Too Much of a Good Thing? The Economics of Investment in R&D, *Journal of Economic Growth* 5, 65-85.
- [9] Mas-Colell, Andreu, Michael D. Whinston and Jerry R. Green (1995). *Microeconomic Theory*, Oxford University Press.

Online-Appendix

Proof of Proposition 1: The current-value Hamiltonian which corresponds to the intertemporal optimization problem of household j is given by

$$\mathcal{H}(j) = \frac{c(j)^{1-\sigma} - 1}{1-\sigma} + \lambda(j) [(r-n)a(j) + I(j) - c(j) - T], \quad (20)$$

where $\lambda(j)$ is the co-state-variable associated with constraint (6). Necessary optimality conditions are $\partial\mathcal{H}(j)/\partial c(j) = 0$, $\dot{\lambda}(j) = (\rho-n)\lambda(j) - \partial\mathcal{H}(j)/\partial a(j)$, and the corresponding transversality condition. Thus,

$$\lambda(j) = c(j)^{-\sigma}, \text{ i.e., } \frac{\dot{\lambda}(j)}{\lambda(j)} = -\sigma \frac{\dot{c}(j)}{c(j)}, \quad (21)$$

$$\frac{\dot{\lambda}(j)}{\lambda(j)} = \rho - r, \quad (22)$$

$$\lim_{t \rightarrow \infty} \lambda_t(j) e^{-(\rho-n)t} a_t(j) = 0. \quad (23)$$

Combining (21) with (22), we obtain the standard Euler equation

$$\frac{\dot{c}(j)}{c(j)} = \frac{r - \rho}{\sigma} \quad (24)$$

Next, substitute (8) and (9) into (7) to obtain the following expression for the profit of each intermediate goods producer i :

$$\pi(i) = \pi = (\kappa - 1) \left(\frac{\alpha}{\kappa}\right)^{\frac{1}{1-\alpha}} [(1 - s_K)(r + \delta)]^{-\frac{\alpha}{1-\alpha}} L^Y. \quad (25)$$

Since final goods producers take the wage rate w^Y as given, it is equal to its marginal productivity of labor, $w^Y = (1-\alpha)Y/L^Y$. Also recall from Definition 1 that $w^Y = w^A \tilde{h}$.

Thus,

$$w^A = \frac{(1-\alpha)Y}{\tilde{h}L^Y} \quad (26)$$

$$= \frac{(1-\alpha)A}{\tilde{h}} \left(\frac{\alpha}{\kappa(1-s_K)(r+\delta)} \right)^{\frac{\alpha}{1-\alpha}}, \quad (27)$$

where (27) follows by using (10). Moreover, the profit-maximizing choice of the R&D sector implies $\Pi = 0$; thus, $P^A \nu A^\phi = (1-s_A)w^A$, according to (13). Substituting (26) into the latter equation implies

$$P^A = \frac{(1-s_A)(1-\alpha)}{\nu A^{\phi-1} \tilde{h}} \left(\frac{\alpha}{\kappa(1-s_K)(r+\delta)} \right)^{\frac{\alpha}{1-\alpha}}, \quad (28)$$

We derive the steady state by assuming that part (i) of Proposition 1 holds and show that the implications of this assumption are consistent with the assumption. For later use, setting $\dot{c}(j)/c(j) = g$ in (24) implies that the long run interest rate reads

$$r^* = \sigma g + \rho. \quad (29)$$

Substituting (25) into (12) and setting $\dot{P}^A/P^A = n$ implies that

$$n + \frac{(\kappa-1) \left(\frac{\alpha}{\kappa}\right)^{\frac{1}{1-\alpha}} L^Y}{[(1-s_K)(r+\delta)]^{\frac{\alpha}{1-\alpha}} P^A} = r. \quad (30)$$

From (2), we find $\dot{A}/A = \nu A^{\phi-1} L^A$. From this it becomes clear that setting $\dot{A}/A = g$ is consistent with L^A growing at rate n . Thus, in steady state,

$$\nu A^{\phi-1} = \frac{g}{N l^A}. \quad (31)$$

Using (31) in (28) and substituting the resulting expression as well as (29) in (30) implies that

$$\frac{1 - \frac{1}{\kappa}}{\frac{1}{\alpha} - 1} \frac{g \tilde{h} l^Y}{(1-s_A) l^A} = \sigma g + \rho - n. \quad (32)$$

