

# **New Economic Geography and Reunified Germany at Twenty: A Fruitful Match?**

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Abstract:

We qualitatively match new economic geography (NEG) to stylized facts on German economic integration after 1989. We find that NEG may explain German integration reasonably well. Germany may currently be close to the peak of the bell curve, which describes the long-run relationship between integration and agglomeration in Germany. As a consequence, further economic integration between the two parts of Germany may eventually foster redispersion of economic activity toward East Germany. We also identify limitations of NEG for explaining German integration, most notably the analytical complexity of multi-region models and its neglect of knowledge spillovers and labor pooling.

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## 1 Introduction

This paper matches new economic geography (NEG) and German reunification to explore, on the one hand, what NEG may contribute to understanding and explaining the economic effects of German integration after the fall of the Berlin Wall, and on the other hand, what German integration may contribute to identifying the strengths and weaknesses of the current state of NEG theory.

Going back to Nobel laureate Paul Krugman's seminal 1991 article on "Increasing Returns and Economic Geography" (Krugman 1991), NEG explains the spatial distribution of economic activity as the result of a trade-off between microeconomically well-founded centripetal and centrifugal forces. It reinvented and substantiated the old ideas of path dependency and cumulative causation from the 1950s (Perroux 1955, Myrdal 1957) that had once been considered central elements of regional economics. By providing a consistent microeconomic foundation of some of the agglomeration and dispersion forces discussed in traditional regional economics, it paved the way for placing back regional economics "squarely in the economic mainstream" (Krugman, 1998: 7). It has inspired many smart economists to approach economic problems from a spatial perspective, and has triggered many innovative theoretical and empirical studies. This has led to a large number of variations and extensions of the original Krugman model, which further broadened our understanding of economic agglomeration and its dependence on economic determinants such as trade costs.

Just as Krugman was breeding on his NEG model, published first as NBER Working Paper in March 1990 (Krugman 1990), the Berlin Wall, for almost 30 years the most blatant symbol of German division after WWII, was torn down, and the two parts of Germany reunified shortly thereafter in October 1990. This reunification was one of the rare historical events of an unexpected, far-reaching reintegration of two parts of a country that had been divided for several decades but still shared largely the same history and culture. It removed the formerly insurmountable institutional and political barriers to trade and migration between West and East Germany virtually overnight.

NEG and German reunification look like a perfect couple. NEG, on the one hand, offers a rich and powerful theoretical framework for analyzing precisely that kind of integration processes that have taken place in Germany over the past two decades. Its solid microeconomic foundation helps in tracing back aggregate economic development to the decisions of workers and firms. And its general equilibrium structure facilitates accounting for the direct as well as the indirect consequences of these decisions. German reunification, on the other hand, offers a natural experiment to test the propositions of NEG. It reduced trade costs between East and West Germany unexpectedly and significantly within a short period of time. If NEG has

something useful to say about real-world economic integration processes, it should be able to correctly predict the economic consequences of German integration.

Still, only few of the numerous studies that have investigated the economic development and prospects of Germany after reunification have actually taken an NEG perspective. And only very few of the many empirical studies on NEG have focused on Germany after reunification. Already a few years after reunification, Brakman and Garretsen (1993) cautioned against overly optimistic expectations about the speed of economic convergence between West and East Germany. Due to its less favorable initial conditions, East Germany may remain the periphery of Germany for a longer time. Roos (2001) and Brakman et al. (2004) estimate the wage equation, derived from a subset of the equilibrium conditions of an NEG model (Helpman 1998), for Germany. They find that regional wages depend positively on regional real market potentials, as hypothesized by the NEG model. Redding and Sturm (2008) investigate one well-known feature of spatial market segmentation, which was dubbed “Grenzöde” by August Lösch (1940: 131) (something like “border barrenness” in English). They show that NEG explains the population losses of the West German regions along the inner German border after World War II fairly accurately.<sup>1</sup> Meier and Bröcker (2011) show that the spatial distribution of the gains in real market potential after the fall of the Berlin Wall, predicted for West German (and Western European) regions from an NEG-flavored spatial computable general equilibrium model, matches the spatial distribution of per-capita income growth fairly well. And Frohwerk (2011) adjusts NEG theory significantly to the German case by extending a standard NEG model to incorporate ex ante asymmetries between regions and imperfect mobility of workers. He shows by way of simulations that the extended NEG model fits several stylized facts of the German economy. Each of these studies is tied closely to a specific NEG model, which allows, on the one hand, bringing detailed restrictions of the model to the data but limits, on the other hand, the economic forces and mechanisms under study to those actually addressed by the respective NEG model.<sup>2</sup>

In the present paper, we complement these studies by a more informal and pragmatic but at the same time more comprehensive analysis of German reunification in the light of NEG. We develop an “NEG view” of German integration during the past two decades by deriving

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<sup>1</sup> Somewhat related to this, Brühlhart et al. (2010) show that NEG explains the increases in employment and wages of the Austrian regions bordering the former Iron Curtain after 1990 fairly accurately. By contrast, Redding and Sturm (2008) do not find significant evidence for an increase in population of the West German regions along the Iron Curtain after 1989.

<sup>2</sup> The model used by Redding and Sturm (2008), for example, does not account for the fact that the regional mobility of workers was quite low in post-war Germany. By treating workers as being perfectly mobile, it tends to overstate the population outflows from the border region after World War II. It does also not account for the fact that the region along the inner-German border received significant amounts of public transfers, financed by the other West German regions. By ignoring these transfers, the model may also overstate the population outflows from the border region.

stylized facts that reflect a broad variety of characteristics of the German economy and its economic development since 1989, and interpreting them in light of current NEG. Of course, “the” single NEG model that addresses all the various characteristics relevant for Germany simultaneously is not—and will probably never be—available. This model would be way too complex. Still, by informally combining NEG models that address subsets of these characteristics, we find that NEG may actually explain the stylized facts fairly well.

In a nutshell, the stylized facts show that progress in economic integration between the two parts of Germany was very high immediately after the fall of the Berlin Wall and slowed down later but has not yet come to a halt. Agglomeration toward West Germany also increased faster initially and slowed down later but has virtually come to a halt recently even though productivity or real wages have not equalized. The facts also show that this process of integration and agglomeration has been accompanied by significant public transfers toward East Germany and significant differences in unemployment rates between the two parts of Germany.

According to our preferred NEG view, the German economy is characterized by a bell-shaped agglomeration pattern where economic activity first agglomerates and then redisperses in the course of economic integration. We find that Germany, which saw increasing agglomeration especially during the 1990s and early 2000s, is currently close to the peak of the bell curve. The agglomeration forces, which result from the greater attractiveness of the larger West German markets for producers and consumers, and which have dominated economic geography in Germany during the 1990s, have increasingly been neutralized by additional dispersion forces, in particular those resulting from imperfect mobility of East German workers. We also suggest that the West-East transfers and the gap in unemployment affect the magnitudes of agglomeration and dispersion forces but not the general shape of the German bell curve. This NEG view implies that future economic integration in Germany, fuelled mainly by further reductions of the “wall in the minds” that many Germans are still cultivating, may eventually foster redispersion of economic activity toward East Germany, and may thereby contribute to reducing the productivity, wage and income gaps between East and West Germany. This redispersion may, however, be delayed for still some time if East German workers become more mobile as the “wall in the minds” comes down gradually, or if the extensive public transfers toward East Germany, which add significantly to its market potential, are reduced in the future. We also discuss limitations of this NEG view. One limitation is that we cannot take possibly complex interactions and feedbacks between German and European integration into account, another, that we cannot discriminate effectively between the backward and forward linkages that are the focus of NEG and the other Marshallian externalities, knowledge spillovers or labor pooling, that may also have shaped economic geography in Germany.

This paper is organized as follows. Section 2 offers a short, selective introduction into the basic features and implications of NEG models and summarizes what we consider “typical” implications of current NEG models.<sup>3</sup> Section 3 describes the stylized facts of the economic development in Germany after reunification. Section 4 brings theory and stylized facts together to develop a specific NEG view of German economic integration after reunification. Section 5 broadens the perspective by discussing some of the limitations of NEG models. It particularly asks whether these models really capture the most important forces determining the spatial economic consequences of German reunification? Section 6 concludes.

## 2 The Essence of Contemporary NEG

NEG is a general equilibrium theory of trade and industry location that explains *why*, *how* and *when* economic activity may cluster in geographic space (Thisse 2011: 1).<sup>4</sup> To explain *why* economic activity may concentrate or deconcentrate, NEG focuses on the trade-off between microeconomically well-founded agglomeration and dispersion forces that arise endogenously from the interplay of increasing returns to scale at the firm level, trade costs and migration of productive factors.<sup>5</sup> The two agglomeration forces are the so-called “market access effect”, and the “cost-of-living-” or “cost-of-production effect”, depending on the model specification (Baldwin et al. 2003: Chapter 2, Ottaviano and Robert-Nicoud 2006). These forces result from Marshallian backward and forward linkages (Marshall 1890).<sup>6</sup> The dispersion force is the so-called “market crowding effect” (Baldwin et al. 2003, Ottaviano and Robert-Nicoud 2006). It arises from the fact that more firms in a market reduce individual firms’ market shares and may compete input prices up and output prices down. To explain *how* agglomera-

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<sup>3</sup> Readers interested in more details are referred to the numerous textbooks and survey articles published over the past decades. Textbooks include Fujita et al. (1999), Baldwin et al. (2003), Combes et al. (2008) and Brakman et al. (2009). Valuable survey articles include Behrens and Thisse (2007), Behrens and Robert-Nicoud (2009), Brakman and Garretsen (2009), Brakman et al. (2005), Brühlhart (2011), Combes (2011), Fujita and Krugman (2004), Fujita and Thisse (2009), Krugman (1998), Puga (2010), and Thisse (2011). Also see the syntheses in Ottaviano and Robert-Nicoud (2006) and Robert-Nicoud (2005).

<sup>4</sup> Standard NEG models have little to say about *where* economic activity agglomerates, by contrast. This is because they typically assume regions to be completely symmetric a priori. Those models that allow for a priori asymmetries between regions suggest that agglomeration is more likely to take place in the region that is favored by exogenous comparative advantages, though.

<sup>5</sup> The endogeneity of the spatial distribution of productive factors, or, more specifically, the mobility of the income and the demand derived from these factors, is, in our view, essentially what distinguishes NEG from New Trade Theory where the spatial distribution of demand is exogenous (Behrens and Robert-Nicoud 2009: 473, Head and Mayer 2004: 2614). This implies that we consider the so-called footloose capital model (see Baldwin et al. 2003: Ch. 3), where capital is interregionally mobile but capital income is repatriated by immobile capital owners part of New Trade Theory but not of NEG.

