Migration, Wages, and Parental Background: Obstacles to Entrepreneurship and Growth in East Germany

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Abstract

East Germany's unemployment rate still doubles that of West Germany and for the last decade its economic growth has been below that of other transition countries. Policy makers often point to the lack of entrepreneurship as one of East Germany's main problems. This paper addresses the question of how East Germany's integration into an established economy, West Germany, may have hindered a fruitful development of entrepreneurship and how this may have affected economic growth. I build a model economy that places Lucas' [1978] span-of-control model into an overlapping-generations framework. Following Hassler and Rodríguez Mora [2000] managerial knowhow is defined as a combination of two factors, innate talent and entrepreneurial parental background. Furthermore, growth depends only on the innate talent of entrepreneurs. In East Germany, the lack of entrepreneurial parental background makes innate talent the decisive factor in occupational choice and more talented entrepreneurs should contribute to high growth rates. However, three key aspects of its integration into West Germany inhibit this mechanism: migration possibilities to West Germany, the way East German wages were regulated upon reunification, and the importance of parental background for entrepreneurship in West Germany. Counterfactual experiments show that eliminating any of these three aspects leads to more entrepreneurs, less unemployment, and higher economic growth in East Germany.

JEL classification: F15, E24, J22
Keywords: Entrepreneurship, Allocation of Talent, Social Mobility, Transition

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1   Introduction

East Germany's economic performance has been quite dismal for the last decade. Since 1991, unemployment rates in East Germany and Berlin, ranging from official rates of $12 - 20\%$ to unofficial rates of $25 - 30\%$, have been twice as high as rates in West Germany.[1] Furthermore, while some other transition countries are growing to catch up with the rest of Europe, for the last decade East Germany's economy has grown more slowly than the economies of Poland, Hungary, or the Czech Republic.[2] East Germany's GDP per capita still remains below 75% of that of West Germany (Statistische Ämter der Länder [2011]). Policy makers have identified entrepreneurship as key to employment creation and economic growth in East Germany: "The Organisation for Economic Co-operation and Development (OECD) and its Local Economic and Employment Development Programme has been working with the Federal Ministry of Transport, Building and Urban Affairs (BMVBS) since 2005 on an analytical and practical project on Strengthening entrepreneurship in East Germany as a critical lever for economic growth and employment creation" (OECD [2007a]).[3]

Less than twenty years ago, private entrepreneurial activity was extremely restricted or even forbidden in East Germany, Czechoslovakia, Poland, and Hungary. Today the lack of entrepreneurship seems to be persisting in East Germany, while other transition economies have managed to overcome this hurdle.[4] Table 1.1 displays the number of enterprises per 1000 inhabitants, labor force participants, and employed individuals for the period 2002-2007, for West Germany, East Germany, the Czech Republic, Hungary, and Poland. By any of these three measures, there were and are significantly fewer enterprises in East Germany compared to West Germany but in particular compared to these other transi-

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[1]Unofficial unemployment rates take into account the so-called "hidden unemployed", individuals who do not appear as officially unemployed due to some form of active labor market policy (training programs, wage subsidies, early retirement schemes) but whose income comes to a large extent in form of subsidies; for unofficial rates: Sachverständigenrat [2007], for official rates: Bundesagentur für Arbeit [2008].

[2]Accumulated growth rates for real GDP per capita for 1992 to 2008 for East Germany, Poland, Hungary, and the Czech Republic are 173%, 214%, 163%, and 174% respectively. Slovenia's GDP per capita has already surpassed that of East Germany, see Figure A-1 of the Appendix.

[3]Numerous newspaper articles have pointed out that the development of the 'Mittelstand' – the small and medium sized enterprise sector– is essential for the revival of the East German economy. However, "in practice, the development of east Germany's Mittelstand is proceeding painfully slowly. Self-employment is still much lower than in west Germany. Small businessmen in east Germany face a number of handicaps, mostly to do with being new to the game;" (The Economist [1996]).

[4]In Hungary, liberalization of communist rules began in the 1970's and by the 1980's a so-called 'second economy' of privately owned businesses had developed. The private sector was officially non-existent in Czechoslovakia but more important in Poland where family farms dominated in agriculture (OECD [1992]).

tion countries.[5] .

Table 1.1: Enterprises per 1000 inhabitants; (labor force participants; employees)

Year	West Germany East Germany (incl. firms with zero employment)		Czech Republic	Poland	Hungary
2002	32;(68;75)	26;(60;67)	86;(174;187)	39;(89;111)	55;(136;145)
2003	33;(68;76)	26;(62;69)	86;(174;189)	38;(88;109)	55;(134;143)
2004	35;(73;82)	30;(70;78)	86;(147;190)	38;(87;108)	56;(137;146)
2005	35;(73;83)	30;(72;82)	84;(167;182)	37;(83;102)	55;(133;144)
2006	36;(74;83)	32;(72;82)	84;(167;180)	38;(87;101)	54;(129;139)
2007	37;(75;84)	32;(73;83)	86;(172;182)	39;(89;99)	56;(130;141)

Data: Eurostat [2005] (NACE: C-I;K), Statistisches Bundesamt [2008] (for Germany)

When in 1990, with the end of the communist era, setting up a firm was legalized and simplified, a whole new set of occupational choices was opened up in East Germany, Czechoslovakia, Poland, and Hungary. However, different from other transition countries, East Germany was integrated into the established economy of West Germany. In this paper I argue that three key aspects of East Germany's integration into West Germany hindered a fruitful development of entrepreneurship: migration possibilities to West Germany, the way East German wages were regulated upon reunification, and the importance of parental background for entrepreneurship in West Germany.

First, since 1989 the unrestricted mobility of East Germans led to major migration flows within Germany. Since 1998 East Germany has been losing around 0.5% of its young population to migration each year.[6] Between 1989 and 2002, net migration to West Germany amounted to 1.3 million people, an equivalent of 7.5% of the original population of the German Democratic Republic (GDR) (Heiland [2004]), and between 1995 and 2007, 19% of East Germans aged 18 to 29 left East for West Germany. Especially young and

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[5]Even though formal aspects of doing business are actually more favorable in Germany than in other transition countries (World Bank [2009]). Earle and Sakova [2000] point out that high rates of unemployment and little welfare provision in transition countries might push individuals into self-employment and thus far from being successful business owners these own-account workers differ little from the unemployed. However, numbers for transition countries in Table 1.1 refer to self-employed with employees, i.e. they operate on a larger scale than that of mere subsistence, making it unlikely that many of them are own-account workers escaping from unemployment.

[6]See Figure A-2 of the Appendix. Compared to international migration rates, these are large numbers; e.g. current annual net migration rates from Ecuador and Mexico are 0.8% and 0.4% respectively CIA [2008]. It is very likely that numbers are upward biased as individuals might be counted more than once, migrating back and forth between East and West Germany. However, as this only applies to formal changes of residence numbers cited are not contaminated by the presence of commuters.

skilled East Germans seem to migrate to West Germany (see Hunt [2006], Ragnitz [2007] or Fuchs-Schündeln and Schündeln [2009]).[7] On the contrary between 1990 and 1998, the Czech Republic and Hungary were net recipients of migration, mainly stemming from other transition countries, while Poland lost between 0.5% and 3.9% of its original population to migration (United Nations [2002]). Second, presumably in order to restrict the number of East Germans migrating to West Germany, West German labor unions pressed for parity of East and West German wages (see e.g. Akerlof et al [1991], Sinn [2002]).[8] In 1991, wages in East Germany were set to 50% of West German wages despite a lower ratio of East- to West German labor productivities. By 1995, East German wages had reached up to 70% or more of West German wages (Sinn [2002], and Fuchs-Schündeln and Izem [2007]). On the other hand, between 1990 and 1997 wages in Poland and the Czech Republic remained stable at around 10-20% relative to wages in West Germany (Sinn [2002]). Third, entrepreneurial parental background was and is decisive for occupational choices of West Germans. Pistrui et al [2000] find that 60% of West German entrepreneurs have a parent who had been an entrepreneur. Contrariwise in East Germany there was no past generation that could pass on knowledge on how to run a business in a newly established market economy and despite abundant government aids only few individuals in East Germany set up their own business.[9].

The particular situation of East Germany, its poor economic performance, and the contrast between other transition economies and East Germany raise several questions: Why do only few East Germans set up a business in East Germany?[10] And can the resulting lack of entrepreneurship in East Germany be linked to low economic growth? What role does each of the proposed key aspects of East Germany's integration into West Germany play? How do the unrestricted mobility of East Germans, the policy of fixing East German wages as fractions of West German wages, and the importance of entrepreneurial parental background in West Germany influence occupational choices of East Germans and thus economic growth?

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[7]Brückner und Trübswetter [2007] on the other hand do not find that those migrating to West Germany are more educated than those staying in East Germany. However, they do find a positive self-selection of migrants according to unobserved individual characteristics.

[8]Officially, labor unions demanded wage equity out of concern for East-West German equity and East German welfare.

[9] Between 1991 and 2005, East Germany received annual public transfers equal to $4.1\% - 5.4\%$ of West German GDP. Transfers for support to enterprises and business-near infrastructure made up between 0.63% and 0.99% of West German GDP (Wurzel [2001])

[10]Diewald et al. [2006] study life-courses of East Germans after reunification and find that transitions into self-employment between 1992 and 1996 have been "surprisingly rare". In particular, they find that "only 4.1 percent of our sample made this step during the Window of opportunity [1/90-6/92], and 3.8 percent did so in the second period [7/92-3/96]" (pg.73).

In order to address these questions, both qualitatively and quantitatively, I build a model economy that places Lucas' [1978] span-of control model into an overlapping-generations framework. Individuals in the model economy are characterized by their innate talent and their parental background. Managerial knowhow is a combination of these two characteristics. Given their managerial knowhow individuals decide to be unemployed, to work, or to set up a business. The innate talent of entrepreneurs determines economic growth. Hence, there is a direct link between individuals' occupational choices and aggregate economic performance. After one generation each individual is replaced by a child of random talent.[11] Children inherit bequests and in case their parent was an entrepreneur they also receive information about how to run a business. As in Hassler and Rodríguez Mora [2000], when technological change is slow, there are few changes in the business environment and past information about how to run a business is valuable. Managerial knowhow of children of entrepreneurs will be higher. They will be the ones to set up their own business, rather than the most talented individuals. Hence, talent is not optimally allocated, individuals' occupational choices exert a negative externality on economic growth and growth remains low. On the other hand, when technological change is fast, past information depreciate rapidly, and managerial knowhow will be determined by individuals' innate talent only. The most talented individuals become entrepreneurs, allocation of talent is optimal, the externality is positive and technological growth remains high.

I first calibrate this model to West Germany before reunification, in particular to pin down the key parameters governing the role of parental background and the link between entrepreneurship and growth. I then present an extended version of the model economy that captures the integration of East into West Germany. While both Germanies share capital and goods markets, labor markets are locally separated. The government fixes wages in East Germany above labor productivity and as fractions of West German wages and finances a lower rental rate of capital for East Germany. Individuals can pay a moving cost and work or set up a business in the other part of Germany.[12] Since wages are set above labor productivity, becoming an entrepreneur is not attractive and East Germans choose to work instead of setting up their own business. While East Germans' general skills are comparable to those of West Germans, their average managerial knowhow is lower than that of many West Germans who have learned from their parents how to run

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[11]Zero correlation of talent between parents and children is a strong assumption. While I will not provide results for alternative assumptions on this correlation, in the course of this paper however, I will indicate and discuss the effects of this assumption on calibration and results.

[12]I abstain from the possibility of commuting; i.e. for instance living in East Germany and working in West Germany. This seems to be a common choice for East Germans (Hunt [2006]). However, for most individuals commuting is a temporary occupational choice as they commute for a limited amount of time and/or as students, while in the model of this paper occupational and migration choices are permanent.

a business.[13] Furthermore and despite investment aids for setting up businesses in East Germany, most talented East Germans migrate to West Germany to set up businesses there. They thus contribute to growth in West Germany, whereas in East Germany few mediocre entrepreneurs imply low economic growth. Given too many workers and too few entrepreneurs in an environment where wages are fixed, there is involuntary unemployment in East Germany. Counterfactual experiments show that had East Germany integrated into a social mobile West Germany, or had East German wages been flexible, or had migration between East and West Germany been restricted, there would be more entrepreneurs, less unemployment as well as higher economic growth in East Germany. However, while flexible wages and a socially mobile West Germany would have also led to more output and higher economic growth for all of Germany, migration restrictions are exclusively beneficial to East German output and economic growth.

1.1 Related Literature

This paper builds on Hassler and Rodríguez Mora [2000]. The authors bring forward various empirical evidence on the negative relation between rates of technological and economic growth and the value of parental background. This relationship implies a positive relation between rates of technological and economic growth and higher intergenerational social and occupational mobility. Kuznets [1966] writes on this matter :"One would tend to assume that internal income mobility is more limited in stagnant or slowly growing countries, than in those showing rapid growth; and there are implications also for the trends in income mobility over the long span of growth within a country."(pg.205).[14] Both relationships between economic growth and social mobility and economic growth and parental background arise in the model of this paper and have also been subject to a larger literature on economic growth, social mobility, and the allocation of talent.[15] While entrepreneurial parental background has a positive effect on entrepreneurship on the individual level, it negatively affects aggregate variables, as little intergenerational occupational and social mobility is associated with low economic growth.[16] Caselli and

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[13] Krueger and Pischke [1995] estimate very similar coefficients for returns to years of schooling for West Germans and East Germans working in West Germany.

[14]According to Olson [1982] a rigid social class structure and low economic growth are just two different ways in which a misallocation of talent due to rent seeking manifests itself in a society.