According to (3) and (14), we obtain

$$\frac{l^Y}{l^A} = \frac{1 - \int_{\tilde{h}}^{\bar{h}} f(h)dh}{\int_{\tilde{h}}^{\bar{h}} hf(h)dh}. \quad (33)$$

Substituting (33) into (32) leads to

$$\Gamma(\tilde{h}) \equiv \frac{\left(1 - \int_{\tilde{h}}^{\bar{h}} f(h)dh\right) \tilde{h}}{\int_{\tilde{h}}^{\bar{h}} hf(h)dh} = (1 - s_A) \frac{\frac{1}{\alpha} - 1}{1 - \frac{1}{\kappa}} \frac{\sigma g + \rho - n}{g} \equiv \Omega(s_A). \quad (34)$$

As $\Gamma'(\tilde{h}) > 0$, the solution of (34) for \tilde{h}^* is unique. Moreover, noting that $\Omega'(s_A) < 0$ and the fact that s_K does not enter (34) confirms comparative-static results in part (ii) of Proposition 1.

That Y and K growth with rate $n + g$ in the long run follows from (10) and (11). Finally, we show that the transversality condition (23) holds under assumption (A1). First, use (21) and $\dot{c}(j)/c(j) = g$ to find that $\dot{\lambda}(j)/\lambda(j) = -\sigma g$. It remains to be shown that $a(j)$ grows with rate g in the long run. Rewriting (6) to

$$\frac{\dot{a}(j)}{a(j)} = r - n + \frac{I(j)}{a(j)} - \frac{c(j)}{a(j)} - \frac{T}{a(j)} \quad (35)$$

reveals that $\dot{a}(j)/a(j) = g$ indeed holds in steady state, if both the lump-sum tax per household (T) and income level $I(j)$ grow at rate g . Recalling from (29) that the long run interest rate r is time-invariant, we see from (27) that wages rates w^A and $w^Y = w^A \tilde{h}$, and therefore all income levels, grow in steady state at the same rate as A (namely at rate g). Moreover, defining $k \equiv K/N$, the lump-sum tax reads

$$T = s_K(r + \delta)k + s_A w^A l^A. \quad (36)$$

Use (36) together with the facts that w^A and k grow at rate g in the long run to see that $\dot{T}/T = g$ holds in steady state. This concludes the proof. ■

Proof of Corollary 1: Part (i) is an immediate implication of the result that \tilde{h}^* is decreasing in s_A (part (ii) of Proposition 1). To illustrate part (ii), suppose that the

distribution of R&D skills is uniform, i.e., $f(h) = (\bar{h} - \underline{h})^{-1}$. Thus, (34) becomes

$$\frac{(\bar{h} - \underline{h})\tilde{h}}{\bar{h}^2 - \tilde{h}^2} = \Omega(s_A). \quad (37)$$

Rewriting (37) reveals that there is only one positive root for the steady state value of threshold skill level \tilde{h} , which is given by

$$\tilde{h}^* = \frac{\underline{h}}{2(1 + \Omega)} \left(1 + \sqrt{1 + 4\Omega(s_A) [1 + \Omega(s_A)] \left(\frac{\bar{h}}{\underline{h}}\right)^2} \right). \quad (38)$$

Hence, the fraction of labor in BGE allocated to R&D, $d^* \equiv \int_{\tilde{h}^*}^{\bar{h}} f(h)dh$, reads

$$d^* = \frac{\bar{h} - \tilde{h}^*}{\bar{h} - \underline{h}} = \frac{\frac{\bar{h}}{\underline{h}} - \frac{1}{2[1 + \Omega(s_A)]} \left(1 + \sqrt{1 + 4\Omega(s_A) [1 + \Omega(s_A)] \left(\frac{\bar{h}}{\underline{h}}\right)^2} \right)}{\frac{\bar{h}}{\underline{h}} - 1}. \quad (39)$$

This reveals that, for a uniform skill distribution, d^* can be written as function of \bar{h}/\underline{h} . However, the relationship is ambiguous. ■