<sup>6</sup> The backward linkages imply that, ceteris paribus, firms prefer being located close to their customers to sell more of their products at low transport costs, thereby achieving higher cost depression (market access effect). The forward linkages imply that customers (consumers or firms that purchase intermediates) prefer being located close to their suppliers to purchase more products (consumer goods or intermediates) at lower trade costs, thereby raising real income or lowering production costs (cost-of-living- or cost-of-production effect).

tion of economic activity may emerge endogenously, NEG shows that the pecuniary externalities caused by backward and forward linkages can lead to a self-reinforcing agglomeration process (cumulative causation). Starting from an equal distribution of worker-consumers and firms across regions, any migration of workers (or firms that use products as intermediate inputs) from one region to another region may increase the incentives for other workers or firms to also move to that region. It triggers a snowball effect, which creates a core-periphery structure. And to explain *when* economic activity is likely to concentrate, NEG analyses how the strength of agglomeration and dispersion forces depends on different microeconomic parameters. Agglomeration is, in particular, more likely to occur if trade costs are neither too high nor too low. At very high trade costs, the market crowding effect dominates the two linkage effects (market access, cost-of-living or -production). As trade costs fall, the linkage effects weaken slower and eventually start dominating the market crowding effect, which triggers agglomeration. As trade costs approach zero, all three effects vanish and location becomes irrelevant.<sup>7</sup>

NEG models can broadly be classified into core-periphery models and models with bell-shaped agglomeration patterns. Core-periphery models essentially focus only on the three effects just sketched.<sup>8</sup> In these models, agglomeration of economic activity is generally *catastrophic*, *complete* and *permanent*.<sup>9</sup> Agglomeration is catastrophic because the incentives to agglomerate increase with increasing agglomeration, like in the models of cumulative causation from the 1950s (Perroux 1955, Myrdal 1957). It is complete because it continues until all mobile factors are agglomerated in just one region. And it is permanent because the linkage effects continue to dominate the market crowding effect as trade costs approach zero. There is no dispersion force in these models that does not weaken with decreasing trade costs, and that may eventually dominate the linkage effects at lower trade costs.

Models with bell-shaped agglomeration patterns overcome the extreme and arguably unrealistic implication of catastrophic, complete and permanent agglomeration of the core-periphery models (see, e.g., Combes et al 2008: Chapter 8 or Brakman et al 2009: Chapter 4.7). These models add additional dispersion forces to a core-periphery model that break the dominance

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<sup>7</sup> Agglomeration is also more likely to occur if (i) goods are more heterogeneous (smaller market crowding effect, larger cost-of-living, or cost-of-production effect), (ii) scale economies at the firm level are stronger (larger market access effect), or (iii) the share of mobile demand in total demand is larger (larger market access effect).

<sup>8</sup> This class of models includes the traditional core-periphery models (“migration models”) that go back to Krugman (1991), the so-called “vertical linkages” models (Krugman and Venables 1995, Venables 1996), and the so-called “linear models” (Ottaviano et al. 2002). Robert-Nicoud (2005) and Ottaviano and Robert-Nicoud (2006) show that most variants of these models are equivalent to each other in terms of their positive implications (e.g., the number and stability of equilibria).

<sup>9</sup> For an exception see the “linear model” of Pflüger (2004), where agglomeration is not catastrophic and not necessarily complete.

of the linkage effects at lower trade costs or higher levels of agglomeration. They suggest that agglomeration is *smooth*, *incomplete* and *temporary* rather than catastrophic, complete and permanent. It is smooth because small changes in trade costs induce only small changes in agglomeration. It is incomplete because agglomeration comes to a halt before all mobile factors are agglomerated in one region. With increasing agglomeration, the dispersion forces eventually dominate the agglomeration forces. And it is temporary because the economy redisperses again at sufficiently low but still positive trade costs. The additional dispersion forces that have been shown to generate one or more of these features include

- congestion costs, which raise fixed and marginal costs of production in the course of agglomeration, or immobile factors such as housing, whose prices or rents increase with increasing agglomeration (Brakman et al. 1996, Helpman 1998, Pflüger and Südekum 2008, see also Ottaviano et al. 2002);
- workers that have (heterogeneous) preferences over noneconomic attributes of regions (location preferences) and are therefore only imperfectly mobile across regions (Ludema and Wooton 1999, Frohwerk 2011: Chapter 3.4, Tabuchi and Thisse 2002, Combes et al. 2008: Chapter 8.2, Murata 2003);
- firm heterogeneity and fixed costs of exporting à la Melitz (2003) (Okubo 2009);<sup>10</sup>
- positive trade costs for goods produced by immobile factors (Fujita et al. 1999: Chapter 7, Picard and Zeng 2005);
- decreasing returns to labor in the non-industrial sector (agriculture), which implies that wages have to increase in the course of industrial agglomeration if workers are immobile between regions but mobile between sectors (Puga 1999);
- a transport sector that charges higher transport costs with increasing agglomeration because of more “return empty” trips (Behrens and Picard 2011).

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<sup>10</sup> Okubo (2009) studies the impact of economic integration on industry location in a two-region vertical linkages model with firm heterogeneity in terms of productivity and with fixed costs of exporting to the respective other region. In this model, low-productivity firms serve only their home market because they cannot afford paying the fixed costs of exporting while the high-productivity firms serve both markets. Agglomeration is generally smooth and incomplete in this model. More precisely, rather than introducing an additional dispersion force, firm heterogeneity and fixed entry costs together strengthen the market crowding effect of the core-periphery model for low-productivity firms. Agglomeration is, however, not temporary in this model. It is permanent because forward/backward linkages do not fade as (variable) trade costs vanish unless the fixed export costs are zero. With positive export costs, there are always some low-productivity firms in the core that do not export to the periphery. Therefore, the variety of intermediate goods available, and thus the forward/backward linkages remain larger in the agglomeration than in the periphery as trade costs vanish. Interestingly, agglomeration comes along with spatial sorting of firms in this model. The low-productivity firms concentrate in the periphery because they are more strongly affected by the fiercer competition in the core while the high-productivity firms concentrate in the core. Baldwin and Okubo (2006) and Okubo et al. (2010) incorporate heterogeneous firms into a footloose capital model. These models lack essential features of NEG, however. There are, in particular, neither forward/backward linkages nor circular causality or endogenous asymmetry between regions in these models.

Not each of these additional dispersion forces is sufficient to individually generate a bell-shaped, i.e., smooth, incomplete and temporary, agglomeration pattern. Positive trade cost for the agricultural good, for example, may generate temporary but still catastrophic and complete agglomeration (Fujita et al. 1999: Chapter 7). Still, following Combes et al. (2008: Chapter 8.3) and Combes (2011), we suggest considering bell-shaped agglomeration patterns the *typical* implication of NEG for at least two reasons. First, there is a whole variety of additional dispersion forces that work toward smooth, incomplete or temporary agglomeration in theory. Many of these forces are empirically relevant and intuitively plausible. The fact that, for example, workers are not perfectly mobile, which may alone generate a bell-shaped agglomeration patterns (Tabuchi and Thisse 2002, Frohwerk 2011) is undisputed and plays a particularly important role in this paper. The other reason is that reality is better characterized by smooth, incomplete and temporary rather than by catastrophic, complete and permanent agglomeration.

Figure 1 depicts such a bell-shaped pattern for the case of two, a priori symmetric regions. It plots the equilibrium share,  $\lambda$ , of one of the regions in the total stock of the mobile factor (e.g., manufacturing employment) against the level of economic integration, represented by the freeness of trade parameter  $\phi$ , which is inversely related to the level of trade costs. All points on the bell-shaped curve represent stable location equilibria. Mobile workers are distributed equally across the two regions ( $\lambda = 0.5$ ) at low levels of integration ( $\phi$  close to zero) because the market crowding effect dominates the linkage effects while additional dispersion forces are comparatively weak. Mobile workers start agglomerating in one of the regions, the core region, once the level of integration passes the so-called “break point”,  $\phi_b$ . (As each the two regions may become the core, there are two symmetric equilibria.) At this point, the linkage effects start dominating the market crowding effect and other dispersion forces. With integration levels slightly above this point, the linkage effects are only slightly stronger than the dispersion forces. The real wage difference between the two regions is consequently small (at least for low levels of agglomeration). In core-periphery models, this small real wage difference is sufficient to trigger catastrophic and complete agglomeration because agglomeration is self-reinforcing. In models with a bell-shaped agglomeration patterns, by contrast, it triggers only gradual and incomplete agglomeration because some additional dispersion forces thwart the self-reinforcing linkage effects. In models with heterogeneous location preferences of workers, for example, the small initial real wage difference induces only those workers to move from the periphery to the core that have the weakest preferences for their home region. With further progress in integration (increasing  $\phi$ ), the gap between the linkage effects and the market crowding effect initially increases, inducing additional workers to move to the core. This, in turn, strengthens the additional dispersion forces, which limits agglomeration. At higher levels of integration, the gap eventually starts decreasing again as both the linkage effects and the market crowding effect become weaker. The additional dispersion forces do not weaken with increasing trade integration, by



contrast. As a consequence, workers start moving back to the periphery and agglomeration decreases. At the so-called “redispersion point”,  $\phi_r$  in Figure 1, the mobile workers are fully dispersed again because the additional dispersion force dominates the gap between linkage effects and market crowding effect.

Figure 1 about here.

### 3 Seven Stylized Facts on German Economic Integration after Reunification

This section summarizes the main characteristics of the German economy at reunification and its development during the following two decades in seven stylized facts (SF).<sup>11</sup>

SF 1 East Germany has been much smaller than West Germany.

East Germany (including Berlin) accounted for only about 30% of the German area and 23% of the population in 1990, the year when Germany was reunified. The density of economic activity was also lower in East Germany. Population and employment densities were about three quarters, output density, one third of those in West Germany.

SF 2 After they had been strictly divided for about four decades, East and West Germany have been integrating very rapidly since the fall of the Berlin Wall. Integration slowed down by the end of the 1990s but has not yet come to a halt. There is still some potential for further integration today.

While trade and factor migration between East and West Germany had been almost completely prohibited during the cold war, the two parts of Germany have been integrating very rapidly after the fall of the Berlin Wall in November 1989. The monetary reunification in July 1990 and the political reunification in October 1990 removed all institutional barriers within a single year. Subsequently, the transport infrastructure between East and West Germany has been improved significantly by massive public investments. About half of the 17 major transport infrastructure projects bundled in the federal program “*Verkehrsprojekte Deutsche Einheit*” (“Infrastructure projects German Unity”) had been completed by the early 2000s (BMVBS 2010). By 2000, the travel time distances between East and West German *Landkreise* (counties) were, for given Euclidean distances, still somewhat higher than those between West German *Landkreise*, according to estimates by Schürmann and Talaat (2000a, 2000b). By 2010, seven projects of the “*Verkehrsprojekte Deutsche Einheit*” were still unfinished, most of them due to unexpected delays.<sup>12</sup>

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<sup>11</sup> These stylized facts are substantively similar to the eight stylized facts discussed in Uhlig (2008).

<sup>12</sup> In addition to the progress in East-West integration, infrastructure investments have also improved the integration of East German regions with each other. By 2000, the Schürmann-Talaat travel time distances

In addition to the institutional and physical impediments to trade, there have been more subtle impediments that are frequently referred to as the “wall in the minds” of the people.<sup>13</sup> These impediments, which are difficult to quantify, have manifested themselves in East German consumers preferring locally produced goods, or in West German consumers purchasing East German goods only reluctantly. They may have also manifested themselves in subjective barriers to migration between East and West Germany. The fact that migration rates among East Germans have been significantly higher for the younger (aged 18–29) than for the older generation (see Uhlig 2008) may indicate that tearing down the wall in the minds is a matter of generational change. Those Germans who grew up in reunified Germany may, on average, have less reservation against moving to, or buying goods from, the respective other part of Germany.

