Department of Economics

Migration Trends in Reverse

The Effect of the Hartz Reforms on East to West German Net Migration

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1. Introduction

The last decade of the 20th century saw major political shifts on the European arena, one of the most significant being the German reunification. The collapse of the eastern bloc not only marked the end of communism in Eastern Europe but also led to the dissolution of East Germany as a sovereign state and its subsequent incorporation into West Germany in 1990. However, the political reunification of Germany did not automatically resolve the economic challenges in the region. In fact, Germany faced an economic stagnation which was addressed by a labour market restructure through Hartz Reforms I–IV in the beginning of the new millennium. While these reforms are widely debated and recognised to increase labour market flexibility (Jacobi et al. 2006), the discussion of their effects on internal migration, another inherited post-unification element, has been underrepresented. Historically the migration trend within Germany has been migration from former East (net sender of people) to former West (net receiver of people), however in the recent years this paradigm has shifted. The trend was explained by the better economic factors like wealth, employment and opportunities in the West labour market (Jacobi and Kluve 2007). Therefore, a change in net migration will also mean more equal economic conditions between the former East and former West. Notably, the start of the increase in the net migration from East to West has started around the implementation of the Hartz reforms in 2003. In the light of this fact, the aligning of these two at first sight uncorrelated events, raises interest in studying the effects of the reform, meant to improve the labour market, on the improvements in net migration from East to West Germany. Moreover, this observation is important to study in order to understand how extensive labour market policies affect demographical shifts and migration equilibriums.

1.1. Research Question and Objective

The aim of this study is to empirically examine whether the Hartz reforms. implemented between 2003-2005, affected the Eastern to Western Germany net migration in the 2000 to 2018 period. The study implements two migration theoretical frameworks, namely the Harris-Todaro Two-Sector Migration Theory (1970) and the Cumulative Causation Theory of Migration developed by Massey (1990). The hypothesis posits that the reforms, through their restructuring of the labour markets, accelerated historical migration trend from East to West throughout a cumulative effect over time. To investigate this, the study implements four empirical models, three different Two-Way Fixed Effects Difference-in-Differences Models,

and an Event Study Model with and without pre-2003 trend adjustment. For all the models we use two control variables, one year lagged GDP per capita per region and one year lagged population density per region. In order to avoid any endogeneity and bias effects, we calculate and assign the mean of the pre-treatment controls to the post treatment years. This thesis aims to answer the following research question:

How did the Hartz reforms affect internal net migration in Germany, from the former East to the former West?

The thesis project imposes clear and deliberate limitations on the research focus. It does not attempt to produce generalised findings, but rather a contextual and regional analysis of how the reforms affected East net migration. Moreover, it does not try to uncover through which mechanism the change in net migration happens, focusing only on the relationship between immigration minus emigration in the East Germany. Additionally, it does not attempt to provide results on how exactly a decrease or increse in net migration occurs in the East-West context. The findings are model based and purposively oversimplifying the complicated and multifactored mechanism that influences patterns and incentives for migration by only studying the impact of the reforms.

1.2. Thesis Structure

The thesis begins with an Introduction, outlining the historical context, the Hartz Reforms, and the research question and objective. The Migration Theories section presents migration theories like Harris-Todaro and Cumulative Causation, building the hypothesis on them. The research gap and previous literature is presented in the Previous Literature section. The Empirical Method explains the methodology, including Two Way Fixed Effects Difference-in-Differences, Event Study, and Parallel Trends. Results and Discussion analyse the Hartz Reforms' impact on East-West migration, followed by Limitations and a Conclusion summarising findings and suggesting future research directions.

1.3. Background

The Hartz Reforms, implemented between 2003 and 2005 (legislated from 2002-2004), aimed to revitalise Germany's labour market through a series of structural changes. Hartz I (2003) introduced Personal Service Agencies (PSAs) to match unemployed workers with jobs and launched a voucher system for state-assigned job placement, though the PSA program was

ultimately deemed unsuccessful (Gaskarth 2014: 15–18). Hartz II (2003) created "mini-jobs" and "midi-jobs," promoting part-time work through tax incentives; by 2003, these were predominantly held by women, either under 20 or over 64, and mostly married (Gaskarth 2014: 20–21). Hartz III (2004) restructured the Federal Employment Agency, tightened benefit eligibility, and imposed sanctions for job refusal, including relocation or accepting low-wage work, it also reduced social security contributions and income taxes (Gaskarth 2014: 24). Hartz IV (2005) implemented major benefit cuts, capping payments at €345 in the West and €331 in the East, introduced one-euro jobs for the long-term unemployed, and finalised previous institutional reforms (ibid). In short, the Hartz reforms sought to improve the labour market by creating vocational programs, by cutting benefits and by reducing barriers on work for different groups (Rinne et al. 2017: 4). Despite large initial reductions in unemployment in the immediate aftermath of the reforms, the probable success of the reforms remains disputed. The apparent improvements following the reforms must therefore be viewed in a broader light of demographic changes, especially if they illustrate the rather traumatic post-cold war legacy of the modern German state. At the same time, the official data on net migration shows a steady increase in the East net migration, specifically in the periods 2001-2005 and 2008-2014. This emerging migration trend aligns very close to the legislation and implementation period of the Hartz reforms. Ultimately turning East Germany in a net importer of people as their net migration becomes positive after 2013.

Figure 1: Net migration per region

Note: Run without controls or FE
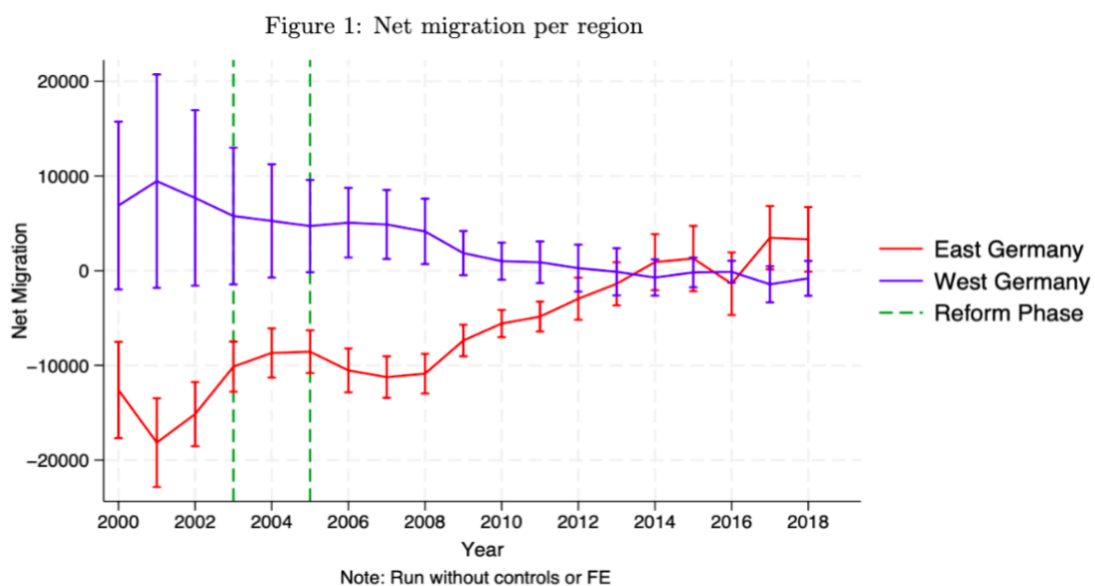
2. Migration Theories

2.1 The Harris-Todaro Migration Theory

The Harris-Todaro model (Harris & Todaro 1970: 126) argues that rural-urban migration decisions are driven by expected wage differentials rather than solely existing or actual wages. Unlike classical equilibrium models that assume wage flexibility and full employment, Harris and Todaro incorporate the possibility of institutionally determined urban wages that remain above rural earnings (Harris & Todaro 1970: 127). In more concrete terms, the expected urban wage is equal to the minimum or institutional wage, multiplied by the probability of securing employment, where:

$$Wu = Wm(Nm/Nu)$$

Here, W_M is the institutional or minimum urban wage, N_M is the number of workers actually employed in urban areas, N_U is the total urban labour force (including new migrants).

