Non-Separable Time Preferences, Novelty Consumption and Body Weight: Theory and Evidence from the East German Transition to Capitalism [‡]

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Abstract

This paper develops a dynamic model to illustrate how diet and body weight change when novel food products become available to consumers. We propose a microfounded test to empirically discriminate between habit and taste formation in intertemporal preferences. Moreover, we show that 'novelty consumption' and endogenous preferences can explain the persistent correlation between economic development and obesity. Empirically studying the German reunification, we find that East Germans consumed more novel western food and gained more weight than West Germans when they got access to a larger variety of food products after the fall of the Wall. The observed consumption patterns suggest that food consumption features habit formation.

Keywords: Endogenous preferences, food consumption, novel goods, habit formation, learning, obesity, economic development, German reunification,

JEL classification: D11, D12, D92, E21, I12, I15, L66, O10, O33, Q18, R22

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1 Introduction

> "Even though the GDR [...] was for the most part self-sufficient concerning production of food and consumer goods, the choice of items available to the average consumer was limited. It is a well-known fact that some of the first items East Germans bought [...] were bananas and other exotic fruits, which had not been available to them in the GDR" (Ganter, 2008, p.81).

Obesity rates have been increasing in all industrialized countries over the last decades (Sassi, 2010; World Health Organization, 2015). The health risks associated with this trend are significant: Obese people are more likely to suffer from diseases such as high blood cholesterol and hypertension (Surwit et al., 1988; Appel et al., 1997; National Heart, Lung, and Blood Institute, 1998; Mohn et al., 2005; Buettner et al., 2007). Moreover, body fat releases hormones such as resistin and leptin that cause type II diabetes and cardiovascular diseases (Trayhurn and Beattie, 2001; Kahn et al., 2009). In general, obesity implies high health care costs, a reduced life expectancy, a lower labor market productivity and worse social outcomes (Fontaine et al., 2003; Cawley, 2004; Cawley et al., 2007; Puhl and Heuer, 2009; Cawley and Meyerhoefer, 2012). Consequently, the fight against the obesity 'epidemic' has received significant attention from policymakers around the world (Griffith and O'Connell, 2010).

Economic development and technological change are often considered to be the key driving force of the rapid increase in obesity rates (Figure A1). To empirically test this hypothesis, the ideal experiment would require exogenous variation in economic development at a specific point in time. However, such an ideal scenario is typically not available because economic development involves multiple factors which asynchronously change over long time horizons. A notable exception is the German reunification. This paper exploits this unique natural experiment to shed light on the relationship between the availability of new food products, food consumption and body weight. It investigates how the availability of novel food—a characteristic of economic growth and development—can persistently change food consumption patterns and body weight.

Overnight, the end of the Iron Curtain made a large set of novel western consumption goods available and affordable to the population in East Germany. That new consumption goods become available and affordable to population masses is a generalizable and pervasive feature of economic growth and development. The business model of the international food industry largely depends on employing food engineering technology and mass marketing strategies to design and introduce novel food products into the market (Dodgson et al., 2014).[1] Simultaneously, international trade and technological innovation have made delicatessen—such as exotic fruit and fresh exotic fishery products like salmon, oysters, or caviar—available and affordable in discount grocery chains around the corner. The increased availability of new products is witnessed by the number of items offered by modern supermarkets. For example, in the US in 1946, the average supermarket carried 2,500 products, in 1975 it carried about 9,000 products, and today it carries almost 44,000 products (Congressional Research Service, 2013; Food Marketing Institute, 2014a,b).

This paper develops a theoretical model of endogenous preferences to study East German food consumption and body weight dynamics in the transition phase from socialism to capitalism.[2] Our basic

[1] In the US, the number of food chemistry patents has tripled from 668 to 2,134 between 1980 and 2012 (World Intellectual Property Organization (WIPO), 2014).

[2] Henceforth, we use the terms GDR and East Germany and the terms FRG and West Germany interchangeably.

hypothesis is that past consumption experiences affect current consumption. The demand-driven model considers forward-looking consumers who have a taste for variety and non-separable intertemporal preferences. Past consumption affects current consumption in two alternative ways: through habit or taste formation. Under habit formation, the marginal utility of consumption decreases with past consumption experiences, whereas under taste formation, the marginal utility of consumption increases with past consumption experiences.