Proof of Proposition 2: The current-value Hamiltonian which corresponds to the social planning problem (16) is given by

$$\mathcal{H} = \frac{c^{1-\sigma} - 1}{1 - \sigma} + \lambda_k \overbrace{[A^{1-\alpha} k^\alpha \underbrace{\left(1 - \int_{\tilde{h}}^{\bar{h}} f(h)dh\right)}_{=l^Y}]}^{=k} - (\delta + n)k - c + \lambda_A \nu A^\phi N \underbrace{\int_{\tilde{h}}^{\bar{h}} h f(h)dh}_{=l^A}, \quad (40)$$

where λ_k and λ_A are co-state variables associated with constraints (15) and (2), respectively. Necessary optimality conditions are $\partial\mathcal{H}/\partial c = \partial\mathcal{H}/\partial\tilde{h} = 0$ (control variables), $\dot{\lambda}_z = (\rho - n)\lambda_z - \partial\mathcal{H}/\partial z$ for $z \in \{k, A\}$ (state variables), and the corresponding transversality conditions. Thus,

$$\lambda_k = c^{-\sigma}, \text{ i.e., } \frac{\dot{\lambda}_k}{\lambda_k} = -\sigma \frac{\dot{c}}{c}, \quad (41)$$

$$(1 - \alpha) \left(\frac{k}{Al^Y} \right)^\alpha = \frac{\lambda_A}{\lambda_k} \nu A^{\phi-1} N \tilde{h}, \quad (42)$$

$$\frac{\dot{\lambda}_k}{\lambda_k} = \rho - \underbrace{\alpha \left(\frac{Al^Y}{k} \right)^{1-\alpha}}_{=Y/K} + \delta, \quad (43)$$

$$\frac{\dot{\lambda}_A}{\lambda_A} = \rho - n - \frac{\lambda_k}{\lambda_A} (1 - \alpha) \left(\frac{k}{A} \right)^\alpha (l^Y)^{1-\alpha} - \phi \frac{\dot{A}}{A}, \quad (44)$$

$$\lim_{t \rightarrow \infty} \lambda_{z,t} e^{-(\rho-n)t} z_t = 0, \quad z \in \{k, A\}. \quad (45)$$

($\lambda_{z,t}$ denotes the co-state variable associated with state variable z at time t .)

Solving (42) for λ_k/λ_A and using (31) implies

$$\frac{\lambda_k}{\lambda_A} = \frac{g \tilde{h}}{(1 - \alpha) l^A} \left(\frac{Al^Y}{k} \right)^\alpha. \quad (46)$$

Suppose that A and k grow at rate n in the long run, whereas \tilde{h} and thus also l^Y and l^A are stationary. These properties are easily confirmed, as are transversality conditions. From (46), we then find $\dot{\lambda}_k/\lambda_k = \dot{\lambda}_A/\lambda_A$. Moreover, using $\dot{c}/c = g$ in (41) implies that

$$\frac{\dot{\lambda}_k}{\lambda_k} = \frac{\dot{\lambda}_A}{\lambda_A} = -\sigma g. \quad (47)$$

Using $\dot{\lambda}_A/\lambda_A = -\sigma g$, $\dot{A}/A = g = \frac{n}{1-\phi}$ and (46) in (44), we obtain

$$\tilde{h} \frac{l^Y}{l^A} = \frac{\rho + (\sigma - 1)g}{g}. \quad (48)$$

Using (33) and the definition of function $\Gamma(\cdot)$, we find that the optimal threshold skill level, \tilde{h}^{opt} , is uniquely given by

$$\Gamma(\tilde{h}^{opt}) = \frac{\rho + (\sigma - 1)g}{g}. \quad (49)$$

Recall that $\Gamma' > 0$. Thus, according to (34) and (49), for $s_A = 0$ we find that

$\tilde{h}^* > \tilde{h}^{opt}$ if and only if

$$\frac{\frac{1}{\alpha} - 1}{1 - \frac{1}{\kappa}}(\sigma g + \rho - n) > \rho + (\sigma - 1)g.$$