As long as W_U exceeds W_A (where W_A is the rural wage, often conceptualised as the marginal product of agricultural labour), migrants from less-industrialised or lower-income regions are drawn to urban areas in search of higher expected earnings, despite the risk of unemployment (Harris & Todaro 1970: 128). Over time, if the minimum wage remains above competitive levels, a persistent pool of urban unemployed emerges, as the number of job-seeking migrants outpaces available industrial jobs (Harris & Todaro 1970: 129). In equilibrium, rural marginal product (W_A) converges to urban expected wage W_A, but the actual wage (W_M)cannot fully equilibrate labour supply and demand if it is institutionally fixed above the market-clearing level (Harris & Todaro 1970: 131).

2.2 The Cumulative Causation Theory of Migration

The Cumulative Causation Theory of Migration developed by Massey (1990), posits that migration is not a one-time event driven solely by immediate economic disparities but rather a self-reinforcing process. According to Massey (1990), the process of migration evolves through distinct yet overlapping phases that reflect the cumulative and self-reinforcing nature of movement. In the initial phase, migration is often sparse and led by pioneering individuals who establish the first social and economic connections between origin and destination regions (Massey 1990: 5). These early movers serve as critical information nodes, providing valuable

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insights about labour markets, living conditions, and logistical challenges to potential migrants. As migration progresses into the network expansion phase, these social ties grow denser, reducing the financial and informational costs of moving, and effectively lowering barriers to entry for future migrants (Massey 1990: 9). This expansion strengthens a cycle of dependency and flow, where the presence of established networks significantly decreases the risks associated with migration. Finally, migration reaches a stage of saturation and self-sustaining momentum, where nearly every household in the origin community becomes linked to migrant networks, perpetuating movement through social obligations and reduced costs (Massey 1990: 12). At this stage, migration becomes less dependent on economic differentials alone and is driven largely by established pathways and social expectations. This cyclical and reinforcing process illustrates how migration intensifies over time, structured by both social capital and economic opportunity.

2.3 Hypothesis

Drawing on both Harris-Todaro's framework (Harris & Todaro, 1970) and Massey's Cumulative Causation Theory of Migration (Massey, 1990), we posit the following hypothesis:

 "The Hartz reforms accelerated the historical East to West migration trend through a cumulative mechanism over time."

The Hartz reforms, by restructuring Germany's labour market and attempting to lower the economic disparities between East and West in fact increased the expected income inequality between these two regions. The reforms focus on creating incentives to join the labour force through low paid jobs and lower unemployment benefits increased the economic inequalities between the regions. One example is the post reform unemployment benefits in East being €331 and in the West €345 mentioned above. According to Harris-Todaro, this incentivised labour mobility as individuals migrated towards regions with higher expected urban income (Harris & Todaro, 1970). Over time, as migration networks expanded, the cumulative causation effect described by Massey (1990) intensified this trend, lowering the economic and social costs of movement and embedding new migration pathways that perpetuated further outflows from East to West. Empirical evidence from the early 2000s strongly supports this theoretical mechanism. An analysis of wage differentials conducted by Karlsson (2009) reveals that East German workers earned approximately 31% less than comparable workers in the West (Karlsson 2009: 29). The study findings reinforce the notion that migration decisions might be

driven not by current employment availability alone, but by the expected wage gains associated with Western labour markets. Further empirical evidence is provided by Schank, Schnabel and Wagner (2023), who uses linked employer–employee microdata to track wage trajectories across Germany. Their findings show that even by the mid-2010s, Eastern workers continued to earn significantly less than their Western counterparts, around 20% less on average, despite similar qualifications and job roles (Schank et al. 2023: 18).

2.4 Reflections and Limitations of the Theories

While the Harris-Todaro model provides a foundational understanding of migration driven by expected wage differentials (Harris & Todaro, 1970), its static nature limits its explanatory power in complex labour markets like post-reform Germany. As Lall, Selod, and Shalizi (2006) points out, the model oversimplifies migration as a one-time decision, overlooking critical dynamics such as return migration, job search from rural areas, and evolving labour market attachment (Lall et al. 2006: 17–18). Furthermore, the model assumes homogeneous labour and risk-neutral agents, neglecting individual heterogeneity and risk aversion that significantly influence migration decisions in uncertain job markets (Lall et al. 2006: 17). Additionally, the binary classification of labour markets into formal employment and unemployment ignores underemployment and the informal sector, which are crucial components of urban labour absorption (Lall et al. 2006: 18). This simplification distorts expected income calculations, particularly for low-skilled or newly arrived migrants. The model's assumption of random job allocation further overestimates employment probabilities, ignoring real-world job search mechanisms like referral networks and varying job-search intensity (Lall et al. 2006: 18).

Moreover, the Cumulative Causation Theory of Migration (Massey, 1990) provides a compelling explanation for how migration perpetuates itself through self-reinforcing mechanisms but still presents some shortcomings in the context of our study. A central critique is that Massey's framework does not explicitly distinguish between internal and external migration, focusing predominantly on international flows where barriers such as legal restrictions, border controls, and cultural differences significantly shape the phases of network expansion and cost reduction. In contrast, internal migration within Germany is unencumbered by such barriers, allowing for more fluid mobility between regions. This ease of movement potentially compresses the distinct phases Massey describes such as initial migration, network expansion, and saturation. As a result, the self-reinforcing mechanisms predicted by cumulative

causation may unfold more rapidly or appear less structured in domestic migration flows. Furthermore, Massey's theory predominantly attributes the persistence of migration to economic incentives and social networks, yet it does not fully account for other drivers of internal migration. In the German context, East to West migration is not solely motivated by economic disparities but also by factors like family reunification, educational opportunities, and retirement, which are less contingent on network-driven cost reductions. These alternative motivations may dilute the observable impact of cumulative mechanisms, making migration less predictable and less driven by economic pathways alone.

3. Previous Research

Previous literature on the Hartz reforms predominantly examines their effects on labour market dynamics, employment stability, wage adjustments, and microeconomic outcomes. Krebs and Scheffel (2013) expands the discourse by adopting a macroeconomic perspective, focusing specifically on the Hartz IV reform and its impact on structural unemployment in Germany. Utilising a structural macroeconomic model that incorporates job-search incentives and incomplete markets, they demonstrate that Hartz IV significantly reduced the noncyclical unemployment rate by approximately 1.4%, from an average of 9% during 2000–2004 to around 7.6% post-reform (Krebs & Scheffel 2013: 684). This reduction primarily arose from increased job search incentives, which led to higher job-finding rates, particularly among the long-term unemployed, whose quarterly job-finding rate rose from 6.3% in early 2004 to 9.3% by early 2006 (Krebs & Scheffel 2013: 670). Further contributing to the debate, Kügler and Bradley (2019) employs detailed micro-level worker-firm matched data and structural labour market modelling to investigate the wage and employment impacts of the Hartz reforms. Contrary to expectations that the reforms would significantly stimulate employment, their results indicate that the reforms did not meaningfully increase overall employment. Instead, they observed a pronounced decline in wages, with average reductions estimated at approximately 4% across all skill groups (Kügler & Bradley 2019: 34). In contrast, Walter (2010) specifically addresses the participation of immigrants in the German labour market following the Hartz reforms, offering insights into shifts in welfare dependency and labour market integration among international migrant populations. Using detailed comparative analysis, Walter demonstrates that the reforms substantially altered welfare eligibility criteria and benefit levels, resulting in decreased welfare dependency rates among immigrants.

However, this outcome coincided with increased economic vulnerability and heightened risks of poverty among this group, particularly affecting migrants with lower skill levels and limited labour market access (Walter 2010: 126-128). However, the existing literature consistently overlooks how the Hartz reforms may have created new incentives affecting internal migration trends between the former Eastern and Western Germany. While older studies such as Burda (1993) already identified key demographic patterns in East-West migration, particularly the high mobility of young people and a U-shaped correlation between migration and town size, this research predated the Hartz reforms and cannot capture the policy-induced effects of structural labour market changes. Similarly, Burda et al. (1998) provides valuable insights into the behavioural drivers of migration using a semiparametric model, finding that individuals at both lower and higher ends of the income distribution are more likely to migrate, a dynamic particularly relevant when considering how Hartz IV altered employment incentives and welfare structures. Their findings suggest that income-related migration incentives may have become more pronounced under the Hartz regime but remain empirically untested in the post-reform context.