SF 3 The rapid economic integration in the 1990s was accompanied by severe shocks mainly to the East German economy. These shocks faded in the late 1990s.

The fall of the Berlin Wall in November 1989 and the reunification in 1990 exposed East Germany to a transformation and a reunification shock (Siebert 1992). These shocks beamed the East German economy into full exposure to the world markets, appreciated its currency by several hundred percent in real terms and deprived it of its traditional markets in the former communist trade block (COMECON). They turned half to two thirds of the East German capital stock obsolete and reduced output by half within a single year (Siebert 1991, Sinn and Sinn 1992).<sup>14</sup> In addition to these shocks, the infrastructure program as well as the restoration and modernization of public and private buildings triggered an unprecedented construction boom in East Germany during the first half of the 1990s (Paqué 2010: 99). The employment share of the construction industry in East Germany increased from below 10% in 1991 to almost 16% in 1995, about 2½ times the share of this industry in West Germany (Ragnitz et al. 2001: 182). This boom was followed by a recession of the industry during the late 1990s and early 2000s, which slowed down aggregate economic growth in East Germany significantly. All these shocks added to the more or less continuous shocks induced by the progress in economic integration itself. The various shocks had petered out by the early 2000s

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between East German *Landkreise* did virtually not differ any more from those between West German *Landkreise* for given distances.

<sup>13</sup> The German sociologist Katja Neller, for example, concludes in 2006 that “significant shares of the East and West Germans are strangers to each other still today; both sides exhibit stereotype images of themselves and the corresponding others and a good deal of prejudices. The frequently cited ‘wall in the minds’ in mutual perceptions has not been removed significantly so far” (Neller 2006: 34–35; English translation by the authors).

<sup>14</sup> A significant fraction of the large East German state-owned combines, which had been the backbones of the East German socialist economy, could not stand competition from West Germany or the world markets because their products were outdated in terms of technology, design, and production efficiency. Many of these combines were ultimately shut down, or downsized significantly while being sold to western investors.

after the transformation and reunification shocks had largely been worked off, the construction recession had been overcome and progress in integration had slowed down.

SF 4 Large transfer payments from West to East Germany have reduced firms' investment costs and have raised per-capita income and consumption expenditures in East Germany.

Net public transfer payments from West to East Germany have accumulated to around 1.5 trillion Euros between 1990 and 2010 (Lehmann and Ragnitz 2012: 27). The two economically most relevant transfers, on which we will focus here, are the public subsidies for investments in physical capital in East Germany, and the social and budgetary transfers towards East Germany.<sup>15</sup> The investment subsidies, which amount to about 10% of total annual net transfers (Lehmann and Ragnitz 2012: 28), arguably reduced capital costs in East Germany by an average 25%–30% during the 1990s (Gerling 1998).<sup>16</sup> This implies that the East-West ratio of effective capital costs was somewhere around 70–75%, which was of a similar magnitude as the East-West ratio of labor costs (gross wage per hour worked, see SF 5 below). The subsidization of capital investments in East Germany has therefore tended to equalize the factor-price ratios (wages / costs of physical capital) between East and West Germany. The factor intensities of production should consequently not have differed much between East and West Germany. In fact, similar to wages, the capital intensity (capital stock per person employed) of the East German economy increased from below 50% of the West German level in the early 1990s to 85% in the late 2000s.<sup>17</sup>

The social and budgetary transfers, which amount to about 90% of total annual net transfers, and which consist to about three fourth of payments to households through the public social security system (Lehmann and Ragnitz 2012: 28), have raised aggregate demand in East Germany well above aggregate factor income. Figure 2 indicates that, relative to West Germany, private and public consumption expenditures per capita in East Germany have exceeded per-capita GDP considerably. The personal transfers have reduced the East-West gap in disposable income and consumption expenditures by about 10 percentage points. As a consequence, private per-capita consumption expenditures in East Germany have been about

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<sup>15</sup> A third major intervention, public investment in infrastructure, was discussed already above.

<sup>16</sup> Intended to encourage private investment—and thereby job creation—in East Germany, these subsidies have comprised a variety of measures, including investment grants, loans, guarantees and special depreciation allowances, offered by state and national governments as well as the EU (Gerling 2002). Small and medium-sized enterprises as well as start-ups were eligible to higher subsidies of up to 50% (subsidy equivalent) (Gerling 2002), which possibly compensated them for their otherwise higher capital costs.

<sup>17</sup> See “Arbeitskreis ‘Erwerbstätigenrechnung des Bundes und der Länder’” ([http://www.vgrdl.de/Arbeitskreis\\_VGR/ergebnisse.asp?lang=de-DE](http://www.vgrdl.de/Arbeitskreis_VGR/ergebnisse.asp?lang=de-DE)). The lower aggregate capital intensity in East Germany reflects partly the lower share of manufacturing in total economic activity in East Germany. Within manufacturing, the capital intensity has even been higher in East Germany in recent years (IWH et al. 2011: 139).

80% of those in West Germany since the late 1990s. The public per-capita consumption expenditures have even exceeded those in West Germany since the mid-1990.

Figure 2 about here.

SF 5 Nominal wages and average labor productivity in East Germany converged to around 80% of the corresponding West German levels during the 1990s and early 2000s but have not converged further since the early 2000s. The East-West gap in nominal wages has been smaller than the gap in average labor productivity throughout the 1990s.

Figure 3 depicts the evolutions of average labor productivity and nominal wages in East Germany relative to those in West Germany. The East-West gap in average labor productivity narrowed fairly rapidly during the first half of the 1990s. The speed of convergence slowed down in the second half of the 1990s, however, and came almost to a halt in the 2000s, when East German labor productivity reached about 80% of the West German level.<sup>18</sup> An important source of the fast increase in labor productivity in the early 1990s has been technological diffusion. Partly induced by substantial public investment subsidies (SF 4) there has been a large inflow of direct investments from western firms, and many East German firms quickly started introducing efficient (western) production technologies and management practices. At a more macroeconomic level, the adoption of West German institutions and improvements of transport and communication infrastructures (SF 2) also contributed to the fast productivity growth of the East German economy. An additional source of increases in labor productivity in the early 1990s was the continued (downward) adjustment of employment to dramatically reduced output levels in many East German firms.

The East-West gap in nominal wages has been significantly smaller than the gap in average labor productivity throughout the 1990s and it narrowed even more rapidly than the latter during the first half of the 1990s. One reason for the fast increase in wages was the attempt to reduce the incentives for East German workers, especially skilled workers, to move to West Germany. Already by the end of the 1990s, however, the East-West convergence of nominal wages came almost to a halt. East German nominal wages have remained at a level of slightly more than 80% of West German nominal wages since then. The gap in *real* wages between East and West Germany has possibly been considerably smaller than that in nominal wages during the 2000s. While official data on regional price levels is not available, price-level estimates suggest that the gap in real wages was somewhere between 93% (Roos 2006) and 87% (Kosfeld et al. 2008) in the early 2000s.

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<sup>18</sup> At a more disaggregate level, West German firms have been found to be on average more productive than East German firms for almost all size classes (Bechmann et al. 2010: 31, Ragnitz et al. 2001: 45–46, Beer and Ragnitz 1997).

The fact that the East-West gap in average labor productivity has been higher than that in wages implies that unit labor costs (wages / labor productivity) have been higher in East than in West Germany. This gap in unit-labor costs narrowed considerably in the early 2000s, however. In manufacturing industries, unit labor costs have even been somewhat lower in East Germany since the early 2000s (Lehmann 2006: 10, IWH et al. 2011: 104).

Figure 3 about here.

SF 6 Unemployment has been persistently higher in East Germany.

Throughout the 1990s and 2000s there have been stark and persistent differences in unemployment rates between the two parts of Germany (Figure 4). The East German unemployment rate has exceeded the West German rate by between 63% (1995) and 135% (2001). In 2010, the East German rate was 13.4%, about 80% higher than that in West Germany (7.4%).

Figure 4 about here

SF 7 Net migration from East to West Germany was substantial during the 1990s and early 2000s but has dropped to almost zero in recent years. The East German employment share has decreased during the 1990s and early 2000s but has remained almost constant in recent years.

Figure 5 depicts the net annual migration flows from East to West Germany (panel a) and the shares of East Germany in German population and employment (panel b). East Germany has lost about 1.8 million people, which is about 11% of its 1989 population, through net migration to West Germany since 1989. This migration has responded fairly sensitively to wage differences (see Figure 3 above) and differing employment opportunities (see Figure 4 above) between East and West Germany. It was particularly high in the early 1990s when the East-West wage gap was still large and the transformation and reunification shocks had raised unemployment in East Germany substantially.<sup>19</sup> It dropped sharply towards the mid-1990s when the wage gap narrowed and the construction boom developed but picked up again during the recession in the second half of the 1990s. After the recession had been overcome in the early 2000s, finally, net migration has decreased more or less continuously, despite persisting East-West differences in real wages and unemployment rates.<sup>20</sup>

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<sup>19</sup> Arntz et al. (2011) find that regional differences in employment opportunities affect interregional migration decisions of workers in Germany stronger than regional differences in wages.

<sup>20</sup> This is where we deviate substantially from Uhlig (2008). Inspecting the migration data only up to 2003 and ignoring the trend break in 2001, Uhlig (2008: 520) does not foresee the substantial decline in migration flows during the 2000s. In 2009, net migration from East to West Germany was particularly low at less than

Figure 5 about here.

The evolution of the share of East Germany in total German employment (Figure 5b) mirrors the migration flows during the 1990s. Except for the few years of the construction boom, it decreased from about 22% in 1991 to about 18.5% in 2002. Since then it has remained virtually constant, by contrast.<sup>21</sup> This is even though nominal and real wages have still been lower in East Germany (see SF 5).

#### 4 Matching Theory and Facts: An NEG view of German Economic Integration

To what extent does NEG theory help in understanding these stylized facts? As explained in the introduction we are not going to answer this question by econometrically fitting a single, well defined, but necessarily highly restrictive, NEG model to the German data.<sup>22</sup> We rather pursue a more informal and pragmatic approach, trying to understand the stylized facts by informally combining insights from different NEG models that address different subsets of those characteristics that we consider important for describing the German economy after the fall of the Berlin Wall. We thereby develop a specific “NEG view” of German integration during the past two decades that can actually explain the stylized facts fairly well. In this view, the German economy moved through a series of disequilibria during the 1990s to approach a series of stable long-run equilibria, which are likely to be located close to the peak of a bell-shaped integration-agglomeration pattern, in the 2000s. Figure 6 illustrates this view.

Figure 6 about here.

The solid line in Figure 6 depicts, in stylized form, the long-run equilibrium employment shares of East Germany ( $\lambda_{EAST}$ ) at various levels of economic integration represented by the parameter  $\phi$ .<sup>23</sup> We consider this equilibrium relation to result from a hypothetical NEG model that features the relevant characteristics of the German economy. Among these characteristics, the imperfect interregional mobility of (East) German workers and the initially much smaller size of the East German economy are of particular importance (both characteristics will be discussed in more detail below). They justify the specific form of the equilibrium agglomeration pattern depicted in Figure 6, which corresponds to the lower branch of the bell curve in Figure 1. Specifically, Frohwerk (2011: Chapter 3.4) has shown that an NEG model with

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19,000 persons, which is about 0.1% of the East German population. This may partly be due to the recession following the financial crisis, which hit East Germany less than West Germany.