Since $1 < \kappa < 1/\alpha$, we have $1/\alpha - 1 > 1 - 1/\kappa$. Moreover, using $g = \frac{n}{1-\phi}$, we find that $\sigma g + \rho - n \geq \rho + (\sigma - 1)g$ holds if and only if $\phi \geq 0$. This confirms that $\tilde{h}^* > \tilde{h}^{opt}$ if $s_A = 0$ and $\phi \geq 0$. Finally, use (10) and (11) to see that Y and K growth with rate $n + g$ in the long run. This concludes the proof. ■

Proof of Proposition 3: First, substitute (29) into (11) to see that the capital-output ratio in decentralized BGE is given by

$$\left(\frac{K}{Y}\right)^* = \frac{\alpha}{\kappa(1 - s_K)(\sigma g + \rho + \delta)}. \quad (50)$$

Second, substitute $\dot{\lambda}_K/\lambda_K = -\sigma g$ from (47) into (43) to find

$$\alpha \left(\frac{Al^Y}{k}\right)^{1-\alpha} = \sigma g + \rho + \delta. \quad (51)$$

Since $(Al^Y/k)^{1-\alpha} = Y/K$, the socially optimal capital-output ratio is given by

$$\left(\frac{K}{Y}\right)^{opt} = \frac{\alpha}{\sigma g + \rho + \delta}. \quad (52)$$

The optimal capital subsidy, s_K^{opt} , follows from setting $(K/Y)^* = (K/Y)^{opt}$. To find the optimal R&D subsidy, s_A^{opt} , set the right-hand sides of (34) and (49) equal to each other. ■

Universität Leipzig

Wirtschaftswissenschaftliche Fakultät

Nr. 1	Wolfgang Bernhardt	Stock Options wegen oder gegen Shareholder Value? Vergütungsmodelle für Vorstände und Führungskräfte 04/1998
Nr. 2	Thomas Lenk / Volkmar Teichmann	Bei der Reform der Finanzverfassung die neuen Bundesländer nicht vergessen! 10/1998
Nr. 3	Wolfgang Bernhardt	Gedanken über Führen – Dienen – Verantworten 11/1998
Nr. 4	Kristin Wellner	Möglichkeiten und Grenzen kooperativer Standortgestaltung zur Revitalisierung von Innenstädten 12/1998
Nr. 5	Gerhardt Wolff	Brauchen wir eine weitere Internationalisierung der Betriebswirtschaftslehre? 01/1999
Nr. 6	Thomas Lenk / Friedrich Schneider	Zurück zu mehr Föderalismus: Ein Vorschlag zur Neugestaltung des Finanzausgleichs in der Bundesrepublik Deutschland unter besonderer Berücksichtigung der neuen Bundesländer 12/1998
Nr. 7	Thomas Lenk	Kooperativer Föderalismus – Wettbewerbsorientierter Föderalismus 03/1999
Nr. 8	Thomas Lenk / Andreas Mathes	EU – Osterweiterung – Finanzierbar? 03/1999
Nr. 9	Thomas Lenk / Volkmar Teichmann	Die fiskalischen Wirkungen verschiedener Forderungen zur Neugestaltung des Länderfinanzausgleichs in der Bundesrepublik Deutschland: Eine empirische Analyse unter Einbeziehung der Normenkontrollanträge der Länder Baden-Württemberg, Bayern und Hessen sowie der Stellungnahmen verschiedener Bundesländer 09/1999
Nr. 10	Kai-Uwe Graw	Gedanken zur Entwicklung der Strukturen im Bereich der Wasserversorgung unter besonderer Berücksichtigung kleiner und mittlerer Unternehmen 10/1999
Nr. 11	Adolf Wagner	Materialien zur Konjunkturforschung 12/1999
Nr. 12	Anja Birke	Die Übertragung westdeutscher Institutionen auf die ostdeutsche Wirklichkeit – ein erfolg-versprechendes Zusammenspiel oder Aufdeckung systematischer Mängel? Ein empirischer Bericht für den kommunalen Finanzausgleich am Beispiel Sachsen 02/2000
Nr. 13	Rolf H. Hasse	Internationaler Kapitalverkehr in den letzten 40 Jahren – Wohlstandsmotor oder Krisenursache? 03/2000
Nr. 14	Wolfgang Bernhardt	Unternehmensführung (Corporate Governance) und Hauptversammlung 04/2000
Nr. 15	Adolf Wagner	Materialien zur Wachstumsforschung 03/2000
Nr. 16	Thomas Lenk / Anja Birke	Determinanten des kommunalen Gebührenaufkommens unter besonderer Berücksichtigung der neuen Bundesländer 04/2000
Nr. 17	Thomas Lenk	Finanzwirtschaftliche Auswirkungen des Bundesverfassungsgerichtsurteils zum Länderfinanzausgleich vom 11.11.1999 04/2000
Nr. 18	Dirk Büttel	Continuous linear utility for preferences on convex sets in normal real vector spaces 05/2000
Nr. 19	Stefan Dierkes / Stephanie Hanrath	Steuerung dezentraler Investitionsentscheidungen bei nutzungsabhängigem und nutzungsunabhängigem Verschleiß des Anlagenvermögens 06/2000
Nr. 20	Thomas Lenk / Andreas Mathes / Olaf Hirschfeld	Zur Trennung von Bundes- und Landeskompetenzen in der Finanzverfassung Deutschlands 07/2000
Nr. 21	Stefan Dierkes	Marktwerte, Kapitalkosten und Betafaktoren bei wertabhängiger Finanzierung 10/2000
Nr. 22	Thomas Lenk	Intergovernmental Fiscal Relationships in Germany: Requirement for New Regulations? 03/2001
Nr. 23	Wolfgang Bernhardt	Stock Options – Aktuelle Fragen Besteuerung, Bewertung, Offenlegung 03/2001