Expanding the broader economic analysis of migration, Borjas (1999) provides a comprehensive theoretical framework for understanding labour flows, emphasising that migration, whether internal or international, is fundamentally driven by income maximisation motives. His model of migration decisions (Borjas 1999) and labour market outcomes offers valuable insights into how wage differentials and skill compositions influence individual migration incentives. Particularly relevant for our study is his discussion of how migration shocks, whether from immigration or internal mobility, affect local labour market equilibria (Borjas 1999). While Borjas primarily focuses on international migration, the underlying mechanisms he identifies, such as the impact of supply shocks on regional wages and the responses of native workers through internal migration, are applicable to internal migration dynamics within a country like Germany after the Hartz reforms. Nevertheless, despite offering a robust framework for understanding labour market responses to migration, Borjas's analysis remains theoretical and does not empirically test how structural labour market reforms, such as Hartz reforms, might alter internal migration incentives or flows. Adding a broader economic dimension, Grabka, Schwarze and Wagner (1999) explores the impact of East-West migration on income distribution post-reunification. They show that although income inequality in East Germany increased, government transfers helped mitigate the effects of market-driven disparities, and migration played a role in equalising income across the country. Yet, their study

does not extend to analysing whether subsequent policy changes like Hartz reforms influenced these migration patterns further.

3.1. Research Gap

The existing literature consistently overlooks how the Hartz reforms may have created new incentives affecting internal migration trends between the former Eastern and Western Germany. Given the historical and persistent economic disparities between these regions, understanding whether and how the reforms influenced internal migration decisions is critical. The omission of internal migration analysis represents a significant gap, as migration could have been a direct response to altered employment opportunities, wage structures, and benefit conditions introduced by the reforms. Therefore, this study explicitly addresses this dimension, investigating the extent to which the Hartz reforms reshaped internal migration patterns from East to West Germany. Moreover, our research will connect two relevant economic topics regarding modern Germany, namely the effects of the Hartz reforms and the internal migration trend (East to West). This study addresses that gap by conducting a macro-level analysis of Hartz reform effect on regional net migration.

4. Empirical Method

4.1. Two-Way Fixed Effects Model

In this study, we employ a Two-Way Fixed Effects Difference-in-Differences (TWFE-DID) model to estimate the causal impact of the Hartz reforms on net migration patterns across German federal states. This method is especially appropriate for our panel dataset, which includes multiple observations for the same units (states) over time, and where both state-level and temporal unobserved heterogeneity may confound the estimated treatment effect. As Allison (2009) explains, fixed effects models are designed to eliminate bias from all time-invariant characteristics of the units, regardless of whether these are observed or unobserved (Allison 2009: 11). The TWFE extension allows us to include both unit (state) and time (year) fixed effects, thereby accounting for unmeasured characteristics that are constant within states over time as well as nationwide shocks or trends that could influence migration uniformly, such as macroeconomic cycles or policy shifts (Allison 2009: 17–18). This dual control is crucial in our context, given the structural economic differences between East and West Germany and

the national scope of the Hartz reforms. By absorbing these sources of heterogeneity, the TWFE framework enables a more credible estimation of the differential effect of the reform in treated (Eastern) versus control (Western) states.

4.2. Regressions

To capture the structural break induced by the reform, we define a binary treatment variable (Reform) which equals 1 for all years from 2003 onwards and 0 otherwise. Our group indicator (post treatment group) comprises the five Eastern federal states (excluding Berlin), which are structurally distinct from Western states due to their historical legacy. We thus define a binary indicator (East) equal to 1 for Eastern states and 0 for Western states. In the context of our study, the exclusion of Berlin is necessary to uphold the Stable Unit Treatment Value Assumption (SUTVA), a core condition for valid causal inference in treatment effect models. As outlined by Rubin (1980), SUTVA requires that each unit has a clearly defined treatment status, and that no unit's outcome is affected by the treatment assigned to another (ibid: 591). Berlin violates this assumption, as its unique status as a reunified city that blends both Eastern and Western institutional, economic, and demographic characteristics makes its classification as either treated (East) or untreated (West) inherently ambiguous.

We utilise two main two-way regressions with fixed effects for time and cross-provincial data. The first regression model relies on the interaction between the Reform dummy and the East German dummy and assumes linear effects on migration:

$$(1) \ Y_{it} = \beta(Reform_t \times East_i) + X_{it}`\gamma + \psi_i + \delta_t + \varepsilon_i$$

Here, (*i*) indexes federal states and (*t*) indexes years. Unit fixed effects (ψ_i) and time fixed effects (δ_t) absorb time-invariant regional differences and nation-wide shocks, respectively. Standard errors (ε_i) are clustered at the state level to allow for arbitrary within-state serial correlation. The outcome variable (Y_{it}) is net migration, measured as the difference between in-migration and out-migration per state-year. Due to data limitations and the COVID pandemic, 2000 to 2018, is our estimation window. The key explanatory variable is the interaction between a reform dummy and an East dummy. Control variables (X_{it}) include one year lagged GDP per capita, and population density. Our main assumption here is imperfect labour mobility, meaning that an increase or decrease in one of those variables will influence migration levels the following year. This is meant to realistically reflect the migration barriers such as moving preparations, costs and retraining periods, but also how migration decisions

are made only after the individuals observe the changes in the GDP per capita, or population density. Based on the analysis presented in Mayda (2005), the use of lagged economic indicators as control variables in migration studies is well-justified. Mayda's study, which examines the determinants of international migration flows across fourteen OECD countries, demonstrates that economic variables in both the origin and destination countries significantly shape migration decisions. Importantly, Mayda emphasizes that migration decisions are not made instantaneously; rather, they respond to economic conditions with some temporal lag. Therefore, the inclusion of these lagged economic indicators aligns with established practices in migration studies. We freeze the post reforms values by calculating the mean of controls during the 1991-2002 period and assign it from 2003 onwards in order to isolate these control variables from any reform effects. GDP per capita captures economic performance and prosperity, and population density accounts for infrastructural variation and urbanisation levels. The control variables are reflecting and aligned with the Harris-Todaro Theory model, giving us insights if increases in population density and GDP per capita are influencing East-West migration. Based on this regression model, we compute and present six TWFE models. Baseline (no fixed effects), State FE only, TWFE (state and year), TWFE and population density, TWFE and GDP per capita, TWFE and all controls (population density & GDP per capita).

The second regression model is the same as the first one for all variables except how we divide the reform dummy into two phases to account for the cumulative effect of migration that can be more pronounced after several years from the implementation period 2003-2005:

$$(2)\ Y_{it} = \beta_1(Phase_{East} \times East_i) + \beta_2(Post_{East} \times East_i) + X_{it}'\gamma + \psi_i + \delta_t + \varepsilon_i$$

The two-phase TWFE model draws its theoretical strength from Massey's (1990) Cumulative Causation Theory of Migration (Massey, 1990). By disaggregating the post-reform period into an immediate phase (2003–2005) and a post-reform phase (2006–2018) and multiplying them with the east dummy, the model captures both the initial impact of the Hartz reforms and the potential for cumulative migration growth as networks mature and job market dynamics stabilise. This temporal distinction allows us to examine whether migration responses emerge swiftly following the policy implementation or if they materialise more gradually as information and labour market conditions adjust over time. Empirically, the two-phase structure introduces non-linear treatment effects, permitting us to distinguish between short-

term shocks and long-term adjustments. Unlike a single reform dummy, this approach captures the potential for heterogeneous responses.