In addition, the model distinguishes between two commodity categories: First, we have familiar food, which is food that had always been available in both parts of Germany, such as potatoes and meat. In contrast, novel food refers to food that East Germans could not consume prior to reunification (but which was always available in West Germany), due to trade barriers and/or extremely high prices of western commodities on the eastern black market. This category includes both industrially engineered food, such as processed or convenience food, and exotic high-quality food, such as exotic fruits. East Germans had no previous consumption experience with novel western food before it suddenly became available when the Wall fell.

This paper's 'Theory of Novelty Consumption' then provides general predictions for the demand of novel and familiar food under intertemporal non-separable preferences of a rational consumer. Applied to the German case, we show how the consumption patterns of East and West Germans would differ under three competing scenarios. First, under the null hypothesis of neither taste nor habit formation, *ceteris paribus*, East and West Germans would exhibit the same consumption patterns after the end of the Iron Curtain. Second, if preferences feature habit formation, novel food consumption would be higher in East than in West Germany. Third, if preferences feature taste formation, novel food consumption would be lower in East than in West Germany. Analogously, empirical consumption dynamics of familiar food would also reveal whether intertemporal preferences feature habit formation, taste formation, or neither of the two. Notably, as we will show, the empirical test of these theoretical predictions do not require individual consumption panel data, but only representative cross-sectional data for East and West Germany.

In that respect, this paper contributes to the literature that develops empirical tests for the existence of habit formation. Proving the existence of habit formation and non-separable time preferences has major implications for macroeconomic models, which typically rely on such properties (Fuhrer, 2000; Attanasio and Weber, 2010). Although significant efforts have been made in the last decades to develop such tests, the findings have been largely inconclusive. Early studies based on aggregated data typically find evidence for habit formation (e.g. Braun et al., 1993), while the findings of individual panel-data based studies have been mixed (Dynan, 2000; Carrasco et al., 2005; Kuismanen and Pistaferri, 2006; Collado and Browning, 2007). This paper's theory constructs an empirical test for the existence of non-separable time preferences which allows us to discriminate between habit and taste formation. By considering a rational forward-looking consumer, our approach dates back to Becker and Murphy (1988) and differs from the alternative approach—initially proposed by Pollak (1970) and more recently extended by Bronnenberg et al. (2012)—where consumers do not take into account how current choices will affect future preferences and behavior.

The second part of the paper implements the empirical test by exploiting cross-sectional data that are representative for East and West Germany. These data include a battery of current and retrospective information on food consumption (and also objective clinical body weight measures). We find that,

shortly after novel western food products became available in the former GDR, a significant share of East Germans persistently changed their diet and started to consume these products. Specifically, 'novelty consumption' in East Germany exceeded West German levels in 1991, meaning that East Germans consumed more of these newly available western products than West Germans. This novelty consumption effect holds both for healthy novel food (such as exotic fruits) and unhealthy novel food (such as convenience food and snacks). In contrast, East Germans' potato consumption was three times higher than West Germans' before the reunification. It fell below West German levels after the reunification. According to our model, all these consumption patterns are consistent with non-separable time preferences featuring habit formation. Interestingly, the changes in eating habits are persistent and still detectable one decade after the reunification. Importantly, the observed consumption patterns cannot be explained by taste for variety alone.

Although all observed consumption choices of novel and familiar food are theoretically optimal because they maximize the consumer's intertemporal utility function, they may not necessarily optimize body weight which is just one component of overall utility (Cawley et al., 2016). Hence, how and whether body weight changes in response to a new mix of healthy and unhealthy food consumption choices is essentially an empirical question. We find that, relative to West Germans, significantly more East Germans gained weight shortly after the fall of the Wall. The more-than-proportional weight gain cannot be explained by less physical activity and calorie output, nor is it a result of worse health care access or lower awareness about medical conditions among East Germans. We also provide evidence that unemployment is unlikely to be the driving force because mostly the working middle-class gained body weight.