Nr. 24	Thomas Lenk	Die „kleine Reform“ des Länderfinanzausgleichs als Nukleus für die „große Finanzverfassungs-reform“? 10/2001
Nr. 25	Wolfgang Bernhardt	Biotechnologie im Spannungsfeld von Menschenwürde, Forschung, Markt und Moral Wirtschaftsethik zwischen Beredsamkeit und Schweigen 11/2001
Nr. 26	Thomas Lenk	Finanzwirtschaftliche Bedeutung der Neuregelung des bundestaatlichen Finanzausgleichs – Eine allkoative und distributive Wirkungsanalyse für das Jahr 2005 11/2001
Nr. 27	Sören Bär	Grundzüge eines Tourismusmarketing, untersucht für den Südraum Leipzig 05/2002
Nr. 28	Wolfgang Bernhardt	Der Deutsche Corporate Governance Kodex: Zuwahl (comply) oder Abwahl (explain)? 06/2002
Nr. 29	Adolf Wagner	Konjunkturtheorie, Globalisierung und Evolutionsökonomik 08/2002
Nr. 30	Adolf Wagner	Zur Profilbildung der Universitäten 08/2002
Nr. 31	Sabine Klinger / Jens Ulrich / Hans-Joachim Rudolph	Konjunktur als Determinante des Erdgasverbrauchs in der ostdeutschen Industrie? 10/2002
Nr. 32	Thomas Lenk / Anja Birke	The Measurement of Expenditure Needs in the Fiscal Equalization at the Local Level Empirical Evidence from German Municipalities 10/2002
Nr. 33	Wolfgang Bernhardt	Die Lust am Fliegen Eine Parabel auf viel Corporate Governance und wenig Unternehmensführung 11/2002
Nr. 34	Udo Hielscher	Wie reich waren die reichsten Amerikaner wirklich? (US-Vermögensbewertungsindex 1800 – 2000) 12/2002
Nr. 35	Uwe Haubold / Michael Nowak	Risikoanalyse für Langfrist-Investments Eine simulationsbasierte Studie 12/2002
Nr. 36	Thomas Lenk	Die Neuregelung des bundesstaatlichen Finanzausgleichs auf Basis der Steuerschätzung Mai 2002 und einer aktualisierten Bevölkerungsstatistik 12/2002
Nr. 37	Uwe Haubold / Michael Nowak	Auswirkungen der Renditeverteilungsannahme auf Anlageentscheidungen Eine simulationsbasierte Studie 02/2003
Nr. 38	Wolfgang Bernhard	Corporate Governance Kodex für den Mittel-Stand? 06/2003
Nr. 39	Hermut Kormann	Familienunternehmen: Grundfragen mit finanzwirtschaftlichen Bezug 10/2003
Nr. 40	Matthias Folk	Launhardt'sche Trichter 11/2003
Nr. 41	Wolfgang Bernhardt	Corporate Governance statt Unternehmensführung 11/2003
Nr. 42	Thomas Lenk / Karolina Kaiser	Das Prämienmodell im Länderfinanzausgleich – Anreiz- und Verteilungsmittlungen 11/2003
Nr. 43	Sabine Klinger	Die Volkswirtschaftliche Gesamtrechnung des Haushaltsektors in einer Matrix 03/2004
Nr. 44	Thomas Lenk / Heide Köpping	Strategien zur Armutsbekämpfung und –vermeidung in Ostdeutschland: 05/2004
Nr. 45	Wolfgang Bernhardt	Sommernachtsfantasien Corporate Governance im Land der Träume. 07/2004
Nr. 46	Thomas Lenk / Karolina Kaiser	The Premium Model in the German Fiscal Equalization System 12/2004
Nr. 47	Thomas Lenk / Christine Falken	Komparative Analyse ausgewählter Indikatoren des Kommunalwirtschaftlichen Gesamtergebnisses 05/2005
Nr. 48	Michael Nowak / Stephan Barth	Immobilienanlagen im Portfolio institutioneller Investoren am Beispiel von Versicherungsunternehmen Auswirkungen auf die Risikosituation 08/2005