To further investigate the temporal dynamics of net migration across German federal states, we employ a modified Two-Way Fixed Effects Model. The central feature of this model is the interaction term, which captures the differential effect of each year on net migration specifically for Eastern states, other terms being the same as in previous models. This allows us to observe how net migration diverges between East and West Germany annually, reflecting the impact of the reforms over time. The model is specified as follows:
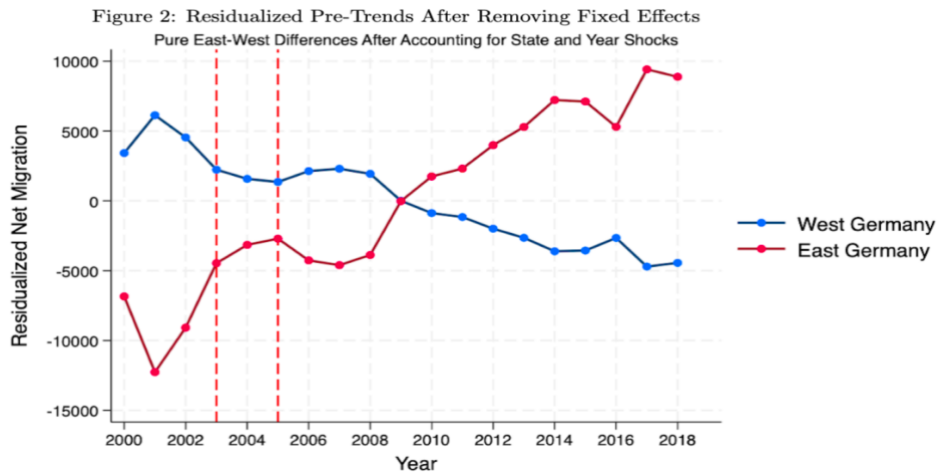
$$(3)\ Y_{it} = \beta(Year_t \times East_i) + X_{it}`\gamma + \psi_i + \delta_t + \varepsilon_i$$

In order for our results to be valid and consistent in presenting the reforms effects on migration, the Parallel Trends Assumption needs to be non-violated, this is the main underlaying assumption for a TWFE model. We discuss in detail this assumption and if it holds for our study in the following section. We also implement a series of placebo tests. We re-estimate the models using artificial treatment years before 2003, specifically 2000, 2001, and 2002, to check if there are any significant treatment effects in the absence of the Hartz Reforms. Additionally, we conduct joint F-tests on the pre-treatment interaction terms to assess whether they are jointly different from zero. Also, we implement the Leave-One-Out Analysis. This test re-estimates the model iteratively, excluding one state at a time, to verify that our results are not driven by any single federal state. For the non-linear TWFE model, we construct 4 other models with different cut points in years 2006, 2007, 2008 and 2009 to increase the robustness and exclude the arbitrary argument of our main cut point. If they all present similar coefficients, we know that the effect in two phases was not specific to our model specification periods.

4.3. Parallel Trend Assumption Tests

The credibility of the TWFE estimation strategy depends critically on the Parallel Trends Assumption (PTA). Meaning, in the absence of the Hartz Reforms (I-IV), net migration trends in Eastern and Western Germany would have evolved similarly. To validate this assumption, we perform both graphical and statistical tests. The visual inspection of the Figure 2 reveals different trajectories for net migration rates in East and West Germany. Specifically, from 2000 to 2002, the lines depicting East and West Germany mirror each other, suggesting that East Germany was constantly experiencing negative net migration, meanwhile West Germany was experiencing a constant positive net migration. Moreover, we can observe the inconsistency in

net migration for East Germany in 2000, 2001 and 2002. One plausible economic explanation could be that those years witnessed an anticipatory effect in migration related to the Hartz reforms, which, though implemented in 2003, were legislated and widely publicised before. Thus, that period might represent a deviation or shock rather than a trend continuation.

Figure 2: Residualized Pre-Trends After Removing Fixed Effects
Pure East-West Differences After Accounting for State and Year Shocks

Turning to statistical analyses, we test the identifying assumption of parallel trends required for causal inference in our framework. Specifically, we posit the following hypothesis:

H_0: In the absence of treatment, the difference in migration outcomes between East and West Germany would have followed parallel trajectories.

H_1: Migration outcomes between East and West Germany exhibited differential pre-reform trends.

To empirically evaluate this assumption, we estimate a fully flexible model with both state fixed effects and year fixed effects that includes relative time indicators for each pre-reform year (2000, 2001, and 2002). These indicators are interacted with the East Germany dummy to capture potential pre-treatment differences in net migration trends between Eastern and Western states. The fully flexible specification allows us to estimate the differential effect for each pre-reform year separately. Our analysis reveals evidence of differential pre-treatment trends between East and West Germany (Table 1). First, the non-monotonic pattern in pre-reform differentials challenges the simplistic linear divergence narrative.

Table 1: Differences in East-West migration trends, 2000-2002

Year	Coefficient	Robust SE	t-statistic	p-value
2000	−12,906.18	8,053.57	−1.60	0.131
2001	−21,037.98	10,485.05	−2.01	0.065*
2002	−16,260.08	8,364.07	−1.94	0.072*

Joint test: $F(3, 14) = 2.50$, p = 0.1021
* Significant at 10% level

East German states experienced a substantial negative differential in 2000 (-12,906), which deepened in 2001 (-21,038) before partially recovering in 2002 (-16,260). This V-shaped pattern suggests complex underlying dynamics that standard TWFE models may fail to capture. The partial recovery could reflect anticipation effects, with migration patterns beginning to respond to announced reforms. It could also mean a temporary shocks or pre-existing cyclical patterns in East-West migration unrelated to reforms. Second, the marginally significant coefficients at 10% for 2001 and 2002 ($p = 0.065$ and $p = 0.072$, respectively) provide evidence of differential pre-trends. While not definitively rejecting parallel trends at the 5% level, these results raise substantial concerns about the validity of this assumption. Given also the fact that we have a very limited number of years observed before the reform implementation, we conclude that there is sufficient evidence to reject the null hypothesis. Moreover, the short pre-reform timespan significantly limits the robustness and generalisability of our assumption validation. Typically, rigorous assessments of PTA rely on longer pre-treatment periods to reliably capture trend dynamics and isolate genuine policy effects. Given these nuanced observations, our assessment indicates that the parallel trends assumption is compromised due to limited pre-treatment data and potential anticipation-driven migration responses. Such violations necessitate a cautious interpretation of subsequent TWFE results. Future analyses could benefit from longer pre-treatment data series or alternative identification strategies.

4.4. Event Study Model

To capture the dynamic effects of the Hartz Reforms on net migration across German federal states, we employ an Event Study Analysis enriched with a Pre-Trend Adjustment. This model assumes that conditional on explicitly controlling for the differential trend identified in the pre-reform period (2000-2002), no further systematic differences exist between East and West Germany's migration trajectories aside from the reform's direct impact. In other words, the divergence in migration trends observed between East and West Germany during the 2000-2002 period primarily reflects a systematic anticipatory response to the Hartz reforms, which

were legislated and publicly known prior to their official implementation in 2003. Under this assumption, the migration dynamics during these specific pre-reform years (2000-2002) constitute a distinct, identifiable shock that differs from the baseline migration trend. By isolating and removing these differences, the pre-trend adjustment sharpens the analysis, allowing us to identify policy-driven changes more accurately. Given the staggered nature of the Hartz Reforms (I-IV), this method enables us to identify not only average treatment effects but also the timing and trajectory of these effects. We estimate the pre-reform migration trends separately for East and West German states over the 2000 to 2002 period. For East Germany, we calculate the average yearly change in net migration, represented as the slope (β_{east}). For West Germany, we perform the same calculation, yielding a separate slope (β_{west}). The difference between these two slopes is interpreted as the differential trend in migration patterns before the Hartz Reforms. This estimation is critical because it reveals systematic differences in migration flows that existed independently of the reform itself. If not accounted for, these underlying disparities could distort our estimates of the Hartz Reforms' true effect, leading to biased conclusions. Once the differential pre-trend is estimated, we proceed to adjust the net migration data for East Germany in the post-2002 period:

$$Y_{it}^{adj} = Y_{it} - (\beta_{east} - \beta_{west)}) \cdot (t - 2002)$$

This adjustment removes the pre-existing differential trend from the East German migration figures, aligning them more closely with the counterfactual scenario of parallel pre-trends. By recalibrating the outcome variable in this manner, we ensure that observed changes after 2003 can be more confidently attributed to the Hartz Reforms rather than to pre-existing migration patterns. Our model is constructed in the following way:

$$(4)\ Y_{it}^{adj} = \sum_{k=-n}^{n} \beta_k D_{it}^k + X_{it}'\gamma + \psi_i + \delta_t + \varepsilon_{it}$$

Here, (Y_{it}^{adj})denotes the adjusted net migration, (D_{it}^k) represents event-time indicator variables centred around the reforms' implementation (2003) with the base year set at 2002, (X_{it}') captures regional control variables (lagged GDP per capita and population density), and (ψ_i), (δ_t) and (ε_{it}) denote state fixed effects, year fixed effects and standard errors. The inclusion of state and year fixed effects ensures that unobserved heterogeneity and common stocks are controlled for, enhancing the reliability of the estimated impacts. Standard errors are clustered

at the state level, reflecting the potential correlation of observations within each federal state over time. Furthermore, this event study model enables a granular understanding of the timing of effects. By observing the trajectory of coefficients over time, we can assess whether the reform's impact was immediate, gradual, or subject to lags. This temporal decomposition is particularly relevant for labour market reforms, where adjustment to new incentives and labour market conditions may not be instantaneous.