[15]A seminal paper on the optimal allocation of talent and economic growth is Murphy et al [1991]. Recently, the topic of the allocation of resources across productive units and its implications for productivity and growth has received a great deal of attention, see e.g. Hsieh and Klenow [2009], Guner et al [2008], and Restuccia and Rogerson [2008] among others.

[16]There is a large empirical literature on the determinants of entrepreneurship. Having had a parent who was an entrepreneur is found to have a positive effect on oneself setting up one's own business.

Gennaioli [2012] provide a model where missing markets result in the prevalence of dynastic firms. As in this paper, managers being selected according to their family ties rather than their talent leads to lower total factor productivity. In Galor and Tsiddon [1997], similar to this paper, parental background and growth are negatively related and as technology adoption evolves, parental background gains importance, wages become more equal, and technological progress slows down. In the model of this paper a positive value for parental background in entrepreneurship inhibits an optimal allocation of talent that would maximize the externality of talented entrepreneurs on economic growth.

As in the recent literature on cross-border flows of managerial talent, the model of this paper allows for entrepreneurs to set up their business in the other part of Germany. However, unlike results in Burnstein and Monge [2009] managerial talent does not flow from West Germany, a region with large 'firm-embedded productivity' towards East Germany where labor is abundant, because East German wages are set above labor productivity. And even though the immediate implementation of West German regulations in East Germany makes both regions' entrepreneurial environments alike, West Germans do not set up businesses in East Germany. Managerial talent moving towards similar environments as in Pica and Rodríguez Mora [2007] is again obscured by the wage setting policy in East Germany. This paper is also related to the vast literature that discusses East Germany's disappointing growth experience. Hunt [2008] provides a recent review of this literature. There is a general consensus that the wage setting policy has been the main cause for East Germany's high unemployment rates (see e.g. Akerlof et al [1991] and Sinn [2002]).[17] According to Snower and Merkl [2006] high unemployment rates in East Germany are a consequence of the wage setting policy in combination with generous welfare provisions. Canova and Ravn [2000] also assign an important role to welfare provisions in magnifying the contraction of output and employment caused by differences in skill level and capital endowment of East and West Germans. Burda and Hunt [2001] claim a dampening effect of the wage-setting policy on migration. In the framework of a labor search model, Uhlig [2006] argues that little networking due to a lack of established production leads to a low productivity and high out-migration scenario in East Germany. Apart from the paper by Canova and Ravn [2000] none of these authors provide general equilibrium models for East Germany's economic experience.

This paper contributes to the literature by being the first one, to the best of my knowledge,

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Dunn and Holtz-Eakin [1996] find intergenerational linkage in self-employment to be stronger along non-financial lines than along financial lines. Arenius and Minniti [2005] find that simply knowing other entrepreneurs is positively and significantly related to being a nascent entrepreneur.

[17] In addition, fixed wages impeded an offsetting of initial effects of the currency union between West and East Germany.

that explicitly models the link between a lack of entrepreneurship and low economic growth in East Germany.[18] In the framework of a general equilibrium model it applies the theory established by the literature on social mobility and economic growth to the context of economic transition. From the historical unique context of a generation without parental background in entrepreneurship arises the natural question of its implications for economic growth. This paper tries to address this question and to provide some quantification of the implications for the case of East Germany.[19] The remaining of this paper is organized as follows. Section 2 presents the basic model which is then calibrated to West German data before 1989. An extended version of the model with features of the reunification of East and West Germany is presented in Section 3. This extended model is then calibrated to data after reunification and its results are presented and discussed in Section 4. Section 5 presents the counterfactual experiments. Section 6 concludes.

2 Basic Model (West Germany before Reunification)

Each period the economy is inhabited by a continuum of individuals of mass one. Individuals differ in initial endowments of capital inherited from their parents and in managerial knowhow. Managerial knowhow is composed of innate talent and parental background. An individual's parental background refers to his parent's occupation of either having been an entrepreneur or having been a worker. According to their managerial knowhow individuals chose to become entrepreneurs or workers. Entrepreneurs produce a homogeneous good by using labor, capital, and their knowhow as inputs. Individuals live for one period, during which they receive their parents' bequests, make optimal occupational choices, lend or borrow capital, work, consume, and pass on bequests to their children. Each individual has one parent and is replaced by one child of random talent. Each period there is a mass L_t^0 individuals whose parents were workers, and a mass L_t^1 individuals whose parents were entrepreneurs, with $L_t^0 + L_t^1 = 1$. The government in this economy manages an unemployment insurance and collects taxes to finance government consumption.

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[18]A recent paper by Bajona and Locay [2009] considers the period before transition and establishes a similar link between a reduced stock of managerial knowledge and low growth rates for planned economies.

[19]Conceptually this paper is also related to studies that exploit the incidence of economic transition as a natural experiment to study entrepreneurship as e.g. Fuchs-Schündeln [2009] and Burchardi and Hassan [2010]. While these papers are empirical studies, the current paper exploits this fact in a theoretical framework.

Preferences An individual born in period t derives utility from personal consumption, c_t, and bequests, b_t, left to his child

$$U(c_t, b_t) = c_t^\omega b_t^{1-\omega}, \tag{2.1}$$

with $0 < \omega < 1$. The parameter ω reflects the importance of personal consumption for an individual's utility relative to bequests left to children.

Endowments Each individual has one unit of productive time that he supplies inelastically. In addition he is endowed with the bequest from his parent, denoted by x_t. Individuals also differ in their managerial knowhow (z_t).

Managerial Knowhow Managerial knowhow is composed of innate talent (q) and parental background (p). Innate talent is independent and identically distributed across time and individuals in $Q = (0, \bar{q}]$, with cdf $F(q)$ and density $f(q)$. Parental background is a variable that is equal to one if one's parent was an entrepreneur and zero otherwise, $p \in \{0, 1\}$. Managerial knowhow is defined as the product of innate talent, (q) and parental background, (p)

$$z_t^p = q(1 + \phi_t p),$$

where $\phi_t \geq 0$ reflects the value that being an entrepreneur's child has for an individual's managerial knowhow in period t. The basic idea is that an entrepreneur passes on information to his child about how to run a business. This private information enhances an individual's managerial knowhow.

Production Every entrepreneur has access to the same technology. He uses his managerial knowhow (z_t^p), employs workers of efficiency units (n_t), and rents capital (k_t) to produce a single output (y_t) used for consumption and bequests

$$y_t = F(z_t^p, n_t, k_t) = A_t (z_t^p)^{1-\gamma+\kappa} (k_t^\nu n_t^{1-\nu})^\gamma, \tag{2.2}$$

where $\gamma \in (0, 1)$ is the span-of-control parameter and $\kappa > 0$ determines the curvature of the entrepreneur's profit function.[20] The capital share of production is given by $\nu\gamma \in (0, 1)$. Capital depreciates at rate δ and A_t is total factor productivity (TFP) which grows at rate g_t.

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[20]In the original Lucas' [1978] span-of-control model wages are constant in talent and κ is equal to zero. Following Chang [2000], in the current paper unemployment benefits are constant, wages are linearly increasing in talent, and thus profits need to increase more than linearly with talent, which requires setting $\kappa > 0$.

Value of Parental Background Following Hassler and Rodríguez Mora [2000] the value of parental background, ϕ_{t+1} is defined as a decreasing function of the TFP growth rate

$$\phi_{t+1} = a(g_t), \tag{2.3}$$

with $a(g_t) \geq 0$ and $\frac{\partial a(g_t)}{\partial g_t} < 0$.[21] Fast technological change implies that today resembles yesterday less and that the value of private information inherited from parents is being reduced. When TFP growth is high, past information about how to run a business becomes completely worthless and everyone's managerial knowhow is solely defined by their innate talent

$$\lim_{g_t \to \infty} a(g_t) = 0.$$

Entrepreneurs Entrepreneurs choose optimal amounts of labor and capital in order to maximize their profits net of income taxes (τ). For any efficiency unit of labor hired entrepreneurs contribute $\tau_t^u w_t$ to the unemployment insurance. Given a wage rate (w_t) and a rental rate for capital (R_t), the entrepreneurs' problem is

$$\max_{\{n_t, k_t\}} \Pi_t = (1-\tau)[A_t(z_t^p)^{1-\gamma+\kappa}(k_t^\nu n_t^{1-\nu})^\gamma - (1+\tau_t^u)w_t n_t - R_t k_t]. \tag{2.4}$$

Combining the two first order conditions of this maximization problem, the optimal capital-labor ratio for entrepreneurs is given by

$$\frac{k_t}{n_t} = \frac{\nu}{1-\nu}\frac{(1+\tau_t^u)w_t}{R_t}, \tag{2.5}$$

which is increasing in the contribution to the unemployment insurance (τ_t^u). Entrepreneurs' profits are given by

$$\pi_t(z_t^p; .) = (1-\tau)(1-\gamma)A_t^{\frac{1}{1-\gamma}}(z_t^p)^{\frac{1-\gamma+\kappa}{1-\gamma}}\left(\frac{\gamma(1-\nu)}{(1+\tau_t^u)w_t}\right)^{\frac{\gamma}{1-\gamma}}\left(\frac{\nu}{1-\nu}\frac{(1+\tau_t^u)w_t}{R_t}\right)^{\frac{\nu\gamma}{1-\gamma}}. \tag{2.6}$$

Higher wages (w_t), higher income taxes (τ), higher contributions to the unemployment insurance (τ_t^u), as well as higher rental rates for capital (R_t), and a larger span-of-control parameter (γ) all reduce entrepreneurs' profits. A higher level of managerial knowhow (z_t^p) on the other hand, increases profits of entrepreneurs. Since $\frac{\partial z_t^p}{\partial \phi_t} \geq 0$, profits are also increasing in the value of entrepreneurial parental background. Given the negative relation between the TFP growth rate and the value of entrepreneurial parental background (see Equation 2.3), low technological growth today implies higher profits for children of entrepreneurs in the future.

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[21]Instead, ϕ_t could be defined as a decreasing function of output growth. Given that the steady-state growth rate of TFP is equal to $(1-\nu\gamma)$ times the growth rate of output, results will most likely be similar.

Workers Workers supply their efficiency units of labor inelastically. Their talent (q) is transformed linearly into efficiency units of labor so that their net wage as workers is given by

$$(1 - \tau_t^u - \tau)w_t q. \qquad (2.7)$$

Workers also pay income taxes (τ). Mimicking the German unemployment insurance, both employers and workers contribute the same fraction τ_t^u of workers' gross wages to the insurance scheme.[22]

Unemployed Unemployed individuals receive a fraction ς of the wage rate per efficiency unit as unemployment benefits (v_t)

$$v_t = \varsigma w_t,$$

which are paid independently of an individual's talent.

Occupational Choices Individuals compare their potential wage to the profits they can make as entrepreneurs. Whenever, $\pi_t(z_t^p; .) \geq (1 - \tau_t^u - \tau)w_t q$, they set up their own business. Given $z_t^p = q(1 + \phi_t p)$, the cut-off value of innate talent ($\hat{q}_t^p$) describing the individual who is indifferent between working or setting up a business is given by

$$\hat{q}_t^p = \left((1 + \phi_t p)^{\frac{-(1+\gamma+\kappa)}{1-\gamma}} w_t^{\frac{1-\nu\gamma}{1-\gamma}} R_t^{\frac{\nu\gamma}{1-\gamma}} \Psi_t^{-1}(1-\tau)^{-1}(1+\tau_t^u)^{\frac{\gamma-\nu\gamma}{1-\gamma}}(1-\tau_t^u-\tau) \right)^{\frac{1-\gamma}{\kappa}},$$

where $\Psi_t = A_t^{\frac{1}{1-\gamma}}(1-\gamma)(\gamma(1-\nu))^{\frac{\gamma}{(1-\gamma)}}(\frac{\nu}{1-\nu})^{\frac{\nu\gamma}{1-\gamma}}$. This threshold is decreasing in the value of entrepreneurial parental background. Individuals whose parents were entrepreneurs set up a business at a lower level of innate talent than individuals whose parents were workers. When TFP grows fast, the value of entrepreneurial parental background vanishes ($\phi_t \to 0$) and the difference in talent between the two marginal entrepreneurs from different family backgrounds disappears. Higher wages make being a worker more attractive relative to being an entrepreneur. A higher rental rate for capital and higher wages (as long as the capital share is restricted to be smaller than unity, $\nu\gamma < 1$) reduce entrepreneurial profits and increase the threshold of occupational choice, leading to fewer entrepreneurs. Both, income taxes (τ) and the contribution to the unemployment insurance (τ_t^u) have ambiguous effects on the occupational choice of individuals. While they reduce both, wages of workers and profits of entrepreneurs, the latter are affected less by an increase in any of the two because contributions to the unemployment insurance are part of labor costs and

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[22]For any worker of type q, a firm contributes $\tau_t^u w_t q$ to unemployment insurance and pays to the worker a gross wage of $w_t q$, of which the government automatically collects a fraction $(1 - \tau_t^u - \tau)$ for income tax and unemployment insurance.

as thus deductible from profit taxes. Higher income taxes (as long as $\nu < 1$) and higher contributions to the unemployment insurance thus reduce the threshold of occupational choice, leading to more entrepreneurs. Individuals then compare unemployment benefits (v_t) to their potential wage. The marginal worker, the individual with talent $q_t^\star$ is indifferent between working or being unemployed $q_t^\star = \frac{\varsigma}{(1-\tau_t^u-\tau)}$. This threshold is independent of both the wage rate and an individual's parental background.