The next section discusses this paper's specific contributions in the context of the existing literature. Section 3 briefly summarizes events around the German reunification and food availability in the GDR. Section 4 formalizes our Theory of Novelty Consumption and Section 5 illustrates how we link the theory with the data. Section 6 provides the results of the empirical analysis and 7 investigates mechanisms and robustness checks. Section 8 concludes.

2 Specific Contributions to the Existing Literature

This paper contributes to and bridges several important strands of the economic literature, most importantly *(a)* studies that empirically and theoretically model driving forces of the obesity epidemic in developed countries, and *(b)* studies that empirically and theoretically test for non-separable time preferences, habit and taste formation.

By investigating how availability and novelty can produce long-lasting demand responses for food consumption, our paper contributes to the literature on economic development and technological change as driving forces behind the obesity epidemic (Philipson and Posner, 1999; Cutler et al., 2003; Egger et al., 2012; Costa-i Font and Mas, 2014). Philipson and Posner (1999), Lakdawalla et al. (2005) and Lakdawalla and Philipson (2009) develop an elegant theory which links technological change and increases in body weight to rising incomes and decreasing food prices. However, Cutler et al. (2003) argue that the rise in the overall US Food Consumer Price Index was only 3% below the corresponding index for non-food between 1970 and 1999. Maybe in contrast to the public perception, at least *average* real

food prices have been surprisingly constant over time. To be specific, average food price inflation was 5.2% between 1960 and 1983 and has been 3.0% since then (Congressional Research Service, 2013).[3] Strulik (2014) argues that being obese is more acceptable the higher the population obesity rate, which would create a social multiplier effect. This would foster an obesity epidemic even when initial triggers (such as decreasing prices) became irrelevant. Our Theory of Novelty Consumption also proposes a possible explanation for why obesity rates continue to rise even though real food prices have been very stable since the 1990s (Ruhm, 2012). We build upon and specify Philipson and Posner (1999), Lakdawalla et al. (2005) and Lakdawalla and Philipson (2009)'s main idea by considering the joint effects of more food availability in conjunction with the impact of previous consumption experiences.

Our theoretical approach builds on, and contributes to, the literature on habit formation and intertemporal preferences (Abel, 1990; Heaton, 1993; Dynan, 2000; Overland et al., 2000; Carroll, 2000; Carrasco et al., 2005; Collado and Browning, 2007; Rozen, 2010; Atkin, 2013), learning in consumption and taste formation (Stigler and Becker, 1977), rational addiction (Becker and Murphy, 1988), and health formation (Grossman, 1972). One special feature of our model is that it requires no *a priori* assumptions on how past consumption affects current preferences. Based on the observed East-West consumption differential, we are able to infer how past consumption affects preferences for current consumption, which is typically an unobserved property of the utility function. In particular, we show that preferences featuring habit formation are revealed by consumption patterns that overshoot in response to exogenous shocks. In contrast, taste formation implies undershooting and monotonic paths of consumption over time.

Our empirical strategy is complementary to papers that use microdata to identify and carve out the causal impact of single specific factors on obesity, such as increased availability of (fast food) restaurants (Currie et al., 2010; Dunn, 2010; Anderson and Matsa, 2011), consumption of soda (Fletcher et al., 2010), increases in portion sizes (Jeitschko and Pecchenino, 2006), increases in gluttony (Griffith et al., 2016), decreases in gas prices (Courtemanche, 2011), increase in cigarette taxes (Courtemanche, 2009), changes in food prices (Grossman et al., 2014; Dubois et al., 2014; Courtemanche et al., 2015; Griffith et al., 2015), cash transfers (Akee et al., 2013), or changes in physical activity (Cawley et al., 2013; Sarma et al., 2014).[4] These studies are all econometrically 'clean' and focus on a single causal impact factor (often related to the supply-side). However, these clean single-cause reduced-form studies typically identify modest effects that are at odds with the general obesity epidemic. We opt for a slightly different empirical approach and provide a 'big picture' perspective when exploiting the German reunification as a large-scale exogenous shock to economic development.