Nr. 49	Wolfgang Bernhardt	Familiengesellschaften – Quo Vadis? Vorsicht vor zu viel „Professionalisierung“ und Ver-Fremdung 11/2005
Nr. 50	Christian Milow	Der Griff des Staates nach dem Währungsgold 12/2005
Nr. 51	Anja Eichhorst / Karolina Kaiser	The Institutional Design of Bailouts and Its Role in Hardening Budget Constraints in Federations 03/2006
Nr. 52	Ullrich Heilemann / Nancy Beck	Die Mühen der Ebene – Regionale Wirtschaftsförderung in Leipzig 1991 bis 2004 08/2006
Nr. 53	Gunther Schnabl	Die Grenzen der monetären Integration in Europa 08/2006
Nr. 54	Hermut Kormann	Gibt es so etwas wie typisch mittelständige Strategien? 11/2006
Nr. 55	Wolfgang Bernhardt	(Miss-)Stimmung, Bestimmung und Mitbestimmung Zwischen Juristentag und Biedenkopf-Kommission 11/2006
Nr. 56	Ullrich Heilemann / Annika Blaschzik	Indicators and the German Business Cycle A Multivariate Perspective on Indicators of Ifo, OECD, and ZEW 01/2007
Nr. 57	Ullrich Heilemann	“The Soul of a new Machine” zu den Anfängen des RWI-Konjunkturmodells 12/2006
Nr. 58	Ullrich Heilemann / Roland Schuhr / Annika Blaschzik	Zur Evolution des deutschen Konjunkturzyklus 1958 bis 2004 Ergebnisse einer dynamischen Diskriminanzanalyse 01/2007
Nr. 59	Christine Falken / Mario Schmidt	Kameralistik versus Doppik Zur Informationsfunktion des alten und neuen Rechnungswesens der Kommunen Teil I: Einführende und Erläuternde Betrachtungen zum Systemwechsel im kommunalen Rechnungswesen 01/2007
Nr. 60	Christine Falken / Mario Schmidt	Kameralistik versus Doppik Zur Informationsfunktion des alten und neuen Rechnungswesens der Kommunen Teil II Bewertung der Informationsfunktion im Vergleich 01/2007
Nr. 61	Udo Hielscher	Monti della città di firenze Innovative Finanzierungen im Zeitalter Der Medici. Wurzeln der modernen Finanzmärkte 03/2007
Nr. 62	Ullrich Heilemann / Stefan Wappler	Sachsen wächst anders Konjunkturelle, sektorale und regionale Bestimmungsgründe der Entwicklung der Bruttowertschöpfung 1992 bis 2006 07/2007
Nr. 63	Adolf Wagner	Regionalökonomik: Konvergierende oder divergierende Regionalentwicklungen 08/2007
Nr. 64	Ullrich Heilemann / Jens Ulrich	Good bye, Professir Phillips? Zum Wandel der Tariflohndeterminanten in der Bundesrepublik 1952 – 2004 08/2007
Nr. 65	Gunther Schnabl / Franziska Schobert	Monetary Policy Operations of Debtor Central Banks in MENA Countries 10/2007
Nr. 66	Andreas Schäfer / Simone Valente	Habit Formation, Dynastic Altruism, and Population Dynamics 11/2007
Nr. 67	Wolfgang Bernhardt	5 Jahre Deutscher Corporate Governance Kodex Eine Erfolgsgeschichte? 01/2008
Nr. 68	Ullrich Heilemann / Jens Ulrich	Viel Lärm um wenig? Zur Empirie von Lohnformeln in der Bundesrepublik 01/2008
Nr. 69	Christian Groth / Karl-Josef Koch / Thomas M. Steger	When economic growth is less than exponential 02/2008
Nr. 70	Andreas Bohne / Linda Kochmann	Ökonomische Umweltbewertung und endogene Entwicklung peripherer Regionen Synthese einer Methodik und einer Theorie 02/2008
Nr. 71	Andreas Bohne / Linda Kochmann / Jan Slavík / Lenka Slavíková	Deutsch-tschechische Bibliographie Studien der kontingenten Bewertung in Mittel- und Osteuropa 06/2008