Figure 2.1 displays these thresholds of occupational choice for individuals from an entrepreneurial family background and those from a working family background. Individuals with talent lower than $q_t^\star$ find it optimal to stay unemployed while those with talent between $q_t^\star$ and $\hat{q}_t^1$ become workers. Individuals with talent higher than $\hat{q}_t^1$ and parental background in entrepreneurship set up a business while those of equal talent but lacking parental background in entrepreneurship become workers. Everyone of talent higher than $\hat{q}_t^0$ decides to become an entrepreneur.

Figure 2.1: Thresholds of Occupational Choice
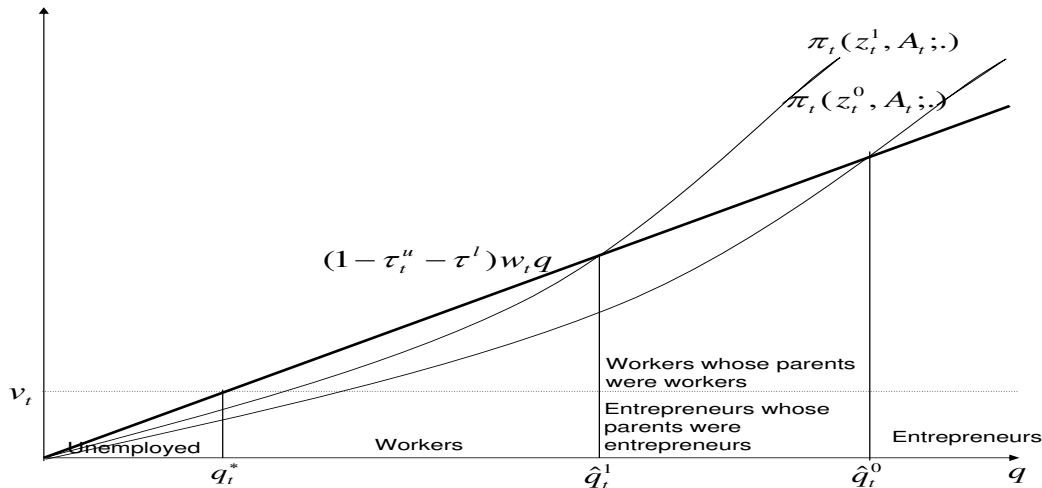
The Individual's Problem An individual born in period t receives his bequest (x_t) and chooses an optimal occupation that determines how he will employ his labor endowment and his bequest. The individual then is unemployed, works, or runs a business. Finally he consumes and leaves a bequest to his child. Formally the individual chooses

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$\{c_t, b_t, I_{q<q^\star}, I_{q_t^\star<q<\hat{q}_t^p}, I_{q>\hat{q}_t^p}\}$ in order to maximize Equation 2.1 subject to

$$c_t + b_t = x_t(1 + R_t - \delta) + v_t I_{q<q^\star} + (1 - \tau_t^u - \tau)w_t I_{q_t^\star<q<\hat{q}_t^p} + \pi_t(z_t^p; .)I_{q>\hat{q}_t^p}),$$

where $I_{q<q^\star}, I_{q_t^\star<q<\hat{q}_t^p}$, and $I_{q>\hat{q}_t^p}$ are indicator functions that take on value one if the individual's talent is lower than $q_t^\star$, between $q_t^\star$ and $\hat{q}_t^p$, or larger than $\hat{q}_t^p$, respectively. Individuals can lend their bequests to firms at the competitive rental rate, R_t. The first order conditions of the individual's problem give rise to the following two optimal decisions:

$$c_t(z_t^p; .) = \omega[x_t(1 + R_t - \delta) + v_t I_{q<q^\star} + (1 - \tau_t^u - \tau)w_t I_{q_t^\star<q<\hat{q}_t^p} + \pi_t(z_t^p; .)I_{q>\hat{q}_t^p},$$

$$b_t(z_t^p; .) = (1 - \omega)[x_t(1 + R_t - \delta) + v_t I_{q<q^\star} + (1 - \tau_t^u - \tau)w_t I_{q_t^\star<q<\hat{q}_t^p} + \pi_t(z_t^p; .)I_{q>\hat{q}_t^p}.$$

The individual spends a fraction ω of his income on consumption and leaves the rest as a bequest to his child. In addition to these two optimal decisions the solution to the individual's problem includes his optimal occupational choice. Given their talent, individuals can choose to set up their own business, to become workers, or to be unemployed. Note that given perfect capital markets the individual's bequest does not affect his occupational choice. Given perfect foresight, individuals compare among potential incomes from the three occupations and choose the one that maximizes their income.[23]

2.1 Aggregate Economy

Aggregate Capital Supply Each period the economy's aggregate capital stock (X_t) is determined by the sum of all bequests from last period

$$X_t = L_{t-1}^0 \int_0^{\bar{z}^0} b_{t-1}(z_{t-1}^0; .)f(q)dq + L_{t-1}^1 \int_0^{\bar{z}_{t-1}^1} b_{t-1}(z_{t-1}^1; .)f(q)dq, \qquad (2.8)$$

where b_{t-1} represents bequest decisions taken last period. Last period's individuals were either children of workers L_{t-1}^0 or children of entrepreneurs L_{t-1}^1.[24]

Growth Rate The TFP growth rate is defined as a one-period percentage change in the level of TFP

$$g_t = \frac{A_t - A_{t-1}}{A_{t-1}}.$$

---

[23]Note that parents do not take into account that becoming an entrepreneur generates a value of parental background and thus a possibly higher managerial knowhow for their children.

[24]Given perfect capital markets and the warm glow motive for bequests in agents' utility, there is no need to follow the joint distribution of wealth and managerial knowhow in this economy.

Following Hassler and Rodríguez Mora [2000], the TFP growth rate is a positive function of the innate talent of last period's entrepreneurs relative to the size of the population

$$g_t = h(\bar{Q}_{t-1}),$$

where

$$\bar{Q}_{t-1} = L^0_{t-1} \int_{\hat{z}^0_{t-1}}^{\bar{z}^0} q f(q) dq + L^1_{t-1} \int_{\hat{z}^1_{t-1}}^{\bar{z}^1_{t-1}} q f(q) dq,$$

and with h being some increasing function in $\bar{Q}_{t-1}$.[25] The innate talent of last period's entrepreneurs is the sum of innate talent of entrepreneurs who are children of workers L^0_{t-1} and those who are children of entrepreneurs L^1_{t-1}. Given these two groups of individuals and a fixed fraction of entrepreneurs in the economy, $\bar{Q}_{t-1}$ is maximized by assigning occupations such that marginal entrepreneurs from both parental backgrounds coincide. However, in case the value of parental background is high, the marginal entrepreneur with an entrepreneurial family background will be of lower talent and given a fixed fraction of entrepreneurs in the economy aggregate innate talent of entrepreneurs will not be maximized. The individual's occupational choice thus exerts a negative externality on the economy's growth rate.

Government The government collects income taxes from entrepreneurs and workers and uses them for pure government consumption. Contributions to the unemployment insurance scheme from both workers and entrepreneurs have to be such as to fully finance benefits paid to the unemployed in each period. Each period the government has to fulfill the following two constraints

$$
\begin{aligned}
G_t &= \tau \{ L^1_t \int_{\hat{z}^1_t}^{\bar{z}^1_t} (y_t - w_t(1+\tau^u_t)n_t - R_t k_t) f(q) dq + \\
&\quad + L^0_t \int_{\hat{z}^0_t}^{\bar{z}^0} (y_t - w_t(1+\tau^u_t)n_t - R_t k_t) f(q) dq + \\
&\quad + L^1_t \int_{\hat{q}_t}^{\hat{z}^1_t} w_t q f(q) dq + L^0_t \int_{\hat{q}_t}^{\hat{z}^0_t} w_t q f(q) dq \},
\end{aligned}
\tag{2.9}
$$

---

[25]Hassler and Rodríguez Mora [2000] reason the positive relationship between entrepreneurs' innate talent and TFP growth as follows: 'the higher the individual entrepreneur's ability to learn or understand or to deal with new or trying situations, the larger will the individual's technological innovations be. This will create a feedback mechanism whereby rapid technology growth creates an environment in which the sorting of individuals to entrepreneurial positions is based on intelligence, not on social background.'(pg.889). Note that population size is unity.

and

$$v_t \int_0^{\hat{q}_t} f(q)dq = 2\tau_t^u w_t \left(L_t^0 \int_{\hat{q}_t}^{\hat{z}_t^0} qf(q)dq + L_t^1 \int_{\hat{q}_t}^{\hat{z}_t^1} qf(q)dq \right). \qquad (2.10)$$

Equilibrium We can now define a competitive equilibrium for the model economy. Given an initial capital stock, X_0, an initial fraction of entrepreneurs L_0^1, and their talent, $\bar{Q}_{-1}$, a government policy, $\{\tau, \varsigma\}$, and a sequence of prices for labor and capital $\{w_t, R_t\}_0^\infty$, a competitive equilibrium is a collection of sequences $\{c_t(z_t^p; .), b_t(z_t^p; .), \hat{z}_t^p, \hat{q}_t, \tau_t^u, G_t\}_0^\infty$ for $p \in \{0, 1\}$ such that:

1. $\{c_t(z_t^p; .), b_t(z_t^p; .), \hat{z}_t^p, \hat{q}_t\}_0^\infty$ solves the individual's problem for each $p \in \{0, 1\}$ and for each t;

2. all three markets, for goods, capital, and labor clear, i.e. equations (2.11)-(2.13) hold for all t;

3. $\{(\tau_t^u\}_0^\infty$ is such that the unemployment insurance is self-financing, equation 2.10 holds for all t;

4. $\{G_t\}_0^\infty$ is such that equation 2.9 holds for all t.

In equilibrium all three markets for goods, capital, and labor must clear. Labor supply is given by the productive time of those individuals who are neither entrepreneurs nor opt for unemployment. Denote by $n_t(z_t^p; .)$ and $k_t(z_t^p; .)$ optimal demands for labor and capital services by an entrepreneur born in period t who has managerial knowhow z_t^p. Then for the labor market to clear we require aggregate labor demand

$$N_t^d = L_t^0 \int_{\hat{z}_t^0}^{\bar{z}^0} n_t(z_t^0; .)f(q)dq + L_t^1 \int_{\hat{z}_t^1}^{\bar{z}_t^1} n_t(z_t^1; .)f(q)dq, \qquad (2.11)$$

to be equal to aggregate labor supply $N_t^s = L_t^0 \int_{\hat{q}_t}^{\hat{z}_t^0} qf(q)dq + L_t^1 \int_{\hat{q}_t}^{\hat{z}_t^1} qf(q)dq$.
For the capital market to clear we require aggregate capital demand to equal aggregate capital supply

$$K_t^d = L_t^0 \int_{\hat{z}_t^0}^{\bar{z}^0} k_t(z_t^0; .)f(q)dq + L_t^1 \int_{\hat{z}_t^1}^{\bar{z}_t^1} k_t(z_t^1; .)f(q)dq = X_t. \qquad (2.12)$$

With $y_t(z_t^p; .)$ being the supply of goods by any entrepreneur of knowhow z_t^p, for market clearing in the goods market we require

$$L_t^0 \int_{\hat{z}_t^0}^{\bar{z}^0} y_t(z_t^0; .)f(q)dq + L_t^1 \int_{\hat{z}_t^1}^{\bar{z}_t^1} y_t(z_t^1; .)f(q)dq =$$

$$= L_t^0 \int_0^{\bar{z}^0} (c_t(z_t^0; .) + b_t(z_t^0; .))f(q)dq + L_t^1 \int_0^{\bar{z}_t^1} (c_t(z_t^1; .) + b_t(z_t^1; .))f(q)dq -$$

$$- X_t(1 - \delta) + G_t. \quad (2.13)$$

Aggregate consumption, bequests, and government consumption have to equal the sum of aggregate production and the depreciated capital stock.

2.2 Calibration

Before presenting the extended version of the model economy that describes the reunification of West and East Germany, I first calibrate the basic model economy to West Germany before reunification. I fix parameter values for preferences and technology and pin down key parameters governing the role of parental background and the link between entrepreneurship and growth. Some parameters are assigned values based on a-priori information, while others are calibrated to match certain statistics of the West German economy before reunification. I also specify the function $h(\bar{Q}_{t-1})$ that relates innate talent of entrepreneurs and TFP growth and the function $a(g_t)$, relating TFP growth and the value of parental background for entrepreneurship.[26]

Fixing Parameter Values For the mean log-talent (μ) and its dispersion (σ), I use values of 2.11 and 0.58 respectively as estimated by Chang [2000] using the US wage distribution for non-supervisory workers. A more regulated German labor market and lower labor-market participation by low-skilled individuals make the use of a West German wage distribution less adequate for estimating a distribution of talents. Factors other than underlying talent lead to a higher mean and lower variation in wages.[27] The US wage distribution, since it is less contaminated by policies, seems to be a better reflection of individuals' talent. The span-of-control parameter (γ) is set to 0.865. Using 3-digit industry data, Burnside et al [1995] estimate returns to scale in production to lie between 0.81 and 0.92. I choose the midpoint of their values. Taking the average over annual values for 1970-1989 for the ratio of depreciation of fixed private capital over gross private capital stock gives me an annual depreciation rate (δ) of 4.6% (Statistisches Bundesamt [2006]).

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[26]One period in this economy is equivalent to approximately one generation - 20 years.

[27]Gernandt and Pfeiffer [2007] estimate a wage distribution for West Germany for gross hourly wages for prime age dependent male workers for 1984-1989, with mean 2.42 and standard deviation 0.118.