<sup>21</sup> East Germany’s employment share in the manufacturing sector has even increased from 12.6% in 2003 to 13.7% in 2010.

<sup>22</sup> See Redding and Sturm (2008), Behrens et al. (2009), Bode and Mutl (2010) or Bosker et al. (2010) for this kind of econometric tests of single, well-specified (but highly restrictive) NEG models.

<sup>23</sup> We take the parameter  $\phi$  to comprise all costs of trade across the former inner-German border. These costs reflect institutional, physical as well as mental barriers to trade.

different-sized regions and imperfect labor mobility due to heterogeneous location preferences of workers gives rise to a bell shaped equilibrium agglomeration pattern and that the (incomplete and temporary) agglomeration is much more likely to take place in the initially larger region under these conditions. In Figure 6, we therefore focus on the lower branch of the bell curve and omit equilibria in which agglomeration takes place in East Germany (the initially much smaller region).<sup>24</sup> In addition to imperfect worker mobility and different sized regions, we take our hypothetical model of the German economy to also include public transfers from the core to the periphery, firm heterogeneity, and labor market imperfections. While these features will generally affect the strength of agglomeration and/or dispersion forces and thus the equilibrium level of agglomeration for a given level of integration we assume that they do not affect the basic structure of the (bell-shaped) agglomeration pattern.<sup>25</sup>

The dashed line in Figure 6 depicts (in stylized form) the actual development of the East German employment share. For different points in time, the crosses (✕) indicate the actual employment shares of the East German economy and the corresponding levels of integration. The horizontal distances between the crosses are supposed to reflect the fact that the speed of integration was very high in the early 1990s but slowed down gradually thereafter (SF 2).<sup>26</sup> The deviation of this dashed line from the solid line reflects our presumption (justified below) that the German economy has not been in (long-run) equilibrium until the early 2000s (“2001” in Figure 6).

With Figure 6 as our reference, we can now explain our NEG view of the German economy in more detail. We do so in a primarily chronological order, starting in 1989. Before the fall of the Berlin Wall inner-German trade was virtually prohibited and the integration level was close to zero (not depicted in Figure 6). The fall of the wall in 1989 and the subsequent monetary and political reunification in 1990 constituted huge integration steps, that increased the level of integration to  $\phi_1$  and  $\phi_2$ , respectively. From the fact that the fall of the Berlin wall triggered immediate and extensive net migration to West Germany (SF 7), we conclude that the fall of the wall alone was sufficient to move the integration level beyond the break point ( $\phi_b$ ) where self-reinforcing agglomeration sets in ( $\phi_1$ , is therefore located to the right of the break point in Figure 6).

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<sup>24</sup> These equilibria, as well as instable equilibria, may be theoretically relevant but are empirically irrelevant.

<sup>25</sup> There is, of course, no single NEG model available in the literature that features all the characteristics of our hypothetical model, and due to its complexity there will most likely never be such a model. Our presumptions on the implications of these characteristics for the shape of the agglomeration pattern can therefore be justified only by the results of a number of more restrictive models in the following discussion.

<sup>26</sup> There are no direct estimates of the integration parameter  $\phi$  and the exact values of this parameter at different points in time are debatable. Still, the stylized facts allow us to narrow down the relevant range of  $\phi$  at specific points in time both relative to each other and relative to the integration levels defining the “turning points” of the bell curve, namely the break-point and the (lower) peak of the bell curve (for more on the latter see below).

For several reasons West Germany enjoyed an early advantage that made it the only likely candidate for hosting the emerging agglomeration. First and foremost, the West German economy was much larger than the East German economy in terms of their endowment with immobile and mobile factors (SF 1). As mentioned above, NEG models with ex ante size differences between regions such as Frohwerk (2011: Chapter 3.4) suggest that, once integration has passed the break point, agglomeration will most likely take place in the larger region.<sup>27</sup> For our NEG view of German integration this implies that the size difference between East and West Germany alone may have given West Germany a head start, leaving East Germany with little chance of developing into the new core of the reunified German economy. There were other factors, however, that have reinforced West Germany's advantage. The West German economy was not only larger than the East German one in terms of population or workforce it was also the much more productive economy. Productivity and wages were much higher in West Germany than in East Germany's highly inefficient socialist economy (SF 5), which, in addition, was subject to huge shocks that rendered much of its capital stock and many of its jobs obsolete (SF 3). Together these factors condemned East Germany to become the periphery of the integrating German economy and to experience outmigration and a shrinking employment share in the beginning agglomeration process. In fact, already by the end of 1990 a net number of about 750.000 East Germans had migrated to West Germany, and by 1991 the East German employment share had decreased to about 22% (SF 7).

Starting even before the political reunification in October 1990, there have been huge public transfer payments from West to East Germany (SF 4). NEG models that investigate public transfers from the core to the periphery suggest that such transfers act as an additional dispersion force (Baldwin et al. 2003: Chapter 17, Brakman et al. 2009: Chapter 11.3.3). By raising disposable income, or reducing production costs in the periphery relative to those in the core, they reduce the incentives of workers and firms to move to the core. We infer from these models that the massive West-East transfers have reduced the degree of agglomeration

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<sup>27</sup> Like the corresponding model with symmetric regions (Ludema and Wooton 1999), the model with imperfect labor mobility and asymmetric regions (Frohwerk 2011: Ch. 3.4) suggests that economic activity first agglomerates partially and then disperses again in the course of increasing economic integration (bell-shaped agglomeration pattern). Unlike the model with ex ante symmetric regions, it suggests, however, that progress in economic integration induces some agglomeration in the initially larger region even at integration levels below the break point (this is reflected in Figure 6 by the slight decrease of the East German equilibrium employment share to the left of the break point). This effect corresponds to the "home market effect" in models of the New Trade Theory (see Combes et al. 2008: Ch. 4). It virtually predetermines that the originally larger region has a much greater chance of becoming the core region once integration has passed the break point. This result is confirmed by the analyses of other NEG models with initially asymmetric regions. Baldwin et al. (2003: 62–65 and 106–107) analyze the case of two asymmetric regions in the core-periphery model of Krugman (1991) and the closely related "footloose entrepreneur" model. Frohwerk (2011) himself investigates both a core-periphery and a bell-shaped NEG model with two initially asymmetric regions. All these models suggest that (full or partial) agglomeration is much more likely to occur in the (ex ante) larger region.



in West Germany. They have reduced the extent of East-West migration and increased the East German equilibrium employment share.<sup>28</sup> Obviously, the transfers have not been sufficient, however, to prevent agglomeration in the West altogether.

The stylized facts suggests that, despite these transfers, forces working towards increasing agglomeration of economic activity in West Germany were actually rather strong in the 1990s. Higher real wages (SF 5) and lower unemployment rates (SF 6) in West Germany created incentives for East German workers to move to West Germany. At the same time, better access to the larger West German market and the gap in unit labor costs between East and West Germany (SF 5) created incentives for firms to locate in West rather than in East Germany. As a consequence net migration of workers from East to West Germany continued (SF 7) and the share of East Germany in total German employment decreased further from about 22% in 1991 to about 18.5% in the early 2000s. After the early 2000s, however, the employment share of East German remained virtually constant and net migration decreased more or less continuously to a level of almost zero in recent years (SF 7).

In principle, the observed net migration from East to West Germany and the declining East German employment shares of the 1990s are well in line with the equilibrium agglomeration pattern of our hypothetical NEG model. The bell-shaped agglomeration pattern of the model suggests that, once the break point has been passed, further progress in the integration of East and West Germany such as that observed during the 1990s (SF 2) will initially lead to increasing levels of (incomplete) agglomeration (the declining part of the solid line in Figure 6). In our view, the German economy should not be considered as having been in long-term equilibrium during the early phase of integration process, however. In Figure 6, therefore, the actual adjustment path does not coincide with that of the stable long-run equilibria for the 1990s. More specifically we presume that actual employment in East Germany was higher than equilibrium employment during these years. There are two main reasons for this presumption. First, given the size of the transformation and reunification shocks and the speed of economic integration in the early 1990s (SF 3 and SF 2) it is very unlikely, in our view, that the German economy adjusted almost instantaneously—or even within only one or two years—to these huge exogenous changes. The central long-run adjustment mechanism of NEG models, namely the interregional mobility of workers and firms just could not work fast enough to keep the employment shares in or close to the fast-moving long-term equilibrium of the German economy. Second, there were features of the transformation process that kept employment in East Germany “artificially” high and that are not captured by the equilibria of our hypothetical NEG model. Immediately after the fall of the Berlin Wall the East German

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<sup>28</sup> We interpret the equilibrium relation in Figure 6 as taking the public transfers from West to East Germany into account. We presume that they do not affect the shape of the bell curve fundamentally but merely flatten the curvature of the bell curve.

employment share was above its equilibrium level because many workers were underemployed on the job in the inefficient socialist economy. Many of the inefficient jobs and firms were kept alive for some time by public subsidies thereby stabilizing East German employment. East German employment was further stabilized (and East West migration reduced) for some years by the temporary construction boom that set in shortly after reunification (SF 3). Taken together, this has kept employment in East Germany (well) above, and the level of agglomeration (well) below, long-run equilibrium levels during the (early) 1990.

The disequilibrium presumption for the 1990s is further supported, in our view, by the rapid convergence of East German wages and average labor productivity toward their West German levels during the first half of the 1990s (SF 5), i.e. during a period of sizeable East West migration and decreasing East German employment shares (SF 7). The coincidence of increasing agglomeration in the West and strong increases of wages and average labor productivity in the East is clearly at odds with the basic equilibrium predictions of NEG models. In particular, if workers are imperfectly mobile due to heterogeneous location preferences, the equilibrium gap in real wages between core and periphery will increase, not decrease, with increasing agglomeration.<sup>29</sup> In fact, the rapid wage convergence of the early 1990s was arguably induced by political and social interests capturing the wage bargaining process rather than by market forces (SF 5).<sup>30</sup> And the strong increase in East German labor productivity can be explained best by the diffusion of more efficient Western production technologies and management practices to East Germany as well as by the delayed (downward) adjustment of East German firms' employment levels to sales that had been dramatically reduced in the early phase of the transformation process (SF 5).

In our preferred view, the German economy thus moved through a series of disequilibria during the 1990s along the dashed line in Figure 6, thereby converging sluggishly toward equilibrium employment shares on the solid bell curve. This convergence has, in our view, been largely completed by the early 2000s, i.e., sometime between 2000 and 2003. By this time, the transformation and reunification shocks had been largely overcome and the construction boom had largely petered out (SF 3).<sup>31</sup> Progress in economic integration had slowed down (SF 2) and the East German economy had no longer been disrupted by large shocks as those in the early 1990s (SF 3). The German economy may therefore be

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<sup>29</sup> With heterogeneous location preferences of workers, an individual worker will migrate from the periphery to the core (only) if the expected gains in terms of higher real earnings exceed his personal (utility) costs of migration. Therefore, increasing integration can lead to additional migration into the core and increasing agglomeration of economic activity only if the real wage gap between the core and the periphery increases (but not if it shrinks as the gap between West and East German wages did in the early 1990s). With perfect worker mobility on the other hand, real wages have to be the same in the core as in the periphery in any incomplete agglomeration equilibrium.

<sup>30</sup> It may thus be interpreted as another exogenous shock to which the East German economy had to adjust.