Nr. 72	Paul Lehmann / Christoph Schröter-Schlaack	Regulating Land Development with Tradable Permits: What Can We Learn from Air Pollution Control? 08/2008
Nr. 73	Ronald McKinnon / Gunther Schnabl	China's Exchange Rate Impasse and the Weak U.S. Dollar 10/2008
Nr. 74	Wolfgang Bernhardt	Managervergütungen in der Finanz- und Wirtschaftskrise Rückkehr zu (guter) Ordnung, (klugem) Maß und (vernünftigem) Ziel? 12/2008
Nr. 75	Moritz Schularick / Thomas M. Steger	Financial Integration, Investment, and Economic Growth: Evidence From Two Eras of Financial Globalization 12/2008
Nr. 76	Gunther Schnabl / Stephan Freitag	An Asymmetry Matrix in Global Current Accounts 01/2009
Nr. 77	Christina Ziegler	Testing Predictive Ability of Business Cycle Indicators for the Euro Area 01/2009
Nr. 78	Thomas Lenk / Oliver Rottmann / Florian F. Woitek	Public Corporate Governance in Public Enterprises Transparency in the Face of Divergent Positions of Interest 02/2009
Nr. 79	Thomas Steger / Lucas Bretschger	Globalization, the Volatility of Intermediate Goods Prices, and Economic Growth 02/2009
Nr. 80	Marcela Munoz Escobar / Robert Holländer	Institutional Sustainability of Payment for Watershed Ecosystem Services. Enabling conditions of institutional arrangement in watersheds 04/2009
Nr. 81	Robert Holländer / WU Chunyou / DUAN Ning	Sustainable Development of Industrial Parks 07/2009
Nr. 82	Georg Quaas	Realgrößen und Preisindizes im alten und im neuen VGR-System 10/2009
Nr. 83	Ulrich Heilemann / Hagen Findeis	Empirical Determination of Aggregate Demand and Supply Curves: The Example of the RWI Business Cycle Model 12/2009
Nr. 84	Gunther Schnabl / Andreas Hoffmann	The Theory of Optimum Currency Areas and Growth in Emerging Markets 03/2010
Nr. 85	Georg Quaas	Does the macroeconomic policy of the global economy's leader cause the worldwide asymmetry in current accounts? 03/2010
Nr. 86	Volker Grossmann / Thomas M. Steger / Timo Trimborn	Quantifying Optimal Growth Policy 06/2010
Nr. 87	Wolfgang Bernhardt	Corporate Governance Kodex für Familienunternehmen? Eine Widerrede 06/2010
Nr. 88	Philipp Mandel / Bernd Süßmuth	A Re-Examination of the Role of Gender in Determining Digital Piracy Behavior 07/2010
Nr. 89	Philipp Mandel / Bernd Süßmuth	Size Matters. The Relevance and Hicksian Surplus of Agreeable College Class Size 07/2010
Nr. 90	Thomas Kohstall / Bernd Süßmuth	Cyclic Dynamics of Prevention Spending and Occupational Injuries in Germany: 1886-2009 07/2010
Nr. 91	Martina Padmanabhan	Gender and Institutional Analysis. A Feminist Approach to Economic and Social Norms 08/2010
Nr. 92	Gunther Schnabl / Ansgar Belke	Finanzkrise, globale Liquidität und makroökonomischer Exit 09/2010
Nr. 93	Ulrich Heilemann / Roland Schuhr / Heinz Josef Münch	A "perfect storm"? The present crisis and German crisis patterns 12/2010
Nr. 94	Gunther Schnabl / Holger Zemanek	Die Deutsche Wiedervereinigung und die europäische Schuldenkrise im Lichte der Theorie optimaler Währungsräume 06/2011
Nr. 95	Andreas Hoffmann / Gunther Schnabl	Symmetrische Regeln und asymmetrisches Handeln in der Geld- und Finanzpolitik 07/2011
Nr. 96	Andreas Schäfer / Maik T. Schneider	Endogenous Enforcement of Intellectual Property, North-South Trade, and Growth 08/2011
Nr. 97	Volker Grossmann / Thomas M. Steger / Timo Trimborn	Dynamically Optimal R&D Subsidization 08/2011