Table 2.2: Parameters

Mean Log Talent (μ)	2.11
Dispersion in Log Talent (σ)	0.58
Span-of-Control (γ)	0.865
Annual Depreciation Rate (δ)	0.046
Parameter for Function Relating Entrepreneurs' Talent to Growth (α)	0.22
Parameter for Function Relating Growth to Value of Parental Background ($\bar{\phi}$)	0.957
Importance of Capital (ν)	0.3468
Relative Importance of Consumption in Utility (ω)	0.8035
Unemployment Benefit (ς)	2.649
Curvature of Profit Function(κ)	0.101
Income Tax (τ)	0.175

Functional Forms and Calibration The two center pieces of the model economy are i)the function relating entrepreneurs' innate talent to technological growth and ii)the function relating technological growth to the value of entrepreneurial parental background for managerial knowhow. The model's results are essentially determined by the functional forms and parameter values assigned to these functions. Careful calibration is thus crucial for obtaining sensible results for the basic model as well as for the extended version of the model economy. I specify the function $h(\bar{Q}_{t-1})$ relating innate talent of entrepreneurs to the growth rate of TFP as follows:

$$g_t = h(\bar{Q}_{t-1}) = \frac{1}{(1 + e^{-\bar{Q}_{t-1}})^{1/\alpha}}.$$

To obtain a positive relationship between innate talent of entrepreneurs and technological growth, $\alpha \geq 0$ has to hold. I choose α equal to 0.22 to match that between 1971 and 1989 real West German GDP per capita grew at an average annual rate of 2.26% (Statistisches Bundesamt [2006]). Finally, I specify the function $a(g_t)$ that relates TFP growth to the value of entrepreneurial parental background

$$\phi_{t+1} = a(g_t) = \frac{\bar{\phi}}{1 + g_t},$$

where $\bar{\phi}$ is a parameter. This parameter is assigned a value of 0.957 to match the intergenerational persistence in occupations.[28] According to Pistrui et al [2000] 60% of West German entrepreneurs have a parent who had been an entrepreneur. I set the calibration target for the percentage of entrepreneurs whose parents were entrepreneurs to 60%. Table 2.2 reports all parameter values.

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[28]Zero correlation of talent between parents and children requires assigning a relatively high value to $\bar{\phi}$ in order to be able to account for the persistence in occupations.

Table 2.3: Calibration Targets

	Data	Model
Average Annual Growth Rate of GDP (1971-1989)	2.26%	2.26%
Percentage of Entrepreneur with Entrepreneurial Parent (1997)	60%	60%
Capital Share (1970-1989)	0.3	0.3
Capital-Output Ratio (1970-1989)	2.32	2.32
Unemployment Rate (1970-1989)	5.4%	5.4%
Business Ownership Rate (1972-1989)	6.9%	6.9%
Tax Revenues to GDP (1975-1990)	12.2%	12.2%

The remaining five parameters are chosen to match the first five calibration targets of Table 2.3. The importance of capital (ν) is calibrated to a value of 0.3468 in order to target a capital share of 0.3 as reported by the Deutsche Bundesbank [2001] for West Germany for 1970 to 1989. The parameter for the relative importance of consumption in utility (ω) is assigned a value of 0.8035 to match an average annual capital-output ratio of 2.32 for West Germany for 1970-1989 (Statistisches Bundesamt [2006]). The unemployment benefit as a fraction of the wage rate per efficiency unit (ς) is calibrated to 2.649 in order to target an average unemployment rate of 5.4% for West Germany between 1970 and 1989 (Bundesagentur für Arbeit [2007]).[29] The parameter for the curvature of the profit function (κ) is assigned a value of 0.101 to match the fraction of entrepreneurs in the model to a business ownership rate of 6.9%, as estimated by Entrepreneurs International (Compendia [2002]) for West Germany for 1972 to 1989.[30] The parameter for the income tax rate (τ) is calibrated to a value of 0.175 to match the ratio of tax revenues to GDP in the model to taxes on income and profits as percentage of GDP of 12.2% for West Germany for 1975 to 1990 (OECD [2006]). I simulate the model economy until convergence to a balanced growth path. The model hits its calibration targets of Table 2.3 well.

In addition, the model is also able to generate statistics on average firm size, unemployment benefits to mean nominal wage, and contributions to unemployment insurance in line with data. Table 2.4 presents additional steady state results for the basic model representing West Germany before reunification. On average, entrepreneurs are twice as talented as the average individual, and entrepreneurs from a working family background are 2.4 times as talented as entrepreneurs from an entrepreneurial family background. Having had a parent who was an entrepreneur increases one's managerial knowhow by

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[29]I use the official unemployment rate because unofficial unemployment rates are not available for years prior to 1993 (active labor market schemes have mostly been in place since 1990).

[30]In this data set business owners include self-employed and owners/managers of incorporated businesses whose income includes profits as well as a salary. Unpaid family workers are excluded. The business ownership rate is constructed by dividing the number of business owners by the total labor force. Data is available from 1972 onwards.

Table 2.4: Additional Steady State Average Results: Annual Values

Entrepreneurship	
Working Background Individuals Becoming Entrepreneurs	3.0%
Entrepreneurs Accumulative Talent ($\bar{Q}_t$)	1.4
Relative Average Intelligence of Entrepreneurs	2.2
Av. Talent of Entrepreneurs from Working vs. Entrepreneurial Background	2.4
Value of Entrepreneurial Parental Background	0.7
West Germany before Reunification	
Growth Rate of TFP	1.57%
Annual Rental Rate of Capital	6.6%
Average Firm Size (Workers)	12.7
Contribution to Unemployment Insurance	0.87%
Unemployment Benefit as Fraction of Mean Nominal Wage	28.3%

around 70%, ($\phi = 0.70$). Only 3% of individuals from a working family background set up their own business, compared to 60% of individuals whose parents were entrepreneurs. TFP grows at an annual rate of 1.57%. The annual rental rate of capital in the model is 6.6%, somewhat higher than the deflated average of German government long-term bond yields over 1970-1989 of 5.2% (IMF and Heston et al. [2011] and United Nations Statistics Division [2010]). The model generates an average firm size of 12.7 workers per firm which is slightly higher than data suggests. Entrepreneurs International (Compendia [2002]) indicate that between 1972 and 1989 the average West German firm had approximately 11 employees. The ratio of unemployment benefits to mean nominal wage in the model is 28.3% and thus comes very close to the ratio of monthly social subsidies to the monthly nominal average equivalent income of 0.29 for West Germany for 1991(Bundesministerium für Arbeit und Soziales [2008]and DIW [1995]).[31] Contributions to unemployment insurance with employers and employees each paying 0.87% of gross wages result somewhat lower in the model than in the data. According to Glismann and Schrader [2002] contributions to unemployment insurance by each employer and employee in West Germany between 1970 and 1989 were equal to 1.45% of gross income.

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[31]According to a letter from the Bundesministerium für Arbeit und Soziales, equivalent data for the time period 1970 to 1989 is not available.

3   Extended Model (Reunified Germany)

Having presented the basic framework I will now extent the model economy to account for aspects of reunification in order to be able to address the two main questions of this paper: Did East Germany's integration into an established economy - West Germany - hinder a fruitful development of entrepreneurship? And did the resulting lack of entrepreneurship affect economic growth in East Germany?

In this paper, the German reunification is modeled as the economic integration of a smaller region into a larger one. Both regions share common goods and capital markets, but their labor markets are locally separated. The government fixes wages in East Germany at a fraction $(1 - \lambda_t)$ of West German wages and governmental investment aids lower the rental rate for capital in East Germany to $R_t^* = (1 - \chi_t)R_t$. Initially, TFP in East Germany is lower than in West Germany $(A_t^* < A_t)$. The economy's aggregate capital stock is given by the sum of the two capital stocks. In contrast to West Germans, all East Germans of the first generation after reunification are children of workers. Paying a fixed moving cost individuals can opt for working or setting up a business in the other part of Germany.[32] In each region there is a fraction of θ individuals who are mobile and a fraction of $(1 - \theta)$ individuals who are immobile. Immobile individuals face infinitely high moving costs $(\eta_t^h = \infty)$ and more mobile individuals face lower moving costs (η_t^l).[33] The distribution of innate talent $f(q)$, is identical for East and West Germans. Upon reunification West Germans can migrate to East Germany and set up a business there, taking advantage of the lower labor cost and a lower rental rate of capital. However, TFP in East Germany is lower and moving requires the payment of a fixed cost. No West German migrates to East Germany to work there, as wages in East Germany are lower. For East Germans, reunification implies free occupational choices. They can decide to set up their own business, to become a worker, to be unemployed, or they can migrate to West Germany to work or to set up a business there.[34]

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[32] Individuals migrate with their children and thus depending on migration and occupational choices made by the first generation of East Germans, their offspring will be East or West German children of workers or entrepreneurs.

[33] I introduce this additional heterogeneity to account for reasons other than wage differentials or education (here $\approx$ innate talent) that induce migration decisions from East to West Germany, e.g. age, family ties (see e.g. Burda [1993])

[34] East German unemployed receive the same benefits as West German unemployed, hence for them the option to migrate to West Germany is never better than staying in East Germany, given that migration is costly. As of 2007, social welfare benefits are the same in East and West Germany but already in 1992 East German benefits were just 4% below those of West Germany (Bundesministerium für Arbeit und Soziales [2008]).

East German Workers East Germans have full knowledge of the wage setting policy. With a certain probability ψ_t, they rationally expect to be involuntarily unemployed when choosing to work in East Germany.[35] East German workers earn a fraction $(1-\lambda_t)$ of West German wages and both voluntary and involuntary unemployed East Germans receive unemployment benefits v_t.[36] Thus expected income of those staying in East Germany to work is given by

$$(1 - \psi_t)(1 - \tau_t^u - \tau)(1 - \lambda_t)w_t q + \psi_t v_t. \tag{3.14}$$

East Germans who migrate to West Germany to work there earn the same wage as West Germans, less a moving cost $\eta_t^{*,j}$

$$(1 - \tau_t^u - \tau)w_t q - \eta_t^{*,j}. \tag{3.15}$$

East German Entrepreneurs East German entrepreneurs face the following profit maximization problem

$$\max_{\{n_t, k_t\}} \Pi_t = (1 - \tau)[A_t^*(z_t^p)^{1-\gamma+\kappa}(k_t^\nu n_t^{1-\nu})^\gamma - (1 - \lambda_t)(1 + \tau_t^u)w_t n_t - (1 - \chi_t)R_t k_t]. \tag{3.16}$$

Bigger differences between East and West German wages (λ_t), and East and West German rental rates of capital (χ_t) increase profits of East German entrepreneurs. Denote their optimal profits by $\pi_t(z_t^p, A_t^*; .)$. East Germans who set up a business in West Germany face the following profit maximization problem

$$\max_{\{n_t, k_t\}} \Pi_t = (1 - \tau)[A_t(z_t^p)^{1-\gamma+\kappa}(k_t^\nu n_t^{1-\nu})^\gamma - (1 + \tau_t^u)w_t n_t - R_t k_t - \eta_t^{*,j}]. \tag{3.17}$$

Higher moving costs ($\eta_t^{*,j}$) reduce profits of East Germans who set up a business in West Germany. Higher West German TFP (A_t) on the other hand, increases their profits. Denote their optimal profits by $\pi_t(z_t^p, A_t, \eta_t^{*,j}; .)$. East Germans compare potential incomes from being unemployed, working or setting up a business in East Germany, and working or setting up a business in West Germany.

Figure 3.2 displays one possible realization of four thresholds of occupational choice for mobile East Germans of the first generation after reunification. East German individuals compare their potential wage in West Germany to the wage they can earn in East

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[35]One might argue that initially East Germans did not have any notion of unemployment as many authors have described that under the communist regimes, the "threat of unemployment was therefore virtually nil[...]" (Roland [2000], pg.9). However, given that periods are equal to one generation the model cannot accommodate a process of learning during one's lifetime and thus it seems sensible to assume that East German's form rational expectations.

[36]Note that given this uncertainty, the problem for an East German individual thus corresponds to maximizing his expected utility, $E_t[U(c_t, b_t)]$.