To statistically verify the efficacy of our pre-trend adjustment, we conduct a joint significance test on the coefficients corresponding to the pre-reform years (2000 and 2001). This test assesses whether any significant differential migration patterns between East and West states persist after applying our adjustment. The resulting adjusted p-value provides a direct statistical measure of our success in aligning pre-reform trends, where a high p-value indicates no statistically significant differences remain in pre-treatment migration trends. Complementing our main specification, we utilise the simple Event Study Model (without any pre-trend adjustments) as both a robustness check and a visualisation tool of the reform's effects for the same period and base line year 2002. This model's primary role is to offer a baseline comparison to our adjusted results relative to the 2002 net migration level. By contrasting the two event studies graphically, we transparently illustrate the degree to which the pre-trend adjustment influences our findings. If both models produce similar outcomes, it provides robust evidence that our main conclusions are not artifacts of the adjustment procedure. Conversely, substantial differences between the adjusted and simple models underscore the necessity of correcting for pre-existing trends, highlighting the methodological robustness of our main specification.

4.5. Urban–Rural Classification: West and East Germany

In applying the Harris-Todaro model to Germany's regional migration dynamics, we rely on the European Commission's classification to distinguish between rural and urban regions. According to the Commission's definition, regions with a population density below 300 inhabitants per square kilometre are considered rural, whereas those exceeding this threshold are classified as urban (European Commission, 2014). This classification allows us to systematically categorise German states according to their mean population densities, as shown in Table 2. Apart from Baden-Württemberg, whose classification fluctuates over time (mean ≈ 0.42), all other states demonstrate stable identities throughout the observed period. However,

the rural-urban classification does not neatly overlap with Germany's historical East-West division. To address this challenge, we are going to calculate and use the mean population density of former West and East Germany (excluding Berlin) during 1991-2018 (all the data available on population density to us) in order to be able to classify them as urban or rural regions. This assumption will allow for a consistent operationalisation of the rural-urban divide, which is essential for applying the Harris-Todaro model to the German context. Moreover, this classification facilitates empirical tractability. In the absence of detailed sub-regional migration, grouping states into rural (East) and urban (West) categories based on population density provides a manageable yet meaningful way to capture the structural characteristics relevant to our research. Finally, due to limitations in time and available resources, this simplifying assumption enables us to conduct a theory-driven and empirically grounded investigation within the scope of this research project. As a result of this assumption, the mean population density of former West states is 613.21 inhabitants per square kilometre, and 131.79 for the former East states (without Berlin). Hence, East Germany can be classified as a rural region, while the West classified as an urban region during the 1991-2018 period.

Table 2: State Summary Statistics with fractions

State	Urban Count	Rural Count	Pop. Density	Urban (mean)	East
BadenWürttemberg	12	16	296.4	.42	0
Bayern	0	28	175.3	0	0
Brandenburg	0	28	85.5	0	1
Bremen	28	0	1593.1	1	0
Hamburg	28	0	2306.5	1	0
Hessen	0	28	287.1	0	0
MecklenburgVorpommern	0	28	73.8	0	1
Niedersachsen	0	28	164.9	0	0
NordrheinWestfalen	28	0	524.0	1	0
RheinlandPfalz	0	28	202.0	0	0
Saarland	28	0	405.6	1	0
Sachsen	0	28	233.6	0	1
SachsenAnhalt	0	28	121.7	0	1
SchleswigHolstein	0	28	177.0	0	0
Thüringen	0	28	144.4	0	1

Total number of unique states: 15. Eastern states: 5, Western states: 10.
Time period covered: 1991 to 2018.

Note: This table provides the classification of each federal state. The Urban and Rural Fraction columns indicate how many times a state is classified as urban or rural, during the total of 28 observed years. The Mean Population Density represents the average number of inhabitants per square kilometer over the full observation period. The Urban (Mean) column reflects the average value of the urban dummy across all years and serves as a reliable indicator of a state's overall urban or rural identity. Lastly, the East column indicates whether a state belonged to the former East Germany.

4.6. Data

We construct our panel data dataset from the archives of the Statistisches Bundesamt (Federal Statistical Office of Germany), the official national statistical authority. As a long-standing and methodologically rigorous institution, the Statistisches Bundesamt ensures consistent definitions, comprehensive coverage, and systematic quality controls. By relying on these official archives for internal net migration, GDP, population per state, and state area measures,

we increase the internal validity and replicability of our analyses, thereby enhancing the overall robustness of our study.

Table 3: Descriptive Statistics

	N	Mean	Std. Dev.	Min	Max
Federal States	420	8.867	4.535	1.000	16.000
Years	420	2,004.500	8.087	1,991.000	2,018.000
Eastern States	140	1.000	0.000	1.000	1.000
Western States	280	1.000	0.000	1.000	1.000
Urban States	124	1.000	0.000	1.000	1.000
Rural States	296	1.000	0.000	1.000	1.000
Total Net Migration	285	-201.281	14,236.165	-74,353.000	61719.000
GDP per Capita	420	27.840	10.196	6.621	64.611
Population Density (km²)	420	452.738	613.399	69.000	2,438.000
Lagged GDP per Capita	405	22.523	7.924	6.621	47.590
Lagged Population Density	405	452.196	604.097	76.000	2,286.000

Total number of unique states: 15. Eastern states: 5, Western states: 10.
Time period covered: 1991 to 2018.

The data for these variables is gathered and grouped at the state level, covering the 15 federal German states from 1991 to 2018 for control variables, and from 2000 to 2018 for net migration (Destatis, 2025). Our main outcome variable, net migration called "net_mig", is measured as the difference between the total number of arriving and departing migrants within each state, inclusive of all age and gender groups (Destatis, 2025). Due to data constraints, migration data is available only from 2000 to 2018, resulting in 285 observations. This time frame is optimal as it avoids the COVID-19 period, which introduced an exogenous shock to migration flows. For the control variables, GDP per capita and population density, we extend the observation window back to 1991 to capture pre-treatment conditions that are crucial for robust estimation. Population density is calculated as the total population divided by the land area of each federal state, with the area provided in square kilometres. All values are expressed in thousands for better interpretability and numerical stability during estimation. The raw data underwent several stages of meticulous preparation. First, the migration data were imported, standardised, and reshaped into a panel format by state and year. GDP and population datasets were similarly reshaped and cleaned. State names were harmonised across all datasets to ensure seamless merging. To address concerns about endogeneity and potential confounding from the Hartz reforms themselves, the control variables, GDP per capita and population density, were lagged and averaged over the pre-reform period (taking value of the mean of 1991–2002). The lagged control variables are named "popden_pre_ll" and "gdp_pre_ll". This method isolates

structural differences between states, preventing post-reform contamination of the controls. This process results in slightly fewer observations for lagged controls (405 instead of 420) due to the loss of the initial year in the lagged series. In summary, the final dataset comprises 420 observations for control variables, years and states (of which 140 for East and 280 for West), 285 observations for net migration, and 405 observations for lagged controls, as represented in the Table 3.

4.7. Weaknesses

The main weakness of our empirical strategy is the limited data on net migration on the state level. Since we have access only to data after 2000, and the implementation period is 2003, we are left with data on 3 years prior to the reform (2000, 2001 and 2002) to assess if the parallel trend assumption holds. This constraint poses a challenge for establishing a robust counterfactual, as shorter pre-treatment periods are less informative in assessing whether migration trends between East and West Germany were truly parallel before the policy intervention. With only three years, it becomes more difficult to visually and statistically confirm that East and West Germany would have followed similar migration paths in the absence of the reform. This challenge together with the evidence of the Parallel Trends Assumption violation (based on the limited data we have), introduces bias and fragility in our TWFE estimates, especially if unobserved factors influenced regional migration differently during the early 2000s. The limited time window also restricts the power of placebo tests and pre-trend analyses. Despite these shortcomings, the chosen time frame still enables a structured analysis of the Hartz reforms' impact on migration, particularly when combined with rigorous event study models that account for the pre-trend. Nonetheless, results should be interpreted with caution, acknowledging that a longer pre-treatment window would have allowed for more conclusive validation of the identification strategy.