The existing literature exploiting the German reunification has studied outcomes such as life and health satisfaction (Frijters et al., 2004a,b, 2005), saving behavior (Fuchs-Schündeln and Schündeln, 2005; Fuchs-Schündeln, 2008), preferences for social policies (Alesina and Fuchs-Schündeln, 2007),

[3] The analogous numbers for the general inflation rates were 5.3 and 2.9%, i.e., almost identical.

[4] There exists yet another literature strand that identifies the impact of (adverse) early childhood conditions on health, and particularly obesity, later in life. These empirical reduced-form papers exploit exposure to World World II (Kesternich et al., 2014, 2015), famines in the 20^{th} century (Lindeboom et al., 2010; van den Berg et al., 2016), or recessions (van den Berg et al., 2006; Scholte et al., 2014). Another related literature strand studies food consumption outside of the obesity context, and mostly in the context of the US food stamp program (Dynan, 2000; Blundell and Pistaferri, 2003; Fisher et al., 2008; Hoynes and Schanzenbach, 2009; Jappelli and Pistaferri, 2010; Wakabayashi, 2010; Hoynes and Schanzenbach, 2012). Atkin (2016) studies culture-related calorie gaps in India. The last related literature strand studies the phenomenon that people seems to be healthier during recessions (Ruhm, 2000, 2005).

educational and labor outcomes (Fuchs-Schündeln and Masella, 2016), social norms (Brosig-Koch et al., 2011), trust (Rainer and Siedler, 2013; Lichter et al., 2015), personality (Friehe et al., 2015), risk taking and propensity to cooperate (Heineck and Süssmuth, 2013), social ties (Burchardi and Hassan, 2013) and conspicuous consumption (Friehe and Mechtel, 2014).

Admittedly, the downside of the reunification approach is that one cannot trace changes in outcome variables back to single specific factors. However, the crucial advantage of the fall of the Wall is its quality as a unique natural experiment of economic development, leading to greater product availability. Usually, economic development involves very slow long-term changes in multiple factors that are almost impossible to identify by conventional reduced-form methods. We deliberately want to study the net impact of abrupt changes in multiple factors of economic development; most importantly, the role of new food consumption opportunities.

3 The German Reunification and Food Availability Under Socialism

3.1 Division and Reunification of Germany

After World War II (WWII), Germany's boundaries changed substantially from its pre-war borders. At the Potsdam Conference in summer 1945, the allies divided Germany into four military occupation zones: American, British, French, and Soviet zones. The division was based on the idea of allocating territory proportional to the size of the nations' army and according to military considerations (Mee, 1977). In 1949, the capitalist and democratic Federal Republic of Germany (FRG) was founded, comprising of the French, British, and American military occupation zones. In the Soviet zone, the German Democratic Republic (GDR)—a totalitarian Stalin-oriented communist state—was forged in 1949. Between 1950 and 1961, about 3.6 million refugees migrated from the GDR to the FRG (Bethlehem, 1999; Bauer et al., 2013; Braun and Kvasnicka, 2014).

To stop the mass exodus, on August 13, 1961, the communist GDR regime started to erect a 155 kilometers (96 miles) long cement and 3.6 meter (12 feet) high "Berlin Wall" around West Berlin. Outside of Berlin and around the rest of the GDR territory, a physically different, but technically very similar 1,393 kilometer (866 miles) long "Inner German Border" was erected (see Figure A2 in the Appendix). This border ran from the Baltic Sea to Czechoslovakia and represented the boundary of the "Iron Curtain." Henceforth, we loosely refer to the whole Inner German border as the "Wall."

For 28 years, from 1961 to 1989, the Wall served as border between the FRG and the GDR. It largely prevented East-West migration, although around 5,000 GDR citizens attempted to escape over the Berlin Wall alone; between 100 and 400 lost their lives at this attempt (Hertle, 2009). After mass demonstrations by the GDR residents, the communist regime decided to allow East-West migration on November 9, 1989. The fall of the Wall was completely unanticipated and unexpected. On October 3, 1990, Germany officially reunited and became one state again.

3.2 Availability, Prices and Consumption Before the Reunification

> "Bananas and exotic fruits have a special symbolic meaning in the relationship between the FRG and the GDR. [...] Initially, the banana [...] [was] symbolic for the shortages and lack of consumer goods in the East.