Germany. The cut-off value, $\tilde{q}_t^{*,l}$ describes the mobile East German individual who is indifferent between working in East or West Germany, while the cut-off value $\hat{q}_t^{*,0,l}$ describes the East German mobile individual who is indifferent between working in West Germany or setting up a business in East Germany. Finally, the cut-off value, $\hat{\tilde{q}}_t^{*,0,l}$ describes the mobile East German individual who is indifferent between setting up his business in East or West Germany

Figure 3.2: Possible thresholds for occupational choice for mobile East Germans of first generation after reunification.
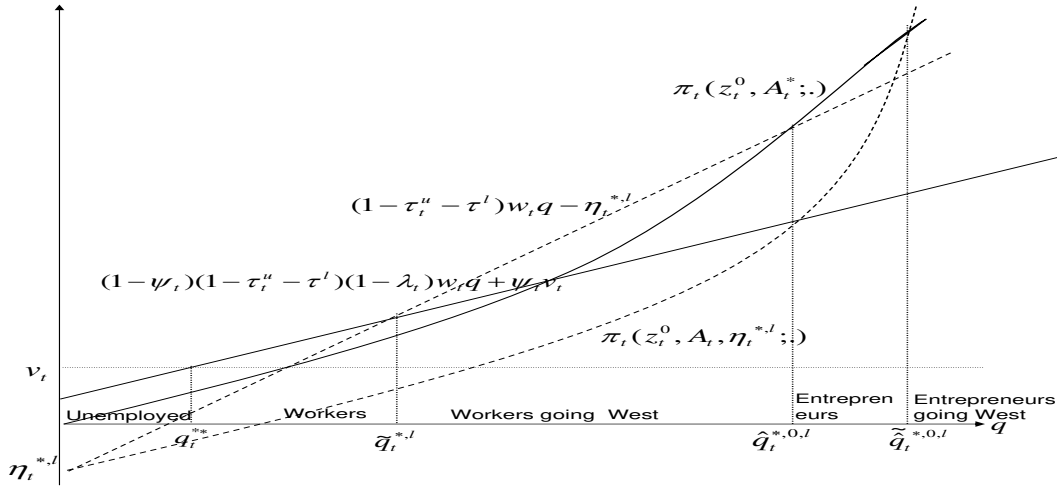
West German entrepreneurs Given a fixed cost for moving from West to East Germany (η_t^j) with $j \in \{h, l\}$, a wage rate for East Germany $(1 - \lambda_t)w_t$, and a reduced rental rate for capital $(1 - \chi_t)R_t$, the problem of a West German who sets up his business in East Germany is

$$\max_{\{n_t, k_t\}} \Pi_t = (1-\tau)[A_t^*(z_t^p)^{1-\gamma+\kappa}(k_t^\nu n_t^{1-\nu})^\gamma - (1-\lambda_t)(1+\tau_t^u)w_t n_t - (1-\chi_t)R_t k_t - \eta_t^j]. \quad (3.18)$$

Smaller discounts on wages (λ_t) and on the rental rate of capital (χ_t) as well as higher moving costs (η_t^j), reduce profits of West Germans who set up their businesses in East Germany.[37] Their optimal profits are denoted by $\pi_t(z_t^p, A_t^*, \eta_t^j; .)$. Individuals in West Germany compare their potential profits from setting up a business in East Germany to

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[37]Moving costs are assumed to be deductible from profit taxes.

the potential incomes resulting from the previously discussed occupations. They compare profits from setting up a business in East Germany (Equation 3.18) to profits they can make as entrepreneurs in West Germany (Equation 2.6). Only if the discount on wages and the discount on the rental rate of capital are large enough to offset the reduced TFP in East Germany do West German individuals prefer to set up a business in East Germany over setting it up in West Germany. If discounts are too small, or differences in TFP are large, no West German individual opts for setting up his business in East Germany. In this case, or if moving costs are very large, or if there are no mobile individuals, thresholds of occupational choices for West Germans after reunification remain unaltered and are as displayed in Figure 2.1.

3.1 Aggregate Economy

Lemma 3.1. *There exists no equilibrium after reunification in which both, West and East German individuals become entrepreneurs in both, East and West Germany.*

There will hence only exist equilibria with either East Germans setting up businesses in East and West Germany or West Germans setting up businesses in East and West Germany (see the Appendix A.5 for a proof).

Growth Rates The growth rate of East German TFP is defined as a positive function of the innate talent of entrepreneurs setting up a business in East Germany ($\bar{Q}^*_t$) relative to P^*_{t+1}, the East German population of next period, i.e. after migration decisions have been taken

$$g^*_{t+1} = h(\bar{Q}^*_t/P^*_{t+1}).$$

Analogously, the growth rate of West German TFP depends positively on the innate talent of entrepreneurs setting up a business in West Germany ($\bar{Q}_t$)

$$g_{t+1} = h(\bar{Q}_t/P_{t+1}).$$

Government After reunification, the government collects income taxes in both, East and West Germany. The government also fixes the discount on East German wages (λ_t) as well as the discount on the rental rate of capital in East Germany (χ_t). Tax revenues are used to finance the difference in the rental rate to lenders but the government cannot run a deficit.[38] Each period contributions to the unemployment insurance from both

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[38]In none of the calibrated versions of the model economy is the restriction on zero debt binding; i.e. investment aids never exceed tax revenues.

workers and entrepreneurs in East and West Germany have to be such as to fully finance all unemployment benefits. Let $K_t^{d,*}$ be aggregate capital demand in East Germany, W_t denotes aggregate net wages of the economy, Π_t are aggregate after-tax profits, and UB_t are aggregate unemployment benefits. Each period the government has to fulfill the following two constraints

$$G_t + \chi_t R_t K_t^{d,*} = \tau(\Pi_t + W_t) - \tau\tau_t^u W_t \tag{3.19}$$

with $G_t \geq 0 \ \vee t$, and

$$UB_t = 2\tau_t^u W_t. \tag{3.20}$$

Equilibrium Given that East German wages are fixed above labor productivity, equilibria after reunification are characterized by involuntary unemployment in East Germany.[39] I require that for an equilibrium there be market clearing in the common markets for goods and capital, and in at least the labor market in West Germany. I allow for the possibility of closure of the East German labor market. Denote aggregate labor demand in East and West Germany by $N_t^{d,*}$ and N_t^d respectively. $N_t^{s,*}$ and N_t^s are aggregate labor supply in East and West Germany. Aggregate capital demand in West Germany is denoted by K_t^d. Let $Y_t^{s,*}$ and Y_t^s be aggregate supply of goods in East and West Germany respectively. Aggregate capital supply after reunification, X_t is given by the sum of the initial capital stocks of West and East Germany. For the capital market to clear we require

$$X_t = K_t = K_t^{d,*} + K_t^d. \tag{3.21}$$

For the goods market to clear the following has to hold

$$\begin{aligned} Y_t^{s,*} + Y_t^s = {} & \omega\{\Pi_t + W_t + UB_t + (1 + R_t - \delta)X_t\} + (1-\omega)\{\Pi_t + W_t + \\ & + UB_t + (1 + R_t - \delta)X_t\} + G_t + \chi_t R_t K_t^{d,*} + \Xi_t - (1-\delta)X_t. \end{aligned} \tag{3.22}$$

Aggregate consumption, aggregate bequests, government consumption, and aggregate moving costs (Ξ_t) have to equal the sum of production and the depreciated aggregate capital stock. The labor market in West Germany has to clear, i.e. aggregate labor supply has to equal aggregate labor demand

$$N_t^s = N_t^d. \tag{3.23}$$

We require the labor market in East Germany to be in positive net supply

$$N_t^{s,*} \geq N_t^{d,*}. \tag{3.24}$$

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[39]Involuntary unemployment is assigned randomly. As entrepreneurs hire 'efficiency units' they are indifferent between hiring few very capable or many less capable workers.

Aggregate labor supply has to be bigger or equal aggregate labor demand. In case the difference between supply and demand in the East German labor market is positive, there is involuntary unemployment.[40] In equilibrium the probability of involuntary unemployment expected by East Germans, ψ_t has to equal the realized rate of involuntary unemployment, i.e.

$$\psi_t = \frac{N_t^{s,*} - N_t^{d,*}}{P_{t+1}^*}. \tag{3.25}$$

We can now define an equilibrium for the model economy after reunification.[41] Given an initial aggregate capital stock X_t, an initial fraction of entrepreneurs L_t^1 for West Germany, and their talent Q_{t-1}, a government policy, $\{\tau, \varsigma, \lambda_t, \chi_t\}$, moving costs $\{\eta_t^j, \eta_t^{*,j}\}$ for $j \in \{h, l\}$ and prices for labor and capital as well as a probability of involuntary unemployment in East Germany $\{w_t, R_t, \psi_t\}$, an equilibrium is a collection of $\{c_t(z_t^p, \eta_t^j; .), c_t(z_t^p, \eta_t^{*,j}; .), b_t(z_t^p, \eta_t^j; .), b_t(z_t^p, \eta_t^{*,j}; .), \hat{z}_t^{p,j}, \hat{z}_t^{*,p,j}, \hat{q}_t, \hat{q}_t^*, \tilde{z}_t^j, \tilde{z}_t^{*,j}, \tilde{q}_t^j, \tau_t^u, G_t\}$ for $p \in \{0, 1\}$ and $j \in \{h, l\}$ such that:

1. $\{c_t(z_t^p, \eta_t^j; .), b_t(z_t^p, \eta_t^j; .), \hat{z}_t^{p,j}, \hat{q}_t, \tilde{z}_t^j\}$ solves the individual's problem for West Germans of types $p \in \{0, 1\}$ and $j \in \{h, l\}$;

2. $\{c_t(z_t^p, \eta_t^{*,j}; .), b_t(z_t^p, \eta_t^{*,j}; .), \hat{z}_t^{*,p,j}, \hat{q}_t^*, \tilde{z}_t^{*,j}, \tilde{q}_t^j\}$ solves the individual's problem for East Germans of types $p \in \{0, 1\}$ and $j \in \{h, l\}$ who are not involuntarily unemployed;

3. for those individuals in East Germany who are involuntarily unemployed optimal decisions about personal consumption and bequests coincide with those of voluntarily unemployed individuals;

4. the rate of involuntary unemployment coincides with East Germans's expectations, equation 3.25 holds;

5. markets for goods and capital and the West German labor market clear;

6. the East German labor market is in positive net supply or inactive;

7. (τ_t^u) is such that the unemployment insurance is self-financing, equation 3.20 holds;

8. the government's budget is balanced, equation 3.19 holds with $G_t \geq 0$.

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[40] Migration and occupational choices are only altered until expected involuntary unemployment is equal to the realized rate. An individual who finds himself involuntarily unemployed cannot reconsider his choice.

[41] Contrariwise to the equilibrium for West Germany before reunification, the equilibrium after reunification is not competitive, given the imposed wage in the East German labor market.

3.2 Calibration

For the extended model economy, I maintain parameters values as fixed and calibrated for the basic model (see Table 2.2).[42] However, some additional parameters need to be specified. I fix values for the discount on wages as well as initial values for relative population size, and capital stock, and calibrate values for relative TFP, the discount on the rental rate, the fraction of mobile Germans, and their moving costs in order to match certain reunification statistics. In 1991, wages in East Germany were set to 50% of West German wages, by 1995, they were fixed at 70% and by 2007 they had reached about 80% of West German wages. I use the intermediate value and set λ_t to 0.3.[43] The original population of the GDR was equal to one fourth the size of the West German population.[44] In order to estimate the initial capital stock of the East German economy, I use data on the German gross capital stock measured in prices of 2000, from the Statistische Bundesamt [2006] and [2011]. In 1991, the per capita capital stock of East Germany was less than half the per capita capital stock of West Germany, i.e. $X_t^* = 0.43X_t$.

Table 3.5: Calibration Targets for the Extended Model Economy

	Data	Model
East to West German Labor Productivity	68%	67%
East-West Net Migration as % of Eastern Population	7.5%	7.5%
Investment Aid to West German GDP	1%	1%
East German Unemployment	27%	27%

The remaining parameters, relative TFP, the discount on the rental rate of capital in East Germany χ_t, the fraction of mobile individuals θ, and their moving costs η_t^l are calibrated to match the targets displayed in Table 3.5. The ratio of East to West German labor productivity measured as GDP per employed person rose from 35% in 1991 to 78% in 2007 (Statistisches Bundesamt [2006]). I take the average value over the years 1991 to 2007 and set the calibration target for the ratio of labor productivities to 68%. I set the initial ratio of East to West German TFP, $\frac{A_t^*}{A_t}$ to 0.7451 to match this target to the model's

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[42]Alesina and Fuchs-Schündeln [2007] find that it takes two generations for East German preferences to convert to those of West Germans. Assuming a different value for the preference parameter ω, for East Germans does not have a direct effect on their occupational choices.

[43] Even though by 2007 around 30% of firms in East Germany had opted out of collective agreements (IAB Betriebspanel [2008]), on average East German labor costs per hour in 2008 were only 27.9% lower compared to West German labor costs (Statistisches Bundesamt [2011]).

[44]The mass of the entire German population is normalized to one; P_t individuals live in West Germany and $P_t^* = 1 - P_t$ individuals live in East Germany. After reunification, migration may alter the population size of East and West Germany.

ratio of output over workers and managers in East and West Germany. The discount on the rental rate of capital in East Germany χ_t, is calibrated to a value of 0.201 to match a ratio of investment-aid to West German GDP of 1%.[45] According to Wurzel [2001] between 1991 and 1995 annual public transfers for support to enterprises and business-near infrastructure were in the range of 0.63% and 0.99% of West German GDP.[46] The fraction of mobile individuals θ, is assigned a value of 0.5 to match that net migration from East Germany between 1989 and 2002 amounted to 7.5% of the original population of East Germany. I set moving costs for mobile Germans η_t^l, to a value of 42.34% of per capita GDP of a pre-reunification generation in the model in order to match an unemployment rate of 27%.[47] Table 3.6 contains all additional parameter values for the extended model economy.

Table 3.6: Additional Parameters for the Extended Model Economy

Discount on East German Wages (λ_t)	0.3
Initial Ratio of East to West German Population	0.25
Initial Ratio of East to West German Capital Stock	0.43
Initial Ratio of East to West German TFP	0.7451
Discount on East German Rental Rate (χ_t)	0.201
Fraction of Mobile Germans (θ)	0.5
Moving Costs for Mobile Germans (η_t^l)	$0.42 \frac{Y_{t-1}}{P_{t-1}}$

4   Results

I simulate the extended model economy for one period (one generation). The extended model economy hits the calibration targets of Table 3.5 well. Table 4.7 displays additional results for one generation after reunification. Results show a lack of entrepreneurship in East Germany as pointed out by the OECD [2007a]. After reunification 6.4% of East Germans set up their own business, but around 24% of them do so in West Germany. Of

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[45]The estimated value of $\chi_t = 0.201$ is somewhat in line with Ragnitz [2002] who finds that in 2000 most firms in East Germany still received investment aids of around one quarter of their investment costs.

[46]These do not include special depreciation allowances, debt servicing expenditure and credits.