While the Two-Way Fixed Effects estimator offers a powerful tool for causal inference in panel data settings, its application is not without limitations, particularly when treatment effects are heterogeneous or when treatment timing varies. Imai and Kim (2019) highlights that the standard TWFE model implicitly assumes a constant treatment effect across all units and time periods, an assumption that may not hold in our context where the Hartz reforms may have produced different migration responses in different states depending on structural conditions such as labour market flexibility, demographic composition, or local policy implementation

(ibid: 8). In our study, the reform was introduced nationally at a single point in time, which somewhat mitigates concerns about staggered treatment timing. However, the potential for treatment effect heterogeneity across East and West Germany remains a concern. Moreover, the two-phase TWFE model places greater demands on statistical power. Dividing the post-treatment period into two distinct dummies effectively reduces the sample size for each coefficient estimate, increasing standard errors and potentially weakening inference. Lastly, the discovery of a non-monotonic, V-shaped pattern in pre-reform migration differentials challenges the linear adjustment method applied in our event study. This nuanced, non-linear divergence suggests that East-West migration dynamics prior to the Hartz reforms were likely influenced by complex underlying economic and social forces. The linear adjustment we applied, while statistically appealing for its interpretability and in line with the possible anticipatory effect, might therefore inadequately represent the true pre-reform divergence. If pre-reform dynamics were inherently non-linear, our model may oversimplify these patterns. Moreover, by relying on linear trend adjustments based on this limited pre-reform window, we run the risk of over-correcting for the observed differential trends. If East and West German migration patterns in the pre-reform years were significantly impacted by temporary external shocks or anticipatory behaviours linked to the impending reforms, our model could inadvertently remove variation genuinely attributable to policy-induced changes. In summary, despite the intuitive appeal and methodological robustness of the pre-adjusted event study, the limitations arising from the violation of the Parallel Trends Assumption, reliance on a short pre-reform observation window, and potential over-correction issues must be acknowledged. Therefore, we advise careful interpretation of the results, with the focus on the overall trend attributed to the reform on net migration based on the models.

5. Results

5.1. TWFE Models Findings

The regression results presented in Table 4 offer an insight into the impact of the Hartz reforms on net migration between East and West Germany during the 2003 to 2018 period.

Table 4: OLS regression with multiple degrees (Net migration, Reform x East)

VARIABLES	(1) Baseline	(2) State FE	(3) Two-way FE	(4) FE + Pop Density	(5) FE + GDP	(6) FE + All Controls
East x Reform Interaction	6,394.0713**	10,636.2250***	16,734.7479*	16,035.2584*	19,517.8339**	18,832.6700**
	(2,548.0497)	(3,161.0605)	(9,083.1623)	(8,235.0167)	(7,797.0985)	(7,007.1606)
popden_pre_l1				225.0374		180.5018
				(206.8653)		(302.1603)
gdp_pre_l1					5,961.6731	5,695.8260
					(7,215.1661)	(7,561.7259)
Constant	-1,996.1077	9,990.7895***	15,277.2099**	-101134.1854	-143940.9262	-218935.3135
	(3,299.7187)	(0.0000)	(6,468.5442)	(90,147.7468)	(176,422.1254)	(212,111.0862)
Observations	285	285	285	285	285	285
R-squared				0.0841	0.0987	0.1022
Number of state_numeric	15	15	15	15	15	15
Year FE	NO	NO	YES	YES	YES	YES
State FE	NO	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In the baseline model (Column 1), the estimated coefficient of 6,394.07 (significant at p<0.01) indicates a significant positive impact of the Hartz reforms on net migration for East German states compared to the West. Incorporating state fixed effects in Column 2 increases the coefficient to 10,636.23, retaining high significance (p<0.01), suggesting robust state-level variations influencing migration. When both year and state fixed effects are included (Two-way FE in Column 3), the estimated effect substantially increases to 16,732.75, though significance weakens to the 10% level, accompanied by increased standard errors (9,083.16). This weakening of significance aligns with our methodological concerns, particularly those surrounding the potential violation of the Parallel Trends Assumption. Introducing control variables for population density and GDP (Columns 4 and 5 respectively) yields similar result and significance for population density (16,035.26) but sees a substantial increase when controlling for GDP per capital 19,517.83 and gaining back significance at the 5% level. Including all controls in Column 6 results in a coefficient of 18,832.67, significant at the 5% level, demonstrating a persistent robust effect despite introducing multiple covariates. The observed increase in the migration effect as additional covariates are introduced into the model reflects the deeper structural mechanisms driving East to West migration. Specifically, the substantial rise in the estimated coefficient upon the inclusion of GDP per capita suggests that economic conditions are a critical determinant of migration flows. This aligns with the theoretical underpinnings of the Harris-Todaro Migration Theory, where expected income differentials between regions act as primary motivators for migration. The enhancement of the effect size when introducing more complex models indicates that previous specifications likely suffered from omitted variable bias, where not accounting for regional economic and geographic disparities masked part of the true migration response to the Hartz reforms. However, the control variables, GDP per capita and population density, in the regression model did not exhibit statistically significant effects on net migration flows between East and West

Germany. This lack of significance indicates that, when isolated, these economic and demographic indicators did not substantially explain the migration patterns observed during the period analysed. Their introduction into the model still contributed to an increase or maintenance of the significance of the main treatment effect, suggesting that the observed impact of the Hartz Reforms on migration was robust to the inclusion of these additional controls. The relatively low R-squared values (maximum 0.1022 in Column 7) indicate limited explanatory power of our models, likely reflecting the complex determinants of regional migration and the short observational window available. Moreover, given the concerns about the violation of the PTA, these results must be interpreted with caution as we cannot isolate them from the pre trend in migration before 2003. Our identified significant positive effects likely reflect some structural changes in migration patterns due to the reforms but may also be partially influenced by unobserved pre-treatment trends or external shocks inadequately captured in our short pre-reform data, making our results in this model biased.

The regression results for the phased TWFE offer an insight into the impact of the Hartz reforms on the immediate reform implementation period (2003-2005) and the post implementation period (2006-2018). The coefficient for the implementation phase (11,029.16, $p<0.05$) indicates a significant increase in net migration from East to West Germany during the reform period. While this effect appears robust, it is crucial to recognise that the spike in migration in 2002, prior to the policy change, complicates causal interpretation. This anticipatory effect or cyclical trend in migration before 2003 could be driving part of the observed effect. The post-reform coefficient (20,633.48, $p<0.05$) nearly doubles the initial phase effect, aligning closer with the previous coefficient in the collum 6. This period likely reflects more stable and network-driven migration flows as described by Massey (1990), where established pathways and reduced costs perpetuate movement independently of immediate economic disparities. Unlike the initial spike, this extended effect suggests a more entrenched pattern of East-to-West migration, consolidating pathways established during the reform's early years. When testing for different phase periods (2003-2006 until 2003-2008 and 2007-2018 until 2009-2018) the results are relatively stable for the initial phase, while the long phase has a deviation of +3,000 in the 2009-2018 period – still quite a consistent approximate effect in terms of migration. While the results are statistically significant, they must be interpreted with caution due to the limited pre-treatment window and violation of parallel trends. Furthermore, the theoretical lens of cumulative causation emphasises that initial shocks can have enduring, self-reinforcing effects, inflating short-term policy impacts. Consequently, the