<sup>31</sup> Also, the fast increase of average labor productivity and wages in East Germany had come to halt (SF 5).

characterized reasonably well by a sequence of stable equilibria of our hypothetical NEG model since then. This is reflected in Figure 6 by the coincidence of the actual employment shares (dashed line) and the long-run equilibrium shares (solid line) for the 2000s.<sup>32</sup>

The evidence summarized in SF 7 clearly suggests that these stable long-run equilibria are characterized by only incomplete agglomeration. During the 1990s and early 2000s the East German employment share decreased by “only” about 4 percentage points to a level of about 18.5% and has remained largely constant since then (SF 7).<sup>33</sup> The German economy has obviously not been converging towards full agglomeration. This conclusion is further reinforced by the fact that agglomeration has come to a halt even though there has still been progress in economic integration during the 2000s (SF 2). This implies that the agglomeration process has not just paused temporarily because progress in integration has paused.

The fact that there has been only incomplete agglomeration suggests that there must have been (additional) dispersion forces at work that have broken the dominance of agglomeration forces in the course of increasing agglomeration. In our hypothetical model we assume that the imperfect mobility of (East German) workers due to heterogeneous location preferences is the main such dispersion force. This assumption is supported by SF 5 and SF 7: The long-run equilibria of the 2000s are not only characterized by partial agglomeration but also by persisting real wage differences between East and West Germany. The gap between East and West German nominal and real wages has stabilized during the 2000s but has not converged to zero (SF 5). Despite persistently lower real wages (and also higher unemployment SF 6), in the East, net migration from East to West Germany has decreased more or less continuously during the 2000s and has dropped to almost zero in recent years (SF 7). We infer from this that the overwhelming majority of East German workers have obviously preferred earning less (or being unemployed) in East Germany over bearing the disutility of leaving their home region towards West Germany. The imperfect mobility of East Germans has limited both the convergence of wages and the agglomeration of employment in West Germany.<sup>34</sup>

In our view, the German economy has been fairly close to the (lower) peak of the bell curve in the 2000s. The main reason for this presumption is that the East German employment share

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<sup>32</sup> The disequilibrium view implies, of course, that the data from the 1990s are of only limited use for determining the precise location and shape of the German bell curve. This is particularly relevant for econometric studies that estimate models derived from equilibria of an NEG model. The data will provide useful information on the approximate location of the curve only if the shocks and the subsequent adjustment processes are accounted for explicitly.

<sup>33</sup> This decrease, which amounts to less than 20% of the East German employment share of 1991, is certainly less than what could plausibly be expected from complete agglomeration predicted by core-periphery models—even if one assumed the share of immobile (agricultural) workers to be rather large in the latter models.

<sup>34</sup> The real wage gap of the 2000s is thus not just a temporary disequilibrium phenomenon but a feature of long-term equilibrium in our view.

has neither increased nor decreased notably since the early 2000s (SF 7), despite further progress in economic integration. Even though the progress in integration has been slower during the 2000s than during the 1990s (SF 2), the East German equilibrium employment share should have decreased notably as additional infrastructure links have been completed and the wall in the minds has become somewhat more perforated during the 2000s, if the German economy had still been far left of the peak of the bell curve in the early 2000s (“2001” in Figure 6). For similar reasons, the equilibrium employment share of East Germany should have increased notably in recent years if the German economy had already moved significantly beyond the peak of the bell curve. In Figure 6, therefore, the levels of integration for the early 2000s ( $\phi_4$ ) and for 2011 ( $\phi_5$ ) are located close to the peak of the bell-curve.

NEG may also help to explain two other stylized facts that are only implicit in Figure 6, namely East Germany’s persistently lower average labor productivity (SF 5) and its persistently higher unemployment rate (SF 6). NEG suggests that the persistent productivity gap between West and East Germany (SF 5) may be caused by the spatial sorting of heterogeneous firms during the agglomeration process. In an NEG model with heterogeneous firms Okubo (2009) shows that the agglomeration of firms into the core region may go hand in hand with spatial sorting of firms by their productivity (see also footnote 10). With increasing integration, more productive firms concentrate in the core in order to benefit from the greater linkage effects there. Less productive firms, by contrast, concentrate in the periphery where trade costs shield them from the fiercer competition by the more productive firms in the core. In equilibrium, this may lead to persistent productivity difference between core and periphery (Okubo 2009). While this spatial sorting cannot explain why the East-West productivity gap narrowed (rather than widened) during the 1990s, it may contribute to explaining why the convergence process stopped well before the East German average labor productivity reached the West German level (SF 5). In addition to its effect on average productivity, the spatial sorting of firms may have also contributed to limiting the decline of the East German employment share. The sorting of less productive firms into the periphery works as an additional dispersion force that tends to reduce the level of agglomeration (Okubo 2009).<sup>35</sup>

NEG forces may also help explain the stark and persistent differences in unemployment rates between East and West Germany (SF 6). Several recent theoretical studies have introduced labor market imperfections in otherwise standard core-periphery models (Epifani and Gancia 2005, vom Berge 2011, Zierahn 2011a) or in an NEG model with a bell-shaped agglomeration pattern resulting from congestion costs (Zierahn 2011b).<sup>36</sup> These models suggest that unem-

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<sup>35</sup> We assume that this effect is taken into account by the equilibrium relation (solid line) in Figure 6.

<sup>36</sup> Epifani and Gancia (2005) and vom Berge (2011) introduce job matching frictions while Zierahn (2011a, 2011b) introduces wage-setting frictions based on efficiency wages into the NEG framework. In addition to

ployment caused by labor market imperfections will generally be higher in the periphery than in the core, which is perfectly in line with SF 6.<sup>37</sup> They also suggest that labor market imperfections constitute an additional agglomeration force but will not affect the basic agglomeration pattern fundamentally.<sup>38</sup> For our view of the German economy after reunification this suggests that the existing labor-market frictions in Germany have not only contributed to the persistently higher unemployment in East Germany. They have also created additional incentives for the East-West migration of workers and have reduced the East German equilibrium employment share.

To sum up, our NEG view of German reunification, which is based on a hypothetical NEG model, matches the stylized facts of Section 3 fairly well. In the course of the rapid economic integration between East and West Germany after the fall of the Berlin Wall (SF 2), economic activity has agglomerated in West Germany (SF 7). East Germany had virtually no chance of becoming the economic core of Germany because it was the initially much smaller and economically weaker region (SF 1). The massive public transfers from West to East Germany (SF 4) have acted like an additional dispersion force, which has reduced the degree of agglomeration in Germany, but could not prevent agglomeration in the West altogether. Agglomeration continued to increase during the 1990s, but came to a halt already in the early 2000s (SF 7). Agglomeration came to a halt despite persistently lower real wages and productivity in East Germany (SF 5) because workers have been only imperfectly mobile. Agglomeration in West Germany may have been further impeded by less productive firms preferring locating in East Germany. This self-selection may also partially explain the persistent productivity gap between West and East Germany (SF 5). Labor market imperfections, by contrast, have acted like an additional agglomeration force, which has tended to increase the degree of agglomeration. Additionally, they have created a persistent West-East gap in unemployment rates (SF 6). Because agglomeration in Germany has not changed notably since the early 2000s (SF 7) even though there has still been progress in economic integration (SF 2), the level of economic integration must have been somewhere close to the (lower) peak of bell curve since the early 2000s.

While the increasing agglomeration of economic activity during the 1990s is principally in line with the bell-shaped equilibrium agglomeration pattern of our hypothetical model, we

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these studies, Peeters and Garretson (2004) discuss the possibly complex implications of regionally asymmetric labor market friction.

<sup>37</sup> Vom Berge (2011) suggests that unemployment may, under certain conditions, be higher in the core in which case nominal wages would also be lower in the core, though. This, however, is not consistent with the situation in Germany, where nominal wages are substantially higher in West Germany (SF 5).

<sup>38</sup> In the case of a bell-shaped agglomeration pattern (Zierahn 2011b) this means that the higher the labor market imperfections, the broader the range of the trade-freeness parameter for which stable equilibrium features agglomeration and the lower the employment share of the periphery within this range, *ceteris paribus*. We assume that this effect is taken into account by the equilibrium relation in Figure 6.

presume that the German economy has not been in long-run equilibrium during the 1990s. In our view this is a consequence of the massive shocks that had hit the East German economy during the early integration process (SF 3). The fast increases in East German wages and average labor productivity in the early 1990s (SF 5) are directly related to these shocks; from an NEG perspective they are otherwise hard to reconcile with the simultaneous decrease of East German employment shares. As the speed on integration slowed down and the various shocks faded in the late 1990s (SF 3), the German economy converged toward a series of long-run equilibria and may reasonably be considered to be in long-run equilibrium in the 2000s.

What are the future prospects of the German economy in the light of this NEG view? In our view, the German economy is currently close to the peak of the bell curve (see above) and there is still potential for future progress in economic integration between East and West Germany. Several infrastructure projects are still unfinished and the wall in the minds has still not been removed completely (SF 2). In addition, studies that explore long-term agglomeration patterns in other developed countries suggest that these countries are already beyond the peak of the bell curve.<sup>39</sup> We thus expect future progress in German integration to eventually push the German economy beyond the peak of the bell curve and to trigger redispersion of economic activity toward East Germany. This redispersion may, however, take some time to materialize as future progress in integration will probably be rather slow, as it has already been during the 2000s. Tearing down the walls in the minds, for example, may be more an issue of generational change than of individual learning.

The redispersion may be delayed further if the wall in the minds does not only affect the consumption but also the migration behavior of Germans. East German workers may become more mobile as the walls in their minds fade. In fact, the younger generation has accounted for a disproportionately high share of the East-West migrants already in the 2000s (Uhlig 2008). In addition, the redispersion may be delayed further if the public transfers from West to East Germany are reduced in the course of further integration. In both cases, further integration will not only move the equilibrium to the right along the bell curve of Figure 6, but will simultaneously move the whole bell curve outwards.

Despite these qualifications, our NEG view on the future prospects of German integration challenges much more pessimistic views, such as that developed in Uhlig (2008). Uhlig

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<sup>39</sup> From simulations based on an extension of the NEG model of Puga (1999), Bosker et al. (2010) find some weak evidence for integration in Europe as a whole being already beyond the peak of the bell curve. And Behrens et al. (2009) suggest that further economic integration between the U.S. and Canada would foster dispersion. In addition, several descriptive studies suggest that the regional concentration of industries in developed countries peaked already decades ago and has been decreasing since then; see Kim (1995) for the U.S., Paluzie et al. (2004) and Rosès et al. (2010) for Spain, Combes et al. (2011) for France, and Brakman et al. (2005) as well as Bickenbach et al. (2010) for the EU-15.

concludes that emigration from East Germany “never stops, eventually turning a dying region into a wasteland” (Uhlig 2008: 520). In our view, by contrast, net emigration has already stopped, and will eventually even turn into net immigration into East Germany. Uhlig derives his conclusion from a labor search model augmented by some exogenous localized network externality. This externality serves a similar purpose in his model as the linkage effects do in our hypothetical NEG model: They make firms in the core more productive. In Uhlig’s model the strength of this agglomeration force does not, however, decrease with increasing integration; contrary to the linkage effects of NEG models. And there are no dispersion forces in his model that may serve a similar purpose as the market crowding effect and the additional dispersion force generated by the limited mobility of workers in our NEG view of German economic integration.