[47]The Sachverständigenrat [2007] publishes numbers of registered and hidden unemployed. Between 1993 and 2003, the number of hidden unemployed in East Germany was on average equal to 55% of registered unemployed. Hence while, the average official East German unemployment rate for 1991 to 2007 was 17.5% (Bundesagentur für Arbeit [2008]), adding the "hidden" unemployed increases unemployment to around 27%. Moving costs for East Germans $\eta_t^{*,j}$ are assumed to be equal to moving costs for West Germans. Immobile Germans face infinitely high moving costs, $\eta_t^h = \infty$.

those who stay in East Germany only 5.3% set up a business, compared to 6.9% of West Germans before reunification. This difference in entrepreneurship rates is reflected in the lower number of entreprises per 1000 inhabitants in East compared to West Germany (see Table).[48] After reunification, no West German migrates to East Germany to set up a business there. The fraction of West German entrepreneurs decreases slightly to 6.8%, due to a higher rental rate of capital. A lower aggregate per capita capital stock and high capital demand by East German firms that face lower capital costs lead to a rise in the rental rate of capital. In addition, the lower per capita capital stock reduces the aggregate capital-output ratio. An inflow of talented East German entrepreneurs increases the fraction of entrepreneurs in the new West German population to 7.1%. Relative accumulative talent of entrepreneurs in West Germany increases and causes West German TFP to grow at an annual rate of 1.66%, compared to 1.57% before reunification. East German entrepreneurs are immobile or less talented individuals and relative accumulative talent of entrepreneurs in East Germany is 13.6% lower than in West Germany. Thus, TFP in East Germany grows at a lower rate of 1.42%. On the aggregate, TFP grows at an annual rate of 1.61%. Increased aggregate TFP growth leads to a slight decrease in the value of parental background. Having had a parent who was an entrepreneur increases one's managerial knowhow by 69.5%, ($\phi = 0.695$).

The fraction of individuals from an entrepreneurial parental background who become entrepreneurs decreases slightly, from 60% to 59.5%, while the fraction of those from a working family background increases from 3% to 3.6%. This is due to the fact that all East German entrepreneurs have a working family background.[49] In the first generation after reunification, GDP per capita in West Germany increases by 2.25% annually, only slightly lower than the annual GDP growth rate of 2.26% for West Germany before reunification. The model's estimates of the per capita GDP ratio for East to West Germany of 52% is eight percentage points lower than the average ratio of 60% for 1991 to 2008 in the data (Statistische Ämter der Länder [2011]). About one third of the East German unemployed, around 10% of the East German population, are involuntarily unemployed. The remaining two-thirds, 17% of East Germans, decide not to work.

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[48]Self-employment rates in East and West Germany of around 8% on the other hand have become very similar as of 2009. However, these rates also include professionals without employees and between 2003 and 2006 unemployed who were paid additional benefits conditional on setting up their own business ('Ich-AG'). Hence, a better statistic for entrepreneurship is the 'possible outcome' of self-employment, the number of enterprises (see Table 1.1).

[49]According to Solga [2006], *elite reproduction* (i.e. outflow from *nomenklatura* to upper service class positions) in East Germany was limited and education and acquired skills rather than party membership were the dominant criteria for elite recruitment after 1989.

Table 4.7: Reunification: Results After One Generation

Entrepreneurship	
Entrepreneurs	6.7%
Entrepreneurs in East Germany	5.3%
East German Entrepreneurs	6.4%
... of those going West	23.8%
Entrepreneurs in West Germany	7.1%
West Germans Entrepreneurs	6.8%
... of those going East	0
Entrepreneurial background individuals becoming entrepreneurs	59.5%
Working background individuals becoming entrepreneurs	3.6%
Value of Entrepreneurial Parental Background	0.695
Entrepreneurs 's relative accumulative talent	1.43
... in East ($\bar{Q}_t^*/P_{t+1}^*$)	1.27
... in West ($\bar{Q}_t/P_{t+1}$)	1.47
Germany	
Annual Capital-Output Ratio	2.26
Annual Rental Rate of Capital	6.8%
Unemployment Rate	9.4%
Annual Growth Rate of TFP	1.61%
Investment Aid to Government Revenue	6.6%
Fraction of Taxes Paid in West Germany	89.5%
Contribution to Unemployment Insurance	1.65%
Fraction of Contributions paid in East Germany	10.5%
Fraction of Unemployment Benefits Paid in East Germany	52.6%
West Germany	
Annual Growth Rate of TFP	1.66%
Annual Growth Rate of GDP per capita	2.25%
Unemployment Rate	5.5%
Average Firm Size	12.4
East Germany	
Annual Output per Capita East to West	51.7%
Annual Growth Rate of TFP	1.41%
Unemployment Rate	27%
of those involuntarily unemployed	33.4%
Fraction of Workers going West	8.7%
Average Firm Size	13.0
Moving Costs to annual GDP per capita East	12.5%

As benefits are indexed by West German wages the fraction of voluntarily unemployed in East Germany clearly exceeds the one in West Germany.[50] The West German unemployment rate remains almost unchanged and aggregate unemployment increases to 9.4%. This result of the model is very much in line with data. Average aggregate unemployment between 1992 and 2007 was 9.8% (Bundesagentur für Arbeit [2007]).

More unemployed individuals and unchanged unemployment benefits require an increase in the contribution to unemployment insurance to 1.65%. More than half of all unemployment benefits are paid out in East Germany, while East German workers and entrepreneurs contribute only 10.5% to the insurance scheme. Data by the Bundesagentur für Arbeit [2006] indicate a cross subsidizing of unemployment benefits between East and West Germany but to a lesser extent. Between 1996 and 2006, on average 35.4% of unemployment benefits were paid out in East Germany. Income of the unemployed in East Germany is thus subsidized by West German contributions and workers and entrepreneurs in West Germany contribute 89.5% to government revenues of which 6.6% are used for investment aids for entrepreneurs in East Germany. Entrepreneurs in East Germany hire on average 0.6 workers more than entrepreneurs in West Germany. This results of the model is consistent with data showing that the small and medium sized sector is relatively more important in West than in East Germany.[51] Around 9% of East German workers migrate to West Germany. Their moving costs and those of East Germans entrepreneurs are equal to around 12.5% of annual East German GDP per capita.[52]

Micro-Data   Ideally one would like to consider micro-data for evidence on the possible interaction of occupational choice and migration. Table 4.8 displays statistics on East-West migration and self-employment taken from the unbalanced German Socioeconomic Panel (GSOEP) for 1992 to 2006. However, given the very small sample size – for instance there are only 32 observations over 14 years on East German self-employed who migrate permanently to West Germany – these statistics can only be viewed as suggestive. Data in Table 4.8 indicates a difference of 20% in the fractions of entrepreneurs in East and West

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[50]This result is in line with findings by Snower and Merkl [2006] and Canova and Ravn [2000] who assign an important role to generous welfare provisions in explaining low output and employment in East Germany.

[51] Data from the Statistische Bundesamt [2008] shows that in 2004 there were 39 and 33.8 firms with 0-9 employees, 2.9 and 2.7 firms with 10-49 and 0.7 and 0.7 firms with 50 and more employees in West and East Germany respectively (per 1000 inhabitants).

[52]Simulating the model for up to five additional generations with decreasing moving costs and convergence of TFP levels in East and West Germany results in a similar scenario for West Germany in terms of rates of unemployment, fraction of entrepreneurs, and GDP growth, while the situation in East Germany will be characterized by empty regions with very few active individuals who are immobile and of low talent.

Germany, of a similar magnitude as the difference estimated by the model.[53] Migration from East to West Germany is slightly higher in this data set than in the data used for calibration, while migration from West to East Germany is very limited (it is zero in the model). Despite a larger West German population for every four self-employed migrating from East to West, there is only one West German self-employed setting up a business in East Germany. Hence fewer East Germans become entrepreneurs compared to West Germans while migrating to the other part of Germany and setting up a business there seems to be an option East German consider more often.

Table 4.8: GSOEP Unbalanced Panel Data on Occupation and Migration 1992-2006

	West (Sample A)	East (Sample C)
Ratios for 18-65 year olds in labor force (number of observations)		
Self-employed	8.8% (765)	7.0% (395)
Permanent migrants to East and West respectively	1.1% (92)	10.5% (597)
Permanent migrants among Self employed	1.0% (8)	8.1% (32)

5 Counterfactual Experiments

Given prospects of a deserted East Germany, the question arises: How could East Germany's growth experience have been different? Especially the wage-setting policy seemed to have oppressed incentives to become an entrepreneur. In addition the importance of parental background for becoming an entrepreneur in West Germany makes it difficult for East German individuals to compete in terms of managerial knowhow. Furthermore, free migration to West Germany implies an attractive outside option for East Germans. I perform three counterfactual experiments that assume for the first period after reunification, 1)East Germany has flexible wages, 2)Parental background has no value for managerial knowhow, and 3)migration between East and West Germany is inhibited. Results of all counterfactual experiments are presented together with Benchmark results (one period after reunification).For results to be comparable to the Benchmark case I adjust the discount on the rental rate of capital (χ_t) such as to keep the absolute amount of investment aid paid at the Benchmark level.

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[53]Difference in levels between model and data are most likely due to the fact that the fraction of entrepreneurs in the model refers to self-employed with employees while the data set includes also own-account workers.

Flexible Wages In this counterfactual experiment I allow for wages to freely adjust in each of the locally separated labor markets. I assume that moving costs, and unemployment benefits paid are maintained as specified in Tables 2.2 and 3.6.[54] In order to avoid introducing a motive for unemployed to migrate as well, unemployment benefits in both parts of Germany are specified as fractions of West German wages. Table 5.9 displays results of this counterfactual experiment. If wages in East Germany are to adjust freely,

Table 5.9: Flexible Wages

	Benchmark	Flexible Wages
Wage per efficiency unit East	100	98.0
Entrepreneurs in East Germany	5.3%	5.6%
East German Entrepreneurs	6.4%	6.4%
... of those going West	23.8%	17.1%
Unemployed East	27%	18.1%
of those involuntarily unemployed	33.4%	0
Net Wage per efficiency unit West	100	100.4
Annual Output per Capita East to West	51.7%	58.5%
Annual Output per capita East	100	112.4
Annual Output per capita West	100	99.2
Total Annual Output per capita	100	100.4
Annual Growth Rate of TFP East	1.41%	1.55%
Annual Growth Rate of TFP West	1.66%	1.63%
Annual Growth Rate of TFP Total	1.61%	1.61%
Average profits Entrepreneur in East	100	105.0
Average profits Entrepreneur in West	100	100.8
Average profits Entrepreneur West German	100	100.4
Average profits Entrepreneur East German in West	100	113.5
Net migration to Population East	7.5%	5.1%
Fraction of Workers going West	8.7%	5.2%

they fall. Gross wages per efficiency unit are 2% lower than in the Benchmark scenario. This fall is large enough to reduce unemployment by nine percentage points to 18%. All unemployment is voluntary. The fact that the rate of voluntarily unemployment in East Germany is more than three times the one in West Germany is due to unemployment benefits being linked to West German wages. Lower East German wages translate into higher profits for entrepreneurs, and a larger fraction of East Germans set up a business

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[54] Note that the guess on involuntary unemployment in East Germany in this case is zero and Equation 3.14 reduces to $(1 - \tau_t^u - \tau)w_t^* q$.

in East Germany, 5.6% compared to 5.3%. Less unemployment and more entrepreneurs imply higher output. Per capita output in East Germany is 12% higher while per capita output in West Germany drops slightly. Thus, the ratio of GDP per capita East-to-West increases to 58.5%. Lower labor costs in East Germany make it relatively less profitable to set up a business in West Germany and fewer entrepreneurs migrate, 17% compared to 23% in the benchmark scenario. More and more talented entrepreneurs in East Germany cause East German TFP to grow at an annual rate of 1.55%. In West Germany on the other hand, there are fewer talented entrepreneurs from East Germany which leads to a reduction in output per capita and TFP growth. West German workers are better off because due to the reduced contribution to unemployment insurance their net wages increase slightly. Increased migration of workers that was supposedly feared by labor unions that pressed for equal wages in East and West Germany does not happen. While workers' wages are lower, their expected wages increase as the threat of involuntary unemployment is eliminated. Hence, less workers migrate to West Germany, 5.2% compared to 8.7% under the Benchmark scenario. Overall migration is reduced by almost one third and of all East Germans, 5.1% leave. In terms of welfare, East German workers are worse off while all entrepreneurs and West German workers gain. On average the East German individual is better off. This positive effect for East Germany dominates and while overall TFP growth remains unchanged, output per capita is slightly higher under the flexible wage scenario. Given that consumption is a fixed fraction of output in this model, flexible wages are welfare improving for all of Germany.

Integration into Socially Mobile West Germany Had East Germany been integrated into an economy where an individual's managerial knowhow was solely defined by his innate talent, the initial disadvantage of missing generations of entrepreneurs in East Germany would have become obsolete. For this counterfactual experiment I maintain the wage discounts for East Germany but set the value of parental background in entrepreneurship to zero. Average managerial knowhow is thus the same for East and West Germans and in order for the average German managerial knowhow in this scenario to be equal to the one in the Benchmark scenario the parameter for the mean log talent μ is raised to 2.148. Table 5.10 displays the model's results for the integration of East Germany into a socially mobile economy.

If parental background has no role for managerial knowhow, the fraction of East Germans who become entrepreneurs is 31% higher than under the Benchmark scenario, 8.4% instead of 6.4% of East Germans set up their own business. However 37.3% of them do so in West Germany. Unemployment is reduced by eight percentage points from 27% to 19% but 3.4% of the East German population is still involuntary unemployed. Migration is

slightly lower due to the reduction in involuntary unemployment, 6.4% of East Germans migrate to West Germany compared to 7.5% in the Benchmark case.