observed long-term effect may indeed represent structural change, however our results are biased and cannot distinguish the reform effects itself from the pre trends. The Leave-One-Out analysis demonstrated that the core DID estimates remained mostly consistent across different state exclusions, suggesting that our results are not driven by any single state anomaly.
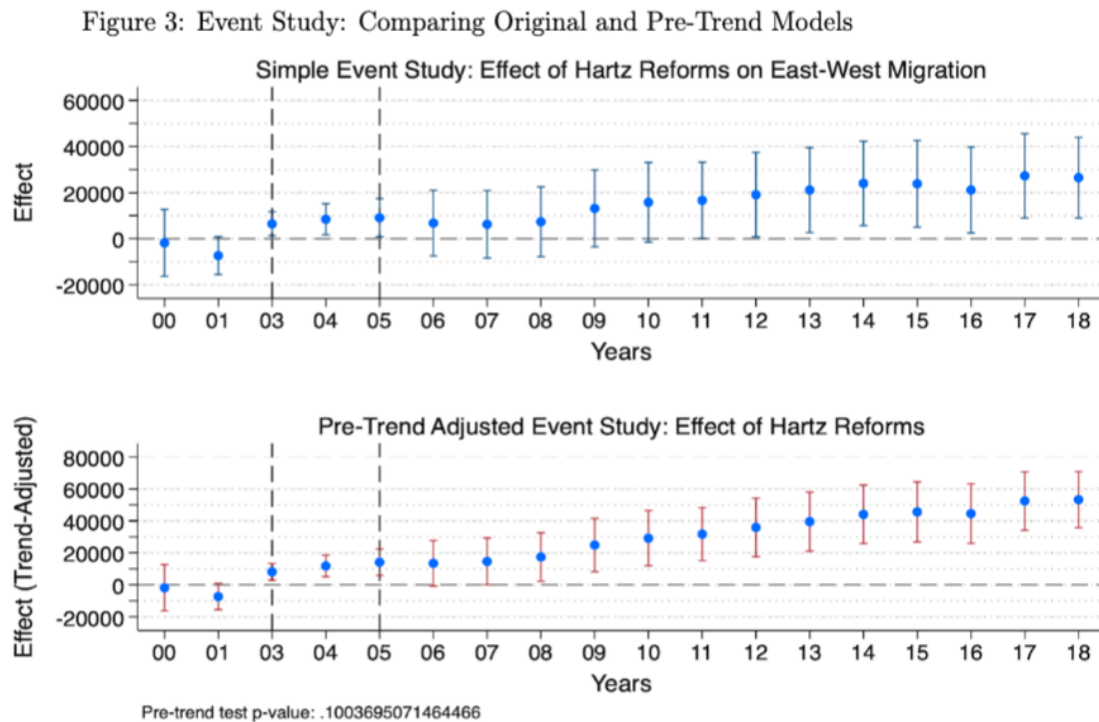
Table 5: Two-Way FE Regression: Yearly East × Reform Effects

Year	Coef.	Std. Err.	z	P>|z|	95% Conf. Interval	
2001	-8131.8	(11573.16)	-0.70	0.483	-30932.7	14669.1
2002	-3353.9	(9919.03)	-0.34	0.736	-22895.9	16188.1
2003	3566.9	(8372.71)	0.43	0.670	-12928.6	20062.4
2004	5535.5	(7755.38)	0.71	0.476	-9743.8	20814.8
2005	6205.6	(7207.06)	0.86	0.390	-7993.4	20404.6
2006	3871.4	(7088.76)	0.55	0.585	-10094.6	17837.4
2007	3358.5	(7122.54)	0.47	0.638	-10674.0	17391.0
2008	4448.8	(7187.78)	0.62	0.537	-9712.2	18609.8
2009	10239.3	(7327.66)	1.40	0.164	-4197.3	24675.9
2010	12885.7	(7460.40)	1.73	0.085	-1812.4	27583.8
2011	13734.0	(7343.78)	1.87	0.063	-734.4	28202.4
2012	16242.0	(7640.51)	2.13	0.035	1189.1	31294.9
2013	18199.4	(7646.02)	2.38	0.018	3135.6	33263.2
2014	21093.6	(7670.39)	2.75	0.006	5981.8	36205.4
2015	20933.0	(7788.25)	2.69	0.007	5589.0	36277.0
2016	18215.1	(7989.81)	2.28	0.024	2473.9	33956.3
2017	24386.7	(7682.44)	3.17	0.002	9251.1	39522.3
2018	23583.4	(7585.91)	3.11	0.002	8638.0	38528.8

Note: Robust SEs in parentheses; FE for state & year.

Table 5 provides further support for the trends observed in the two-phase DID analysis. The initial post-reform years (2003-2005) show modest and statistically insignificant effects on net migration, aligning with the earlier interpretation that short-term movements may reflect anticipatory behaviour rather than true structural change. From 2012 onwards, the coefficients grow in magnitude to an approximate expected increase between 16,000 and 23,500 attributed to the reforms and gain statistical significance, peaking steadily until 2018. This progressive increase is consistent with the previous TWFE models, as all the models reveal that the reforms might have increased the East net migration on the long run with approximately 20,000 or close to that estimate. However, these results also do not truly depict the reforms effects as they are bias and influenced by the pre trend in net migration. Therefore, we advise to interpret them as trajectory depicting findings, rather than absolute effects of the reforms.

5.2. Event Study Findings

Figure 3: Event Study: Comparing Original and Pre-Trend Models

Pre-trend test p-value: .1003695071464466

Reform implemented 2003-2005 (2002 baseline). Linear pre-trend adjustment applied to post-reform outcomes.

The Event Study Analysis, visualised in the comparison of Basic and Pre-Trend Adjusted Models, provides a granular view of how net migration evolved relative to the 2002 baseline and 2000-2002 pre trend adjustments. The simple model suggests mild and insignificant changes in net migration during the initial years post-implementation, reflecting the earlier ambiguity regarding short-term effects. However, the Pre-Trend Adjusted Model clarifies this trajectory by accounting for systematic differences in pre-reform migration trends. Once adjusted, the estimated effects approximate more substantial and consistent migration increases from 2009 onwards, aligning with the Cumulative Causation theory. Moreover, the pre-trend adjusted model includes a p-value of 0.10, suggesting that while pre-trends were not perfectly parallel, they were not significantly different either. The adjustment appears to address this moderately. The linear pre-trend adjustment serves to sharpen the temporal analysis, revealing a clearer upward trend in net migration that becomes more entrenched over time. This adjusted trajectory suggests that the observed migration shifts are more closely related to the Hartz reforms than initially indicated by the unadjusted event study, particularly in the long-term phase where migration appears to stabilise at a significantly higher level than pre-reform benchmarks. However, it is important to notice that the adjusted model indicates an approximate increase of between 50,000 and 56,000 post-2013, which can be caused by the

linear pre trend adjustment and not reflect the true impact of the reforms. The graphical representation of the Event Study models further emphasises the temporal dynamics of migration post-Hartz reforms. In the upper panel (Simple Event Study), the initial post-reform years (2003-2005) demonstrate mild and inconsistent effects on migration, closely mirroring the findings from the Two-Way Fixed Effects models. These early fluctuations suggest that observed shifts in net migration might be related to anticipatory responses or transient shocks rather than structural changes triggered by the reform itself. It is not until approximately 2011 that the migration effect begins to approximate a more stable and significant increase effect in the simple model. These findings can reflect phenomena like institution and market rigidity and imperfect labour market mobility, and would need further research to tackle and understand their effects. In contrast, the lower panel (Pre-Trend Adjusted Event Study) corrects for pre-existing migration differentials, revealing a sharper and more persistent upward trajectory in net migration from 2009 onwards. However, we believe that the trend identified by the adjusted model is correct, but the magnitude of the reforms impact might be closer to the the simple event study (top panel) results of approximately 20,000 in the long run, reflecting more accurate the migration data. Moreover, it is important to acknowledge the wide confidence intervals in both models show increasing uncertainty (wider CIs) in later years, suggesting less precision in long-term estimates.

6. Discussion

The validity of our findings hinges critically on the PTA, which underpins the DID estimations. While the pre-trend adjustment was designed to address deviations observed in 2001 and 2002, it is important to acknowledge that this correction is model-based, and any imperfections in estimating the differential trend may bias our results. Therefore, our results are model based and relative to 2000-2002 period and should be interpreted in that way. The Placebo Test further supports this concern, showing subtle but non-negligible pre-reform shifts that, although not statistically significant, suggest latent differences in migration trajectories that may not be fully captured by our adjustment. Consequently, the effect sizes estimated in our post-reform analysis should be interpreted as approximations of the true effect rather than definitive measures. This is particularly true in the event study where adjusted estimates exceed observed official data, indicating a methodological inflation potentially linked to the linear

nature of the trend adjustment. Therefore, while our analysis approximates the trajectory of migration shifts post-Hartz, it cannot claim precise quantification of the reforms' effect.