## 5 Limitations of NEG for Understanding German Economic Integration

In the preceding section, we looked at German economic integration solely from the perspective of NEG and of Germany. We now broaden this perspective to identify possible limitations of this view. For the sake of brevity, we focus on four issues that are particularly relevant in our view:<sup>40</sup> the internal heterogeneity of both West and East Germany, the European integration, other Marshallian externalities, and forces emphasized by neoclassical theory.

### *Two versus many regions within Germany*

Our NEG view treats reunified Germany as a two region economy. Virtually all theoretical insights from NEG models to which we referred in the preceding sections are derived from two region models only. These two-region NEG models may not be suited too well for explaining the geographical distribution of economic activity in Germany. East and West Germany are far from being internally homogeneous regions. The southern parts of both East and West Germany are populated more densely and are richer in terms of per-capita income than their northern parts.<sup>41</sup> And even these four parts of Germany are rather heterogeneous internally (Bode 2008). In addition to this regional heterogeneity, most infrastructure investments in the course of German integration have affected trade costs between different regions within Germany quite asymmetrically. Generally they reduced trade costs between two West German regions much less than those between two East German regions or those between a West and an East German region.

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<sup>40</sup> A variety of recent survey articles offer thorough evaluations of the strengths and current weaknesses of NEG. See, among others, Fujita and Krugman (2004), Behrens and Thisse (2007), Behrens and Robert-Nicoud (2009), Brakman and Garretsen (2009), Brühlhart (2009), Fujita and Thisse (2009), Krugman (2009), and Combes (2011).

<sup>41</sup> Some southern regions of East Germany have even surpassed the poorest West German regions in terms of per-capita income (Bode 2002, Vollmer et al. 2010).

The analysis of three or more region models is qualitatively much more complex than that of two region models for essentially three reasons. First, the characterization of equilibria is of higher dimensionality: There may be several agglomerations in equilibrium rather than just one, and it is not a priori clear how many and which regions will host agglomerations in equilibrium. Second, interactions between regions are much more complex because regions interact with each other not only directly but also indirectly through third regions. This so called “threeness effect” introduces complex feedback effects, which complicate the analysis significantly (Behrens and Thisse 2007: 461/462). And third, geographic space will generally not be “neutral”, i.e. trade costs, and changes in trade costs, are likely to differ between different pairs of regions, and the incentives to agglomerate in a particular region will generally depend on this region’s relative position within the whole network of regions (Brakman et al. 2009: 171, Behrens and Thisse 2007: 462).

While the theoretical literature on multi-region NEG models is still in its infancy, existing results suggest that main qualitative results of the two-region models sketched in Section 2 continue to hold in models with three or more regions at least under simplifying (symmetry) assumptions about the structure of trade costs and of their changes in the process of integration.<sup>42</sup> This is true, in particular, for the fundamental differences in the agglomeration patterns implied by models without additional dispersion forces on the one hand and models with additional dispersion forces on the other. In Krugman-type models with three or more regions the agglomeration forces resulting from forward and backward linkages will generally dominate the market-crowding effect in the case of medium or low trade costs—just as in the two region case. As a consequence, without additional dispersion forces most or even all but one of the regions will host no mobile workers at all in equilibrium for sufficiently low trade costs (complete and permanent agglomeration). For the case of many regions, this has been shown to be true, e.g., for the special case of the so-called “racetrack economy” (Fujita et al. 1999: Chapter 6.2; Brakman et al. 2009: Chapter 4.9).<sup>43</sup> For sufficiently low transport costs, stable equilibria of this model will generally be characterized by the agglomeration of all mobile factors in a very small number of regions (generally only one or two). All other regions will host none of the mobile factor.<sup>44</sup>

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<sup>42</sup> Even under these simplifying assumptions results for three or more region economies have generally been obtained by way of simulation only.

<sup>43</sup> The “racetrack economy” is a multi-region Krugman-type NEG model, with the special feature that the regions are equally spaced around the circumference of a circle with transports costs between any two regions depending on the (shorter) distance around the circle between the two regions.

<sup>44</sup> Another example is the three-region extension of the Krugman (1991) model with equal transport costs between all pairs of regions (Fujita et al. 1999: Section 6.1). The equilibria of this model resemble those of the two region core-periphery model almost perfectly: For high transport costs there is a single stable equilibrium with the mobile factor being equally distributed among the three regions. For sufficiently low transport costs, by contrast, the mobile factor always ends up completely concentrated in just one region.



As for the two-region case, the equilibrium structure of the multi-region economy may look fundamentally different in the presence of additional dispersion forces. Theoretical examples of multi-region economies with additional dispersion forces suggest that agglomeration patterns will then be characterized by some kind of higher-dimensional version of the bell curve. Brakman et al. (2009: Section 7.4.3), for example, show that agglomeration will generally be highly incomplete and only temporary in the case of a racetrack economy with congestion costs: At intermediate levels of integration, the mobile factor will generally be centered around a small number of large agglomerations; most, or even all, regions will host a positive share of the mobile factor, however (incomplete agglomeration). As integration continues to increase, congestion costs will eventually start to dominate and the large agglomerations will start to shrink (redispersion). In a similar vein, Bosker et al. (2010) show that an extension of the Puga (1999) model without interregional labor mobility (see Section 2) to the case of multiple (not necessarily equidistant) regions may also generate a bell-shaped agglomeration pattern.

While the available multi-region models are still too stylized to serve as an appropriate representation of a multi-region model of the German economy, they nonetheless indicate that our NEG story of German reunification may not be completely off the track just because it neglects the multi-region nature of both East and West-Germany. While it certainly grasps the complexity of regional interactions within and between East and West Germany only incompletely, it may still capture the crucial interactions between East and West-Germany, including the bell-shaped agglomeration pattern.<sup>45</sup> Much more research into the properties of multi-region NEG models is warranted, however (Behrens and Thisse 2007: 462). This research may be particularly relevant for Germany where changes in the smaller-scale agglomeration patterns within West and East Germany will likely gain importance in the future after the large-scale east-west divide, which has clearly dominated during the past two decades, has been overcome.

### *European and German Integration*

Our NEG view of German integration abstracts from globalization in general, and from progress in European integration in particular. Germany is a highly open economy, however,

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<sup>45</sup> What is much harder to defend, however, is our argument that East Germany (or even all of its sub-regions) was condemned to shrink during the agglomeration phase just because it was the smaller region at the time of reunification. In multi-region models, the question which regions are likely to grow and which are likely to shrink during the agglomeration process does not only depend on the regions' initial sizes but on the whole geographical structure of (initially) large and small regions. An initially small region may well grow during the agglomeration process if it benefits from an advantageous geographical location in the overall network of differently sized regions. This does not, of course, rule out that the decrease of the East German employment share after reunification (SF 7) was a consequence of the self-reinforcing agglomeration effects stressed by NEG in general and by our NEG view of German reunification in particular. It just implies that the comparatively small size of East Germany may not be a sufficient explanation for this development.

and it is well integrated with its European neighbors. It exports about half of its GDP, and about 60% of these exports go to the EU-27. And there has been quite some progress in globalization and European integration during the last two decades. Focusing on European integration, there have been two major integration processes running in parallel. On the one hand, economic integration within Western Europe has been advanced by the Single Market Program, completed in 1992, and the currency union, established in 1999/2002.<sup>46</sup> On the other hand, economic integration with Middle and Eastern Europe has been advanced by the fall of the Iron Curtain and the subsequent EU-accession of 10 Middle and Eastern European countries in 2004 and 2007. On top of these two major integration processes, trans-European transport networks (TEN-T) have been improved and extended, which has added to reducing distance-related trade costs within Europe (DG MOVE and TEN-T EA 2010). This progress in European integration may have had a significant effect on economic geography within Germany, thereby overlaying or augmenting the effects of German reunification by possibly complex general-equilibrium interactions and feedbacks.

The consequences of increasing openness to foreign trade (external integration) on the internal economic geography of a country have been investigated by models that extend standard NEG models with (usually) two regions, interpreted as two regions of the “home country”, by adding at least one additional region interpreted as the “foreign country” or the “rest of the world” (for a survey see Brülhart 2011). These models assume that there is both (costly) trade in goods and factor mobility between the regions of the home country, whereas the exchange between countries is restricted to trade in goods. Given that West Germany is closer to Western Europe while East Germany is closer to the Middle and Eastern Europe, models that assume the domestic regions to differ in terms of their access to the foreign country (see e.g., Brülhart et al. (2004) and Crozet and Koenig 2004) appear to be particularly relevant for analyzing the effect of European integration on economic geography within Germany. According to these models foreign trade liberalization favors the re-location of domestic economic activity toward the region that is closer to the foreign country (Brülhart 2011: 67). Due to their greater proximity to the foreign market, firms in the border region will be able to serve a greater share of the additional export demand induced by trade liberalization and this effect will generally dominate the disadvantage of greater competition from imports. Empirical studies tend to support this theoretical prediction (Brülhart 2011: 78, 80). For Germany, this implies that integration with Western Europe should have fostered agglomeration toward West Germany while integration with Middle and Eastern Europe should have weakened this agglomeration. Overall, the two effects may have (partially) canceled out each other so that neither East Germany nor West Germany may have enjoyed a

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<sup>46</sup> The accession of Austria, Finland and Sweden in 1995 likely had little effect because these countries had already been highly integrated with the EU before.

sizeable net advantage from their respective border locations—particularly so if integration with Eastern and with Western Europe were of similar importance for German exports, which however is difficult to assess.

Theory suggests, however, that there is an additional effect of trade liberalization on domestic economic geography that may be relevant even if both regions have equal access to foreign markets. By intensifying foreign trade, the liberalization generally reduces the relative importance of (inter-regionally mobile) domestic demand, thereby weakening both the forward/backward linkages and the market-crowding effect. This may either foster or impede domestic agglomeration, depending, in particular, on the overall strength of dispersion forces (Brülhart 2011). If the relatively weak market-crowding effect is the only dispersion force (as in Krugman 1991) foreign trade liberalization will tend to foster domestic agglomeration because it weakens the dispersion force more than the agglomeration forces (Monfort and Nicolini 2000, Paluzie 2001). In the presence of additional dispersion forces, e.g., in the form of congestion (Krugman and Livas Elizando 1996), or stronger competition effects, e.g. in the form of lower price markups in the agglomeration (Behrens et al. 2007), foreign trade liberalization will, by contrast, tend to impede agglomeration.<sup>47</sup>

In summary, these models suggest that progress in European integration may have contributed to slowing down the agglomeration process within Germany during the late 1990s and early 2000s, if East Germany had either benefitted more from European integration than West Germany, or if both parts of Germany had benefitted to a similar extent but the intensified foreign trade has weakened the inner-German agglomeration forces relative to the dispersion forces. While we cannot empirically separate the effects of the European from those of the inner-German integration in this paper, we note that part of the effects we attributed to the inner-German integration in our NEG view in Section 4 may actually be due to European integration.

#### *Forward/backward linkages versus other Marshallian externalities*

NEG typically covers only one of the three Marshallian externalities, forward/backward linkages, but ignores the two other externalities, labor market pooling and knowledge spillovers.<sup>48</sup> These three Marshallian externalities may easily be confounded with respect to their impact on observed geographic patterns of economic activity because they tend to be observationally

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<sup>47</sup> The “empirical evidence mirrors the theoretical indeterminacy” (Brülhart 2011: 80).