Table 5.10: Integration into Socially Mobile Economy

	Benchmark	Integration into Socially Mobile Economy
Wage per efficiency unit West	100	97.9
Entrepreneurs in East Germany	5.3%	5.6%
East German Entrepreneurs	6.4%	8.4%
... of those going West	23.8%	37.3%
Average profits Entrepreneur in East	100	103.3
Average profits Entrepreneur in West	100	118.1
Average profits Entrepreneur West German	100	122.0
Average profits Entrepreneur East German in West	100	86.41
Unemployed East	27%	19.2%
of those involuntarily unemployed	33.4%	17.9%
Annual Growth Rate of TFP East	1.41%	1.53%
Annual Growth Rate of TFP West	1.66%	1.92%
Annual Growth Rate of TFP Total	1.61%	1.85%
Annual Output per Capita East to West	51.7%	57.1%
Annual Output per capita East	100	110.8
Annual Output per capita West	100	100.3
Total Annual Output per capita	100	101.3
Net migration to Population East	7.5%	6.7%
Workers going West	8.7%	4.9%
Entrepreneurial Backgr.		
Indvs. Becoming Entrepreneurs	59.5%	5.26%
Working Backgr.		
Indvs. Becoming Entrepreneurs	3.6%	5.92%

However, the composition of migrants changes. More East Germans migrate to West Germany to set up their business and fewer East Germans migrate to work in West Germany, 4.9% compared to 8.7%. Higher employment leads to more output. East Germany produces 10% more output per capita and its TFP grows at a higher rate. Given, no value of parental background for managerial knowhow, talent is optimally allocated and aggregate TFP growth is higher, overall output per capita is higher and welfare improves with respect to the Benchmark scenario. The fraction of entrepreneurs coming from an

entrepreneurial family background is reduced to values for individuals coming from a working family background.[55]

Migration Restriction If migration between East and West Germany is inhibited, occupational choices of East Germans are equal to those of West Germans before reunification. For this counterfactual experiment I assume that all East and West Germans are immobile, i.e. have infinitely large moving costs. I set the fraction of mobile Germans θ, to zero and maintain all parameter values as well as the wage discount. Table 5.11 displays the model's results for the case of no migration between East and West Germany.

Table 5.11: Migration Restrictions

	Benchmark	No Migration
Entrepreneurs in East Germany	5.3%	5.4%
Average profits Entrepreneur in East	100	113.5
Average profits Entrepreneur in West	100	99.4
Average profits Entrepreneur West German	100	100.2
Gross Wage per efficiency unit West	100	100
Contribution to Unemployment Insurance	1.65%	1.5%
Net Wage per efficiency unit West	100	100.2
Unemployed East	27%	21.3%
of those involuntarily unemployed	33.4%	23.2 %
Annual Growth Rate of TFP East	1.41%	1.66%
Annual Growth Rate of TFP West	1.66%	1.60 %
Annual Growth Rate of TFP Total	1.61%	1.61%
Annual Output per Capita East to West	51.7%	61.4%
Annual Output per capita East	100	116.7
Annual Output per capita West	100	98.3
Total Annual Output per capita	100	99.7
Average Firm Size	13.0	13.6

Without the option to migrate 5.4% of East Germans decide to set up their own business. Those talented entrepreneurs who opt for migration under the benchmark scenario, now set up their businesses in East Germany. Thus, average profits in East Germany

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[55]The fact that the latter fraction is slightly larger than the former, 5.9% versus 5.2% is entirely due to the fact that all East German entrepreneurs are children of workers. For West German individuals these fractions are identical.

increase by 13% despite the lower discount on the rental rate of capital. More talented entrepreneurs hire more workers and the average firm size increases by 0.6 workers. More employment is created and unemployment is reduced by about six percentage points. Still 23.2% of the unemployed, i.e. about 5% of the East German population is involuntary unemployed. More and more talented entrepreneurs also contribute to TFP growth which is high at 1.66% annually, an increase of 18% over TFP growth in the Benchmark case. More and better entrepreneurs and higher employment lead to more output. Without the option to migrate East German per capita output is 17% larger compared to the Benchmark scenario. West Germany on the other hand, deprived of the inflow of talented entrepreneurs from East Germany sees its output per capita reduced by around 2% and faces lower TFP growth. In the case of complete restrictions on migrations the negative effects for West Germany dominate and while overall TFP growth remains constant, output per capita is 0.3% lower compared to the Benchmark scenario and thus welfare slightly decreases.

6   Conclusion

East Germany's post-1989 experience is and has been remarkably different from that of other transition countries. While East Germany is suffering from high rates of unemployment and low economic growth, other transition countries are flourishing. This paper argues that East Germany's integration into an established and highly regulated economy hindered a fruitful development of entrepreneurial activity. Especially the West German policy of fixing wages in East Germany at a fraction of West German wages oppressed incentives to set up businesses.[56] In addition the option to migrate to West Germany drew in the most talented and mobile East Germans, while the importance of entrepreneurial parental background in West Germany, implied an initial disadvantage for East Germans who lacked any entrepreneurial tradition.

Counterfactual experiments show that East Germany's experience could have been better had wages been flexible in East and West Germany, had parental background in entrepreneurship played no role for managerial knowhow, or had migration to West Germany been very costly. However, while flexible wages and managerial knowhow defined by innate talent only would have also led to more output and higher economic growth for all of Germany, migration restrictions would have been exclusively beneficial to East German output and economic growth. The lack of entrepreneurship, employment, and

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[56]For Southern Italy, Alesina et al [2001] find a similar negative effect of a government wage setting policy - high public sector wages - on entrepreneurship.

economic growth in East Germany would have been less severe had West German policy makers opted for flexible wages in both parts of Germany. Results of counterfactual experiments show that contrary to conventional wisdom, flexible wages would have decreased migration from East to West Germany as the threat of involuntary unemployment had disappeared and expected wages for those staying in East Germany would have increased. Based on the calibration of the model, in a world of flexible wages around 416,000 fewer East Germans would have migrated to work or set up a business in West Germany. In essence, East Germany's economic take-off seems to have been hindered by West German policies and institutions.[57] The model's result for the counterfactual experiments even suggest that under the current reunification scenario, West Germany benefited from a selective inflow of migration. One is thus left with the question to what extent the current reunification scenario has been self-serving for West Germans.

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[57] This finding is in line with that of various other authors (see e.g. Diewald et al [2006] or Bonin and Zimmermann [2000]).

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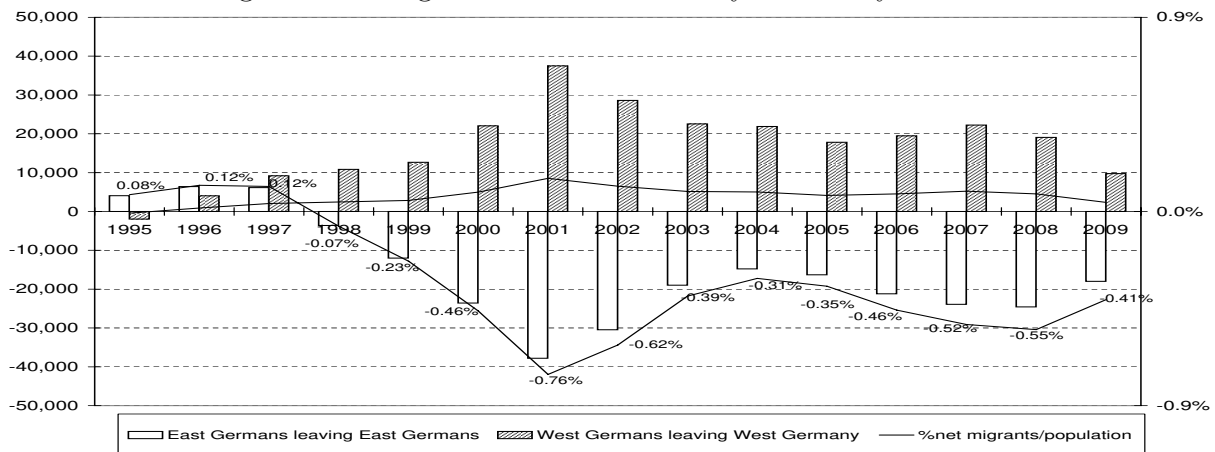
A   Appendix

A.1   Growth Rates

Figure A-1: Growth Rates of Real GDP per Capita (chained)
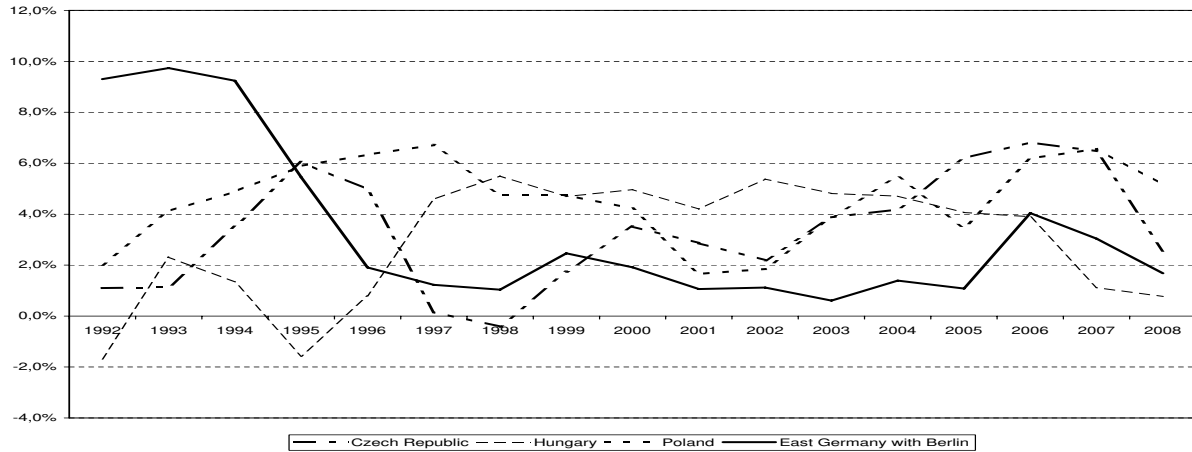
Data: Heston et al. [2011], Statistische Ämter der Länder [2011] (for East Germany).

A.2   Migration Rates

Figure A-2: Migration within Germany of 25-50 year-olds

Data: Statistische Ämter des Bundes und der Länder [2007], excluding Berlin.

A.3   Sensitivity Analysis

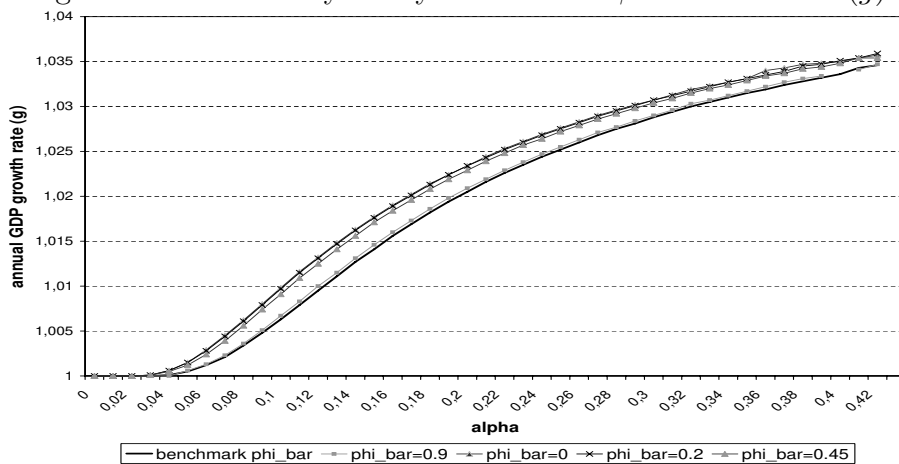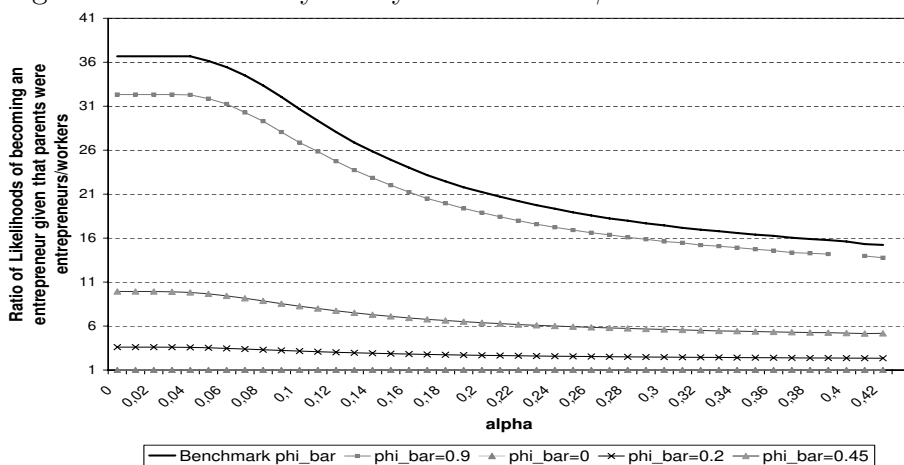Figure A-3: Sensitivity Analysis for α and $\bar{\phi}-$Growth Rate (g)