[...] The banana can also be reminiscent of the run on certain goods shortly after fall of the Berlin wall (p. 144, Patent, 2013)."

The epigraphs above nicely illustrates some of the facts concerning food choices around the time of the German reunification. First of all, note that the GDR was the richest and most prosperous socialist economy, e.g., when compared to the Union of Soviet Socialist Republics (USSR). In 1990, it was the 21st biggest economy in the world. Its Gross Domestic Product (GDP) per capita was $9,679 (West Germany: $15,300; US: $21,082) (CIA World Factbook, 1990; Classora Knowledge Base, 2014). Although the population of the GDR did not suffer from malnutrition or hunger, food was only produced within the GDR or imported from other socialist countries, mostly the USSR. This led to a restricted food availability in the GDR.[5] The GDR state food policy heavily subsidized basic food such as potatoes, milk or butter. Consequently, the state-determined prices were relatively low and comparable with those in the FRG (where basic food was also subsidized).

Table 1 shows consumption per capita and prices for select staple food categories in the GDR (1989) and the FRG (1988). First, potato consumption was three times higher in the GDR in 1989 (9.7 kg vs. 3.03 kg per month and person). One reason lies certainly in the limited availability of food substitutes, another potentially in prices differences. Relative to disposable household income, potato prices were only half as high in the GDR (0.02% vs. 0.04%). However, given the very low demand elasticity of potatoes—using US Nielsen Scanner data, Hsieh et al. (2009) estimate the demand elasticity at an insignificant -0.1—it is very likely that substitute food, not prices, accounted for the three times higher potato consumption in East Germany.

[Insert Table 1 about here]

Second, Table 1 illustrates that GDR residents consumed slightly more than 5 kg (12lbs) meat per month and per person, whereas meat consumption in the FRG was slightly below 5 kg. Although absolute prices for meat were slightly higher in West Germany, because net household income was about 50% higher, relative meat prices were lower in West Germany.[6]

Third, although comparable, egg and sugar consumption was slightly higher in West Germany (25.4 vs. 31 eggs, and 1.18 vs. 1.56 kg of sugar per person/month).

Finally, Table 1 displays prices and consumption of exotic fruits. Western products were officially not available in the GDR. Only people with friends and relatives in West Germany had partial access to these products. Imports came only from 'friendly' socialist countries such as the USSR or Cuba. Consequently, exotic fruits were basically not available or only available at horrendous prices that normal people were not able to pay. The last row of Table 1 shows that GDR citizens had to pay an equivalent of € 12 ($16) for a can of pineapples, which were only available in delicatessen stores. In the local currency, the price was 18 Ostmark and represented 7.2% of the net weekly income of a single household. This equaled the price for a train ticket over 200km (124 mi) (Böhme, 1971; Schwarzer, 1999; Woll, 2012; Maecker, 2013)

[5] Official state rationing on food was abolished in the 1960s (Bochniak, 2009).

[6] Note that this table likely contains measurement errors due to limited data availability and comparability. Particularly the comparison of net household incomes per person is based on several assumptions. For the GDR, we use net household incomes according to the Zentralverwaltung für Statistik der DDR (1988) and for the FRG equalized disposable household incomes according to the German Socio-Economic Panel Study (SOEP) (Wagner et al., 2007; Grabka, 2000).

In summary, *(i)* people did not suffer hunger in the GDR but food choices were limited and mostly locally produced products available; *(ii)* basic (familiar) food such as potatoes, meat, eggs or sugar was subsidized by the government—in East as well as in West Germany—which kept prices low; *(iii)* it is reasonable to assume that the quality of staple food was comparable in East and West Germany; *(iv)* western products and imported products from non-communist countries were only available in West Germany; *(v)* meat consumption was comparable, potato consumption three times as high, sugar consumption lower, and exotic fruit consumption significantly lower in the GDR as compared to the FRG.