<sup>48</sup> Labor market pooling refers to the benefits of employers and workers from thick regional markets for specialized labor. Higher local demand and supply of specialized labor improves the quality of matches between employers and employees and insures workers and firms against idiosyncratic shocks. Knowledge spillovers refer to the benefits from the diffusion of localized, valuable knowledge across workers or firms. Interpersonal knowledge spillovers and some of the gains from pooling of high-skilled labor are sometimes investigated under the label of localized human-capital externalities (Moretti 2004).

equivalent to each other (Combes and Overman 2004, Duranton and Puga 2004, Puga 2010). All three of them tend to favor the concentration of economic activity (Duranton and Puga 2004, Combes et al 2008: Chapter 11.2).<sup>49</sup> Empirical studies theoretically founded in NEG may therefore misinterpret the effects of labor pooling or knowledge spillovers as those of forward/backward linkages, which may give rise to inappropriate policy conclusions. Further improvements of the inner-German transport infrastructure may, for example, yield little returns, if economic prosperity in East Germany has mainly been hampered by a lack of knowledge spillovers or thin markets for specialized labor.

Those studies that test the three Marshallian externalities directly against each other find all three externalities to be relevant, at least for Northern America.<sup>50</sup> For European countries, the available evidence is rather ambiguous, however. For France, Combes et al. (2011) find that forward/backward linkages affected aggregate productivity in French départements significantly during industrialization (1860 and 1930) but not any more in recent years (2000). In recent years, the aggregate regional productivity has, according to Combes et al. (2011), been shaped by the human-capital intensity of the regional workforce, which may be associated with labor pooling or knowledge spillovers but not with forward/backward linkages. For Germany, by contrast, Alecke et al. (2006) find that forward/backward linkages and labor pooling but not knowledge spillovers contribute to explaining the spatial concentration of manufacturing industries.

While the results of these studies differ from each other for many reasons, they indicate that forward/backward linkages are likely to have impacted the economic geography of reunified Germany but are unlikely to be the only type of Marshallian externality that had such an impact. Our NEG-based interpretation of the evolution of the German economy may consequently overstate the effects of forward/backward linkages. Agglomeration of economic activity in West Germany has probably also been fostered by higher R&D productivity in West Germany,<sup>51</sup> which may be due to more extensive knowledge spillovers among West German firms (Bode 2004). It has probably also been fostered by higher gains from labor pooling. More research is definitely warranted to empirically assess the relative importance of the three Marshallian externalities in general, and the relevance of forward/backward linkages in particular in shaping economic geography in Germany after reunification.

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<sup>49</sup> As Ellison et al. (2010: 1196) put it: “Each Marshallian theory predicts that the same thing will happen for similar reasons: plants will locate near other plants in the same industry because there is a benefit to locating near plants that share some characteristic.”

<sup>50</sup> See Rosenthal and Strange (2001, 2004), Rigby and Essletzbichler (2002), Baldwin et al. (2008, 2010) and Ellison et al. (2010).

<sup>51</sup> See Aschhoff et al. (2008: 13), BMBF (2010), Griffith et al. (2006), Felder and Spielkamp (1998), or IWH (2011: 156), among others.

### *NEG-based versus Neoclassic Approaches*

Another “competitor” to NEG in understanding economic geography in Germany is neoclassical theory. Krugman (2009: 569–570) argues, for example, that the forward/backward linkages stressed by NEG have been waning rather than gathering strength over the last decades. And Brülhart finds that “centrality of European regions has been losing importance as a determinant for the location of employment” (Brülhart 2006: 227).<sup>52</sup> So, should we better leave NEG to economic historians and development economists and rather focus on the neoclassical approach that explains the spatial distribution of economic activity by exogenous, natural comparative advantages?

The standard neoclassical framework predicts that the initial differences in per-capita income, labor productivity, factor intensities and relative factor prices between East and West Germany after the fall of the Berlin Wall should have been eliminated, or at least continuously been reduced, by West-East migration of capital or East-West migration of labor. We do, in fact, observe factor migration in these directions during the past two decades (see SF 7 and SF 4). At the same time, the relative factor prices have been roughly equalized during the past 20 years (SF 5), and East German per-capita income and labor productivity have converged to about 80% of those in West Germany (SF 4 and SF 5).

The remaining productivity difference between East and West Germany is nonetheless significant. Klodt (2000) illustrates the contribution of the standard neoclassical approach to productivity convergence in Germany by a simple back-of-the-envelope calculation of the hypothetical productivity of East Germany (relative to that of West Germany). If East and West Germany share the same production technology, the East German relative productivity will, according to the neoclassical framework (Cobb-Douglas technology, capital share of  $\alpha = 0.3$ ), be directly proportional to its relative capital intensity, i.e.,  $y^*_E/y^*_W = (k_E/k_W)^\alpha$ .  $k$  denotes observed capital intensity (capital stock per worker),  $y^*$  the labor productivity (GDP per worker) predicted by theory, and  $E$  and  $W$  index East and West Germany.<sup>53</sup> This hypothetical relative productivity,  $y^*_E/y^*_W$ , is plotted as the dashed line in Figure 7 along with the observed relative productivity (solid line). The hypothetical productivity increased considerably during the 1990s and early 2000s, reducing the “factor input gap”, i.e., the East-West productivity gap attributable to differing factor intensities, from about 15% in the mid-1990s to 5% in the late 2000s. Factor migration has, in fact, contributed significantly to productivity

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<sup>52</sup> Brülhart (2009) argues, though, that NEG is still highly relevant for developing countries where the degree of urbanization is associated positively with growth (see also Brülhart and Sbergami 2009).

<sup>53</sup> We do not distinguish between raw labor and human capital here for simplicity, which can be justified by the finding of Fuchs-Schündeln and Izem (2012) that skills do not differ significantly between East and West German workers. The results of this back-of-the-envelope calculation are rather insensitive to the choice of the capital share ( $\alpha$ ).

convergence during this period, as suggested by neoclassical theory. However, the “technology gap”, i.e., the East-West productivity gap *not* attributable to differing factor intensities, has been large (about 15%) and has not decreased over time. This gap, which accounts for three fourth of the observed current productivity gap, cannot be explained by the standard neoclassical framework that treats total factor productivity (TFP) as a black box. By augmenting the standard neoclassical framework, several studies offer possible explanations for this the technology gap, though.<sup>54</sup> Still, we doubt that a framework built on decreasing returns to scale and perfect competition holds a comparative advantage for microeconomically explaining the stylized facts outlined in Section 3 as a whole.

Figure 7 about here.

## 6 Conclusions

This paper matches new economic geography (NEG) and German reunification, to explore, on the one hand, the contribution of NEG to understanding and explaining the economic effects of German integration after the fall of the Berlin Wall, and on the other hand, the contribution of German integration to identifying the strengths and weaknesses of current NEG theory.

We find that NEG reasoning is fairly well suited for explaining and understanding important aspects of the evolution of the German economy after reunification. It offers a plausible story for why the blooming East German landscapes predicted by Germany’s former chancellor Helmut Kohl have not appeared, and may not appear in the near future. At the same time, it offers a plausible story for why the catastrophic scenario of East Germany being depopulated has not, and likely will not, become reality either. In our view, the most plausible NEG view of German integration suggests that Germany may currently be somewhere close to the peak of the bell curve that describes the equilibrium relationship between integration and agglomeration in NEG. This would imply that further economic integration, fuelled, among others, by removing the “wall in the minds” of many Germans, will foster redispersion of economic activity toward East Germany.

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<sup>54</sup> For example, Burda (2006) suggests that migration costs may have slowed down economic convergence between East and West Germany below the rate predicted by Barro (1991). Canova and Ravn (2000) suggest that taxation of the (mostly West German) owners of physical and human capital to finance the social transfers may have discouraged capital investments and additional work effort by high-skilled workers after reunification. And Snower and Merkl (2006) suggest that regional differences in unemployment may be due to a host of institutional distortions of labor markets that boosted wages and unemployment in East Germany after reunification. These studies indicate that opening the black box of TFP may enhance the power of the neoclassical framework to explain selected aspects German integration.

Nonetheless, a good deal of uncertainty remains. This uncertainty relates, on the one hand, to possibly complex general equilibrium interactions among the many agglomeration and dispersion forces that shape the German economy, and to the adequate parameterization of NEG models, which is notoriously difficult. It is, for example, difficult to assess to what extent the removal of the “wall in the minds” will weaken the redispersion forces by enhancing the mobility of East Germans. On the other hand, the uncertainty relates to the extent to which economic forces ignored so far by NEG theory shape German economic geography. In addition to forward/backward linkages, knowledge spillovers or labor pooling may affect this economic geography significantly. If it were these externalities that drive agglomeration, further integration of East and West-Germany would less likely lead to redispersion because these externalities will not generally vanish in the course of economic integration. This is where NEG—or regional economics more generally—needs more theoretical and empirical research most urgently in our view. We need to trace back each of the three Marshallian externalities to specific characteristics and behavioral patterns of individual workers and firms in order to disentangle them from each other more clearly. This requires, amongst others, taking heterogeneity across workers and firms more serious. Workers should be assumed to differ not only in their locational tastes. They should also be assumed to differ in their knowledge or their abilities. Heterogeneity in individuals’ knowledge is obviously a necessary ingredient of the micro-foundation of knowledge spillovers and therefore of any “comprehensive theory of geographical economics in the brain power society” (Fujita 2007: 490). Important first steps to such a micro-foundation have recently been taken by Berliant and Fujita (2008, 2011). As to firm heterogeneity, recent developments in trade theory indicate that there is still something to be learned for location theory from the fact that more productive firms face different opportunities than less productive firms. A promising way of modeling worker and firm heterogeneity jointly is the approach invented recently by Behrens et al. (2010). Behrens et al. trace firm heterogeneity back to heterogeneity across individuals in a system-of-cities model.<sup>55</sup> Maybe this is the kind of modeling approach that has the potential to trigger the “post-Krugman revolution” that Behrens and Robert-Nicoud (2009: 469) consider overdue in NEG.

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<sup>55</sup> Behrens et al. (2010) explain spatial sorting of “more talented” individuals into cities and the existence of more productive firms in larger cities by a combination of individual talent and “luck”. Talent and luck jointly determine an individual’s productivity. An individual learns about his “luck” only after he made his location decision in this model. Individual location decisions thus depend only on talent while the occupational decisions (entrepreneur or worker) depend on productivity. The most productive individuals choose to become entrepreneurs and set up a firm while the less productive individuals choose to become workers. Since firms benefit from the size of the local market (forward/backward linkages), more talented individuals are generally better off in larger cities.