Figure A-4: Sensitivity Analysis for α and $\bar{\phi}$ - Ratio of Likelihoods

A.4 Occupational Choices after Reunification

East Germans East German individuals compare their potential wage in West Germany to the wage they can earn in East Germany. The cut-off value, $\tilde{q}_t^j$, describes the East German individual who is indifferent between working in East or West Germany $\tilde{q}_t^j = \frac{\psi_t \varsigma w_t + \eta_t^{*,j}}{(1 - \tau_t^u - \tau)(\psi_t + \lambda_t - \psi_t \lambda_t) w_t}$. Higher moving cost $(\eta_t^{*,j})$ reduce labor income in West Germany and thus the benefits from migration and raise the threshold as well as do higher wages in East Germany, a lower λ_t. A positive possibility of involuntary unemployment ψ_t, reduces the potential income of working in East Germany and thus lowers the threshold. Comparing their potential wage in West Germany to the profits they can make as entrepreneurs, East Germans set up their own business in East Germany whenever, $\pi_t(z_t^p, A_t^*; .) \geq (1 - \tau_t^u - \tau) w_t q - \eta_t^{*,j}$. The cut-off value, $\hat{z}_t^{*,p,j}$, describes the East German individual who is indifferent between working in West Germany or setting up a business in East Germany.[58] Furthermore, East Germans measure profits they can make as entrepreneurs in East Germany, against profits they can make setting up their business in West Germany. The cut-off value, $\tilde{z}_t^{*,p,j}$ describes the East German individual who is indifferent between setting up his business in East or West Germany

$$\tilde{z}_t^{*,p,j} = \left(\eta_t^{*j}(w_t(1 + \tau_t^u))^{\frac{(1-\nu)\gamma}{1-\gamma}} R_t^{\frac{\nu\gamma}{1-\gamma}} \Psi_t^{-1} \left(1 - \frac{A_t^*}{A_t(1 - \lambda_t)^{\frac{(1-\nu)\gamma}{1-\gamma}}(1 - \chi_t)^{\frac{\nu\gamma}{1-\gamma}}} \right)^{-1} \right)^{\frac{1-\gamma}{1-\gamma+\kappa}}.$$

This threshold of occupational choice is independent of the individual's parental background, $\tilde{z}_t^{*,p,j} = \tilde{z}_t^{*,j}$. Higher moving cost $(\eta_t^{*,j})$ reduce entrepreneurial income in West Germany and increase the threshold. Higher wages in East Germany on the other hand, a lower λ_t, reduce entrepreneurial income in East Germany and thus lower the threshold as does a higher rental rate for capital, a lower χ_t. This last threshold is positive only if $(1 - \lambda_t)^{(1-\nu)\gamma}(1 - \chi_t)^{\nu\gamma} > \frac{A_t^*}{A_t}^{1-\gamma}$. Only if the discount on wages and the discount on the rental rate of capital are small enough to not offset the higher TFP in West Germany do East German individuals decide to set up a business in West Germany. Finally, individuals also compare the unemployment benefit v_t to their potential wage in East Germany. The cut-off value $\hat{q}_t^*$, describing the East German individual who is indifferent between working in East Germany or being unemployed is given by $\hat{q}_t^* = \frac{\varsigma}{(1 - \tau_t^u - \tau)(1 - \lambda_t)}$. Some of the comparisons individuals make in order to make their optimal occupational choice were omitted in

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[58] Note that the profit function for entrepreneurs in East Germany and the function for wage income in West Germany might cross twice. Initially being an entrepreneur in East Germany is always better than working in West Germany, due to fixed moving costs. However, with increasing talent wage income increases and individuals are able to pay the fixed costs and thus might prefer to work in West Germany instead of setting up a business in East Germany. Given increasing returns to knowhow for entrepreneurs, there might exist a second threshold where setting up a business in East Germany becomes again more attractive as opposed to working in West Germany, $(\hat{z}_t^{*,0,l}(q)$ in Figure 3.2) .

Figure 3.2 in the main body of the paper in order to keep visualization clean and because they are not relevant for results discussed later. However, in the model individuals have to compare among each occupation and rank them in order to make the right choice. Here I present additional comparisons as well as the resulting consequences for equilibrium equation. East German individuals also compare working in East Germany to setting up a business in East Germany. Whenever $\pi_t(z_t^p, A_t^*; .) \geq (1-\psi_t)(1-\tau_t^u-\tau)(1-\lambda_t)w_t q + \psi_t v_t$ they set up their own business in East Germany. However, this choice is only relevant whenever the resulting threshold is smaller than the one resulting from the choice between working in East or West Germany ($\tilde{q}_t^j$). In this case the marginal worker who goes to West Germany is more talented than the marginal entrepreneur in East Germany. Then only if the profit function for entrepreneurs in East Germany and the function for wage income in West Germany cross twice will there be any East German working in West Germany. In all equilibrium equations one would have to substitute the new threshold for $\hat{z}_t^{*,p,j}$ and possibly $\tilde{q}$ for the second crossing of the profit function for entrepreneurs in East Germany and the function for wage income in West Germany.

East Germans compare incomes from working in West Germany to profits from setting up a business in West Germany. Whenever $\pi_t(z_t^p, A_t, \eta_t^{*,j}; .) \geq (1 - \tau_t^u - \tau)w_t q - \eta_t^{*,j}$, they decide to set up a business in West Germany instead of working there. This occupational choice is only relevant whenever the marginal entrepreneur who sets up his business in West Germany exists and has less knowhow than the marginal entrepreneur in East Germany. Then, depending on the curvature of the profit function there might be no East German who wants to set up his business in East Germany. It could also be the case that those with less talent than the marginal worker who migrates to West Germany set up their businesses in East Germany. If East Germans find it profitable to go to West Germany to set up a business there, discounts on wages and rental rate are not large enough to offset the lower TFP in East Germany. Hence, neither will West Germans set up a business in East Germany. Individuals in East Germany also compare working in East Germany to setting up a business in West Germany. Whenever $\pi_t(z_t^p, A_t, \eta_t^{*,j}; .) \geq (1-\psi_t)(1-\tau_t^u-\tau)(1-\lambda_t)w_t q + \psi_t v_t$, they decide to set up a business in West Germany instead of working in East Germany. Again this choice is only relevant if the marginal entrepreneur who sets up his business in West Germany exists and has less knowhow and talent than the marginal entrepreneur in East Germany and the marginal worker who migrates to West Germany. Thresholds resulting from comparing unemployment benefits to wages paid in West Germany, or possible profits earned in East or West Germany, are never relevant. Situations in which they could matter are ruled out, given that West Germans only migrate to East Germany to set up their businesses there.

West Germans The cut-off value of managerial knowhow $\tilde{z}_t^{p,j}$, describes the individual who is indifferent between setting up his business in West or East Germany

$$\tilde{z}_t^{p,j} = \left(\eta_t^j (w_t(1+\tau_t^u)^{\frac{(1-\nu)\gamma}{1-\gamma}} R_t^{\frac{\nu\gamma}{1-\gamma}} \Psi_t^{-1} \left(\frac{A_t^*}{A_t(1-\lambda_t)^{\frac{(1-\nu)\gamma}{1-\gamma}}(1-\chi_t)^{\frac{\nu\gamma}{1-\gamma}}} - 1 \right)^{-1} \right)^{\frac{1-\gamma}{1-\gamma+\kappa}}.$$

This threshold of occupational choice is independent of an individual's parental background, $\tilde{z}_t^{p,j} = \tilde{z}_t^j$. Higher moving cost ($\eta_t^j$), a lower discount on wages (λ_t), and a lower discount on the rental rate of capital (χ_t), all reduce entrepreneurial income in East Germany and thus raise the threshold. As managerial knowhow is defined in the interval $z_t^p \in (0, \bar{z}_t^p]$ this last threshold needs to be strictly positive, i.e: $\frac{A_t^*}{A_t(1-\lambda_t)^{\frac{(1-\nu)\gamma}{1-\gamma}}(1-\chi_t)^{\frac{\nu\gamma}{1-\gamma}}} - 1 > 0$.

This is the case only if $(1-\lambda_t)^{(1-\nu)\gamma}(1-\chi_t)^{\nu\gamma} < \frac{A_t^*}{A_t}^{1-\gamma}$. West Germans also compare their wage income to profits from setting up a business in East Germany. Whenever $\pi_t(z_t^p, A_t^*, \eta_t^j; .) \geq (1-\tau_t^u-\tau)w_t q$, they decide to set up a business in East Germany instead of working in West Germany. However, the threshold resulting from this choice is only relevant whenever $\tilde{z}_t^j \geq 0$, and $\tilde{z}_t^j \leq \hat{z}_t^p$, i.e. whenever the marginal entrepreneur who sets up his business in East Germany exists and has less knowhow than the marginal entrepreneur in West Germany. In this case in all equilibrium equations one would have to substitute the new threshold for $\hat{z}_t^p$ and $\bar{z}_t^p$ for $\tilde{z}_t^j$. Individuals in West Germany also compare unemployment benefits to profits from setting up a business in East Germany. Whenever $\pi_t(z_t^p, A_t^*, \eta_t^j; .) \geq v_t$, they decide to set up a business in East Germany instead of being unemployed. Only if $\tilde{z}_t^j \geq 0$ and $\tilde{z}_t^j \leq \hat{z}_t^p$ and $\tilde{z}_t^j < q_t^\star$ does this choice become relevant, i.e. whenever the marginal entrepreneur who sets up his business in East Germany exists and has less knowhow than the marginal entrepreneur in West Germany and also less knowhow than the marginal worker.

A.5   Proof of Lemma 3.1

The threshold of managerial knowhow that determines who is indifferent between setting up a business in East or West Germany only exists for West German individuals if $(1-\lambda_t)^{(1-\nu)\gamma}(1-\chi_t)^{\nu\gamma} < \frac{A_t^*}{A_t}^{1-\gamma}$ and for East Germans this threshold only exists if $(1-\lambda_t)^{(1-\nu)\gamma}(1-\chi_t)^{\nu\gamma} > \frac{A_t^*}{A_t}^{1-\gamma}$. These conditions are mutually exclusive.

A.6   Discussion- Intergenerational Persistence of Occupations

How many entrepreneurs come from an entrepreneurial family background? Looking at West German data for 1970 and 1980, Arum and Müller [2004] find that 14.7% of all self-

employed had a self-employed father. Lohmann and Luber [2004] report that between 1984 and 1988, 36% of West German males with a self-employment family background became self-employed. On the other end of the scale, Klein [2000] finds that only 39% of all German family firms are in their founder generations, rising the likelihood of being an entrepreneur if one's parents were so to 61%. Similarly, Pistrui et al [2000] find that 60% of West German entrepreneurs have a parent who had been an entrepreneur. According to Mueller [2006] German employees whose parents have been self-employed are about 1.5 times as likely to start a business as others.[59] Geißler [2006] differentiates between social mobility of entrepreneurs with more than 10 employees and those operating on a smaller scale. He estimates that 50% of the former and 19% of the latter had parents who were also entrepreneurs. Given the broad span of estimates for the persistence of entrepreneurship across generations, I consider alternative interpretations of occupational inheritance. Within the framework of the model the most wealthy individuals, who consume more and leave more bequests to their children, will always be entrepreneurs. Hence, one can clearly distinguish between three different economic 'classes' in the model: the unemployed, the working class, and the entrepreneurial class. The question of 'how many entrepreneurs come from an entrepreneurial family background?' can thus be turned into a question of 1)class mobility and/or 2)wealth persistence and/or 3)earnings mobility.

West Germany is generally found to be a society of relatively little class mobility. Erikson and Goldthorpe [1993] conclude that in West Germany "quite contrary to a [...] 'semi-classless' form of society and a 'land of fluidity' [...] historically formed influences on class-mobility chances have largely retained their power" (p.151) Müller and Pollak [2004] consider class mobility in West Germany and find that for the periods 1976-80, 1982-90, and 1991-99, 64%, 63%, and 63% of large employers, and higher and lower grade professionals with higher technical, administrative and managerial occupations remained within their class. Furthermore, the authors conclude that "we cannot find any major changes in (absolute) mobility experiences in the last quarter of the twentieth century." (pg.91) "Germany continues to have strong inheritance effects [...] as well as particularly marked distinctions between a manual and non-manual space of social mobility."(pg.110) "In sum [...] in Germany a large part of the effects of origin class on class destination is mediated through education. In particular the hierarchical component in class-mobility results from class inequalities in educational participation and education-based class allocation."(pg.106) This observation combined with recent data by the OECD [2007b] showing that "students from a blue-collar background are about one-half as likely to be in higher education as compared with what their proportion in the population would suggest."(pg.116) indicate little class mobility in West Germany.[60]

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[59]For the US Lentz and Laband [1990] find that 50% of all self-employed proprietors are 2nd generation proprietors.

[60]Comparing social mobility among European countries, Breen and Luijkx [2004] conclude that "Germany, France, Italy, and Ireland seem to be the least fluent countries [...] [in]-notably Germany- there

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Estimates of wealth persistence by Morck et al. [1998] also sketch a picture of rather limited intergenerational mobility in West Germany, while Solon [2002] cites estimates of intergenerational earnings elasticity that describe Germany as a country of relatively high earnings mobility. However, as Goldberger [1989] points out: "Naturally enough the sociologists' models incorporate outcomes other than income or earnings. Now suppose that intergenerational links are stronger for occupation or socioeconomic status than for income or earnings. Then restricting attention to the monetary measures could lead an economist to understate the influence of family background on inequality."(pg.513). Estimates on class mobility provide the most widely encompassing concept of the dependence of one's status on family background. In the model class mobility and occupational mobility coincide and thus given that Pistrui et al [2000]'s and Müller and Pollak [2004]'s estimates are very similar I am confident using the former as a target for calibration.

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is no statistically significant change[...] towards a weaker association between origins and destinations." (pg 73).