The TWFE models estimate reveal a gradual escalation in East-to-West migration, attributing approximatively between +5,000 and +11,000 during the initial period and an increase to approximatively +20,000 on the long run. These results are in line with the findings from the simple event study, however the model also indicated that right after the 2005 implementation phase (2005-2008), the reform might have had a marginally positive or equal to zero impact on the net migration, showing more significant effect after 2010. This temporal distribution aligns with the Cumulative Causation Theory by Massey (1990), which posits that migration is a self-reinforcing process. The initial shifts during and post the reforms' implementation is smaller and can be seen as a new wave of "early movers", which laid the groundwork for network effects that reduced informational and financial barriers for subsequent migrants. The more substantial increases observed post-2010 mirror the expansion phase of cumulative migration, where established networks drive cost reductions and perpetuate movement independently of immediate economic incentives. The Event Study models visualisation further solidifies this perspective, demonstrating that after pre-trend adjustments, migration patterns approximate a cumulative upward trajectory, becoming more structured over time.

The hypothesis anticipated that these reforms accelerated the historical migration trend through a cumulative mechanism, meaning it expected the reform to lower the net migration of East states. The evidence challenges this assumption in a fundamental way. While the cumulative mechanism is indeed observable, the directionality of migration shifted, contradicting the hypothesis that East would continue to be a net exporter. Instead, East Germany approximated zero net migration and ultimately transitioned towards positive net inflows by 2016. This indicates that the reforms, along with broader economic adjustments, might have contributed to a regional reversal in migration flows, facilitating East Germany's transformation from a source of outmigration to a more balanced, and eventually net-positive, migration region. We cannot attribute causation between net migration trend change and the reforms, however based on our models, the reforms were expected to contribute to the acceleration of the net migration increase on the long run, but the exact scale of their influence remains partially obscured by methodological and data limitations. However, our study reveals that there is a need for more research on the migration trends between East and West prior to 2000 in order to fully understand how the reforms affected those patterns. Moreover, besides a larger dataset,

research incorporating complex economical models needs to be done to account specifically how much the reforms increased the net migration and contributed to the shift in the historical migration trend.

From an economic standpoint, the reversal of migration flows from East to West Germany underscores the capacity of labour market reforms to not only influence the volume but also the directionality of internal migration. The Hartz reforms appear to have contributed to a gradual recalibration of migration dynamics by altering economic incentives. Moreover, our study points out that large-scale labour market interventions can have non-linear effects on regional mobility, potentially stabilising historically imbalanced migration patterns over extended periods through a cumulative effect. Future policies aimed at regional balance should consider these mechanisms and long-term structural adjustments as critical pathways for sustainable demographic shifts. However, empirically it is increasingly complicated to account for the magnitude of such reforms in the long term since there are many other factors and elements that affect migration and cannot be directly accounted for. Therefore, we hope to shed more light on this topic through our research and contribute to the increased interest in studying these mechanisms on a larger scale.

7. Limitations

The findings presented in this analysis are subject to several limitations that are crucial to acknowledge. First, the model dependency and assumption of parallel trends underpinning the TWFE estimations represent a core vulnerability in the identification strategy. Despite applying Pre-Trend Adjustments in the Event Study to correct for observed differences between East and West Germany from 2000 to 2002, evidence from placebo tests and graphical analyses suggests that deviations existed before the reforms and the linear trend adjustment could potentially not be enough to completely isolate the reforms from the pre-trends. This implies that our adjustments based on the model assumptions, although methodologically structured, may not have fully captured the underlying migration dynamics, introducing the risk of over or under correction. Consequently, the observed trajectory of East Germany upwards migration trend should be seen as an approximation rather than a definitive outcome and not interpreted as solely attributable to the Hartz reforms. Additionally, the limited availability of net migration

data, spanning only three pre-reform years, constrains the robustness of our parallel trends validation, reducing our capacity to observe longer-term migration equilibria and potentially missing underlying secular trends. This temporal limitation is further compounded by the simplification of migration mechanisms in our model. While labour market adjustments through the Hartz reforms are a plausible driver of the observed changes, migration is inherently multifaceted, influenced by housing, education, social networks, and broader regional and global factors. The analytical focus on labour market incentives, though theoretically justified, risks oversimplifying these complex mechanisms of migration. Furthermore, the Event Study's sharp increases in adjusted estimates post-2013 raise concerns of potential upward bias introduced through linear corrections. The widening confidence intervals during this period also suggest increasing uncertainty in our estimates, reflecting both methodological constraints and the inherent variability of migration decisions over time. While robustness checks like the Leave-One-Out analysis help validate our findings, they do not fully mitigate concerns around linear assumptions and potential regional shocks. Thus, the results must be interpreted as trajectory approximations rather than precise measurements of the Hartz reforms' impact, and they remain influenced by our model's assumptions.

Another key limitation lies in categorising regions as either rural or urban. This assumption overlooks the possibility of within-state heterogeneity, particularly since states like Baden-Württemberg appear to transition from more rural to more urban over time. Moreover, the binary classification of a larger region disregards a nuanced reality of both rural and urban entities in the same constituencies. This oversimplification helps operationalise the Harris-Todaro framework but may not accurately capture the complex reality of modern Germany's geographical structure, where there are both urban and rural states in East and West. Future research might address these spatial gradations using more disaggregated data at the district or municipal level. Moreover, the exclusion of Berlin from our analysis is critical to address. It was motivated by SUTVA violation but also by the fundamental challenges it poses for data collection. East Berlin, in particular, is notorious for its fragmented archival record. Following the fall of the Wall, the GDR government deliberately dispersed or destroyed many local data sources. These difficulties persist into the post-reunification era, since administrative boundaries in urban and central Berlin have been redrawn repeatedly since 1990 (Blokland 2021: 252). Most notably, the 2001 reform merged twenty-three Bezirke into twelve (Ahlfeldt et al. 2012: 2133). Although archival data do exist for both pre- and post-reunification periods, aligning contemporary divisions with historical ones presents a major obstacle. Ahlfeldt et al.

(2012) encountered this inconsistency of spatial units and addressed it by constructing a bespoke dataset drawn from the 1933, 1987, and 2005 censuses. However, their methodology is ill suited to our purposes, as it relies on multiple disparate sources tailored to their specific research question and does not provide a continuous series for a single variable, such as net migration over an extended period.

8. Conclusion

In conclusion, answering our research question based on our models, the Hartz reforms appear to have positively influenced internal migration in the former East, particularly picking up in effect after 2009 and contributing to shift the historical trend of East to West migration. Our analysis, employing Two-Way Fixed Effects models and Event Study methodologies, suggests that the reforms potentially had a gradual and cumulative positive effect on East migration patterns. Contrary to the expectation of an accelerated East-to-West migration (net decrease for East) based on the Harris-Todaro Model, the empirical evidence reveals a cumulative increase in net migration for East Germany over the long term, possibly contributing to the transition from a net exporter to a net importer of people. This observed effect is most pronounced from 2009 onwards in all the models, aligning with the maturation of reform-induced labour market adjustments and the establishment of stronger economic and social networks in East Germany. However, while the results are suggestive of an acceleration of the shift in migration in the long run due to the reforms, it is crucial to interpret them with caution. Our findings are model-dependent and relative to the 2002 migration trend and overall 2000-2002 pre-trends while sensitive to the assumptions of parallel trends and pre-trend adjustments. Thus, while the Hartz reforms are likely to have contributed to this observed trend, the exact magnitude and isolated impact remain approximations rather than definitive measures. Our analysis approximates a trajectory rather than delivering an absolute causal claim, acknowledging the complexity and multi-factored nature of internal migration dynamics in post-reform Germany. Therefore, we advise for further research that builds upon our findings and incorporates more advanced models, larger datasets and nuanced control variables, to pin down the exact effects of the reforms on East to West net migration. Our study also suggests a need for a long-term migration trend study between East and West Germany, in order to exactly contextualize the effect of the Hartz reforms and inform future policymakers about concrete strategies to influence and achieve migration shifts and equilibriums.

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