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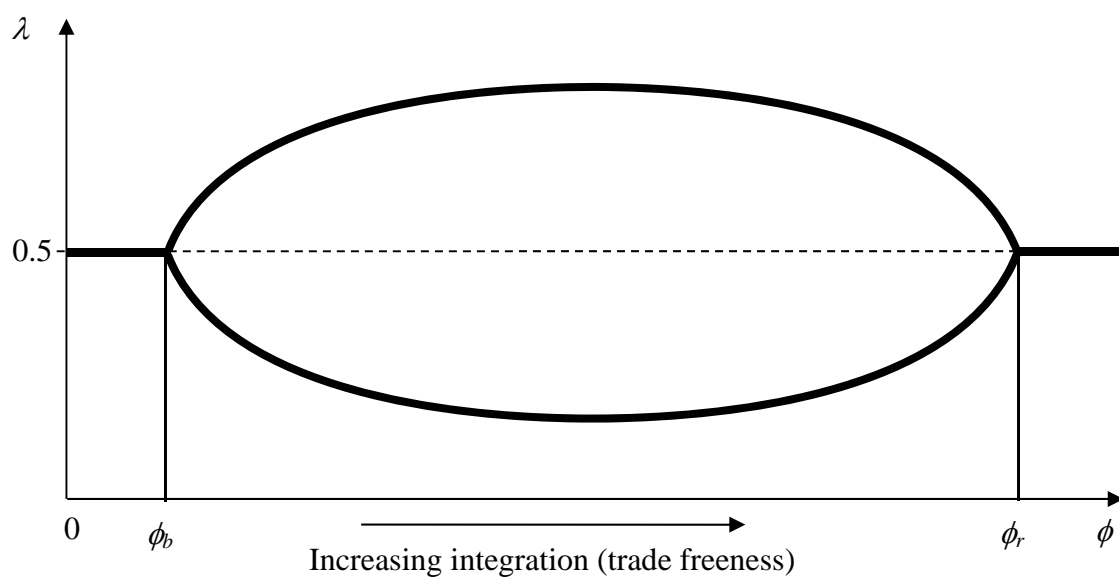
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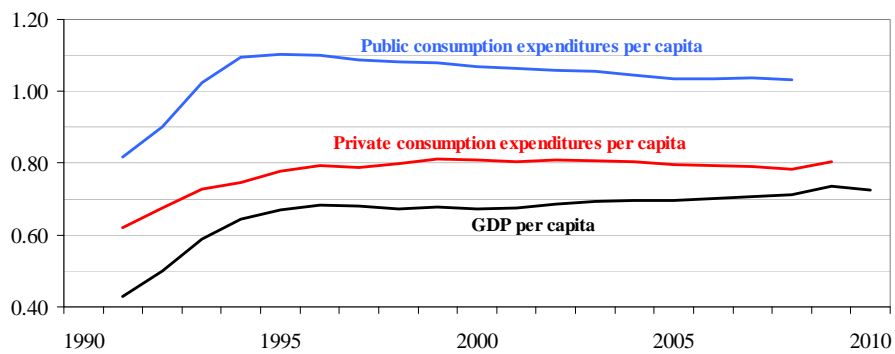
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Figure 1. Bell-shaped agglomeration pattern



Notation:  $\lambda$  ( $0 \leq \lambda \leq 1$ ): share of region 1 in total manufacturing employment.  $\phi$  ( $0 \leq \phi \leq 1$ ): integration level (freeness of trade),  $\phi_b$ : break point,  $\phi_r$ : redispersion point.

Figure 2. GDP, and private and public consumption expenditures per capita in East Germany (West Germany = 1)

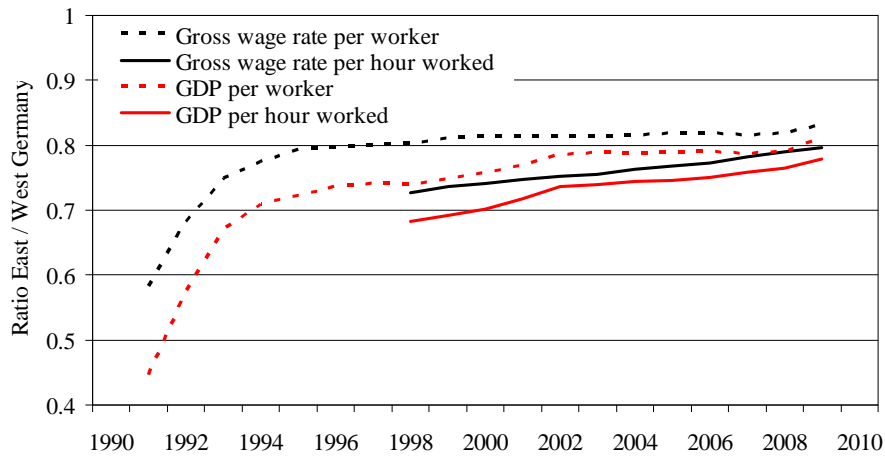


Note: East Germany inclusive, West Germany exclusive of Berlin.

Source: Statistische Ämter des Bundes und der Länder ([http://vgrdl.de/Arbeitskreis\\_VGR/ergebnisse.asp](http://vgrdl.de/Arbeitskreis_VGR/ergebnisse.asp)).

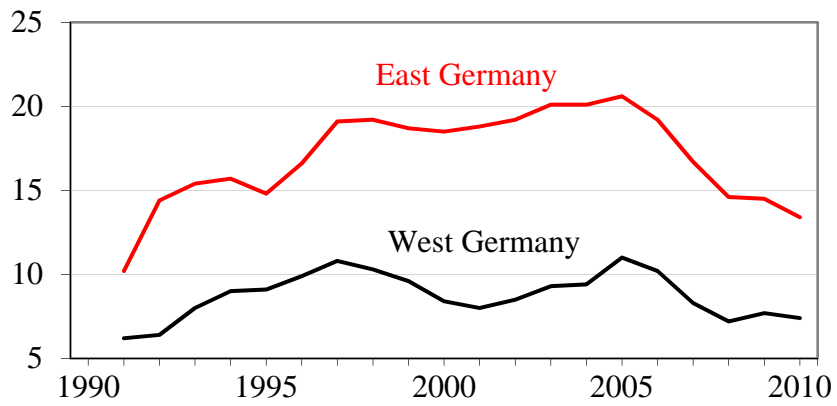


Figure 3. Nominal wages and average labor productivity in East Germany 1991 – 2009 (West Germany = 1)



Source: Statistische Ämter des Bundes und der Länder ([http://vgrdl.de/Arbeitskreis\\_VGR/ergebnisse.asp](http://vgrdl.de/Arbeitskreis_VGR/ergebnisse.asp)).

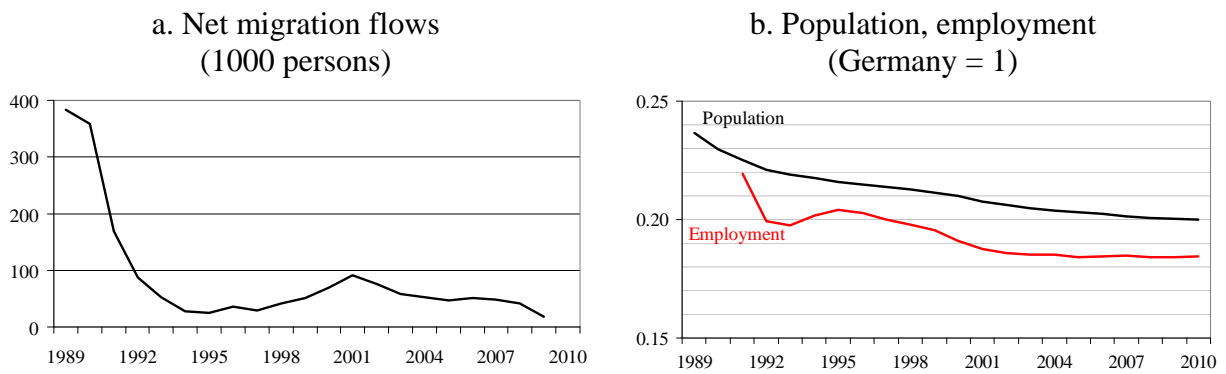
Figure 4. Unemployment rates in East and West Germany 1990–2010.



Note: East Germany includes Berlin

Source: Bundesagentur für Arbeit,

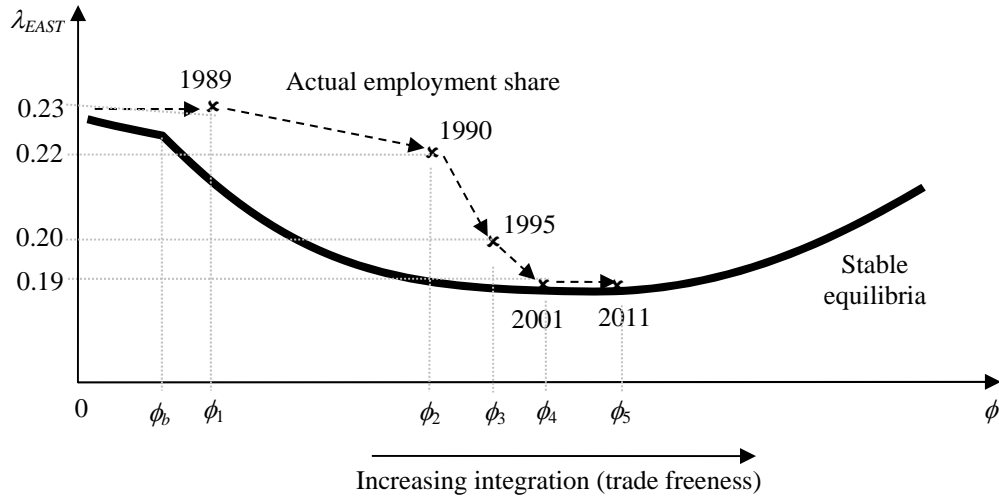
Figure 5. Net migration flows from East to West Germany and shares of East Germany in German population, employment, GDP and unemployment



Note: East Germany includes Berlin in all years and variables.

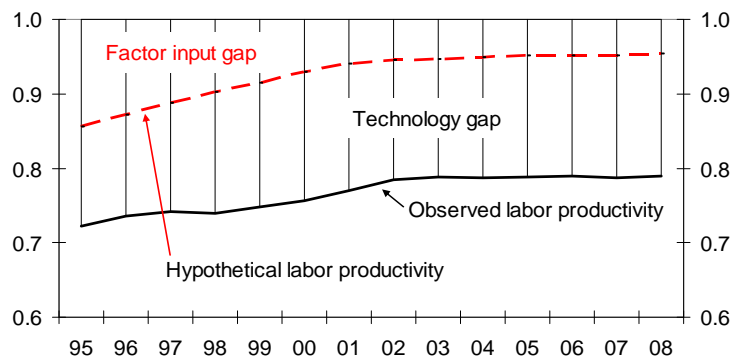
Sources: Bundesagentur für Arbeit, Statistisches Bundesamt, Statistische Ämter des Bundes und der Länder, Wolff (2010: 89).

Figure 6. Bell-shaped curve of equilibrium employment share and development of actual employment share of East Germany



Notation:  $\lambda_{EAST}$ : share of East Germany in total German employment,  $\phi$ : trade freeness.

Figure 7. Hypothetical and observed labor productivity in East Germany (West Germany = 100)



Note: Hypothetical labor productivity:  $y_E^*/y_W^* = (k_E/k_W)^{0.3}$ , where  $k$  is capital intensity (capital stock/person employed) and  $y$  is GDP/worker; observed labor productivity:  $y_E/y_W$ .

Source: Statistische Ämter des Bundes und der Länder ([http://vgrdl.de/Arbeitskreis\\_VGR/ergebnisse.asp](http://vgrdl.de/Arbeitskreis_VGR/ergebnisse.asp))