Nr. 98	Erik Gawel	Political drivers of and barriers to Public-Private Partnerships: The role of political involvement 09/2011
Nr. 99	André Casajus	Collusion, symmetry, and the Banzhaf value 09/2011
Nr. 100	Frank Hüttner / Marco Sunder	Decomposing R^2 with the Owen value 10/2011
Nr. 101	Volker Grossmann / Thomas M. Steger / Timo Trimborn	The Macroeconomics of TANSTAAFL 11/2011
Nr. 102	Andreas Hoffmann	Determinants of Carry Trades in Central and Eastern Europe 11/2011
Nr. 103	Andreas Hoffmann	Did the Fed and ECB react asymmetrically with respect to asset market developments? 01/2012
Nr. 104	Christina Ziegler	Monetary Policy under Alternative Exchange Rate Regimes in Central and Eastern Europe 02/2012
Nr. 105	José Abad / Axel Löffler / Gunther Schnabl / Holger Zemanek	Fiscal Divergence, Current Account and TARGET2 Imbalances in the EMU 03/2012
Nr. 106	Georg Quaas / Robert Köster	Ein Modell für die Wirtschaftszweige der deutschen Volkswirtschaft: Das "MOGBOT" (Model of Germany's Branches of Trade)
Nr. 107	Andreas Schäfer / Thomas Steger	Journey into the Unknown? Economic Consequences of Factor Market Integration under Increasing Returns to Scale 04/2012
Nr. 108	Andreas Hoffmann / Björn Urbansky	Order, Displacements and Recurring Financial Crises 06/2012
Nr. 109	Finn Marten Körner / Holger Zemanek	On the Brink? Intra-euro area imbalances and the sustainability of foreign debt 07/2012
Nr. 110	André Casajus / Frank Hüttner	Nullifying vs. dummifying players or nullified vs. dummified players: The difference between the equal division value and the equal surplus division value 07/2012
Nr. 111	André Casajus	Solidarity and fair taxation in TU games 07/2012
Nr. 112	Georg Quaas	Ein Nelson-Winter-Modell der deutschen Volkswirtschaft 08/2012
Nr. 113	André Casajus / Frank Hüttner	Null players, solidarity, and the egalitarian Shapley values 08/2012
Nr. 114	André Casajus	The Shapley value without efficiency and additivity 11/2012
Nr. 115	Erik Gawel	Neuordnung der W-Besoldung: Ausgestaltung und verfassungsrechtliche Probleme der Konsumtionsregeln zur Anrechnung von Leistungsbezügen 02/2013
Nr. 116	Volker Grossmann / Andreas Schäfer / Thomas M. Steger	Migration, Capital Formation, and House Prices 02/2013
Nr. 117	Volker Grossmann / Thomas M. Steger	Optimal Growth Policy: the Role of Skill Heterogeneity 02/2012 (Eingang im Dekanat 03/2013)