4 A Theory of Novelty Consumption

4.1 A Model of Intertemporal Consumption Preferences

Consider an intertemporal optimization problem where a forward-looking consumer has a taste for variety and non-separable time preferences, represented by the following utility function:

$$\mathcal{U}\left(n_t, f_t, g_t, N_t, F_t, W_t, Z\right). \tag{1}$$

At each point in time, the choice variables are n_t, f_t and g_t. The vector n_t represents *Novel Food* that only became available in East Germany after the reunification, e.g., exotic fruits and convenience food. In contrast, vector f_t denotes *Familiar Food* that has always been available in both parts of Germany, e.g. potatoes and meat. Non-food activities, such as physical exercise, and non-food consumption are represented by g_t. The utility function is assumed to be concave in the choice variables to allow the consumer to have a taste for variety.

Intertemporal preferences are assumed to be non-separable: past consumption experiences with novel and familiar food—which we denote by N_t and F_t, respectively—affect the instantaneous utility function. In principle, this may occur in two ways. A first possibility is that N_t and F_t only affect the level of current utility, in which case the derivatives $\mathcal{U}_N$ and $\mathcal{U}_F$ are different from zero. A second (and more interesting) possibility is that N_t and F_t also affect the marginal utility of current consumption, as formally captured by the sign of the two cross derivatives $\mathcal{U}_{nN}$ and $\mathcal{U}_{fF}$. Under the last interpretation, in which past consumption affects both the level of utility and marginal utility, we can distinguish two cases:

If the cross derivative is negative ($\mathcal{U}_{nN}, \mathcal{U}_{fF} < 0$), past consumption has a satiating effect which reduces the marginal utility of current consumption. Consistent with the macroeconomic literature (see, e.g, Abel, 1990; Overland et al., 2000; Carroll, 2000), we label this case as *habit formation*. If instead the interaction term is positive ($\mathcal{U}_{nN}, \mathcal{U}_{fF} > 0$), past consumption has a reinforcing effect on the marginal utility of consumption, as it is typically assumed in the literature on *taste formation* (Stigler and Becker, 1977; Becker and Murphy, 1988). When $\mathcal{U}_N = \mathcal{U}_F = 0$ we are back to the standard case in which past consumption experiences do not affect current preferences.

Current consumption choices increase consumption experience, which depreciates over time at a constant rate δ (for a similar assumption, see Becker and Murphy, 1988):

$$\dot{N}_t = n_t - \delta N_t, \qquad \dot{F}_t = f_t - \delta F_t \tag{2}$$

Body weight W_t depends on current and past food consumption (Levy, 2002; Dragone, 2009), on physical exercise γ (which is one component of vector g), and on individual characteristics Z:

$$W_t = W\left(n_t, f_t, \gamma_t, N_t, F_t, Z\right). \tag{3}$$

Given income M_t, assets A_t, the market interest rate r_t, and the price p_t^j of good j at time t—which includes the opportunity costs of time and the transaction costs required to obtain the good—the dynamic budget constraint is

$$\dot{A}_t = r_t A_t + M_t - p_t^n n_t - p_t^f f_t - p_t^g g_t. \tag{4}$$

The consumer chooses the path of food and non-food consumption that maximizes the following discounted stream of utility:

$$\max_{\{n_t, f_t, g_t\}} \int_0^\infty e^{-\rho t} U\left(n_t, f_t, g_t, N_t, F_t, Z\right) dt \tag{5}$$

$$\text{s.t. } \dot{A}_t = r_t A_t + M_t - p_t^n n_t - p_t^f f_t - p_t^g g_t \tag{6}$$

$$\dot{N}_t = n_t - \delta N_t \tag{7}$$

$$\dot{F}_t = f_t - \delta F_t \tag{8}$$

where $U\left(n_t, f_t, g_t, N_t, F_t, Z\right) = \mathcal{U}\left(n_t, f_t, g_t, N_t, F_t, W\left(\cdot\right), Z\right)$ and ρ is the intertemporal discount factor.

4.2 Identifying Assumptions of the Theory

In the following, we list and discuss the identifying assumptions of the theoretical part. In the next section, the discussion will be complemented by a separate discussion on the main identifying assumptions of the empirical part. Some of the assumptions overlap, but mostly contain specific theoretical or empirical challenges. For the sake of clarify, we decided to discuss them separately. In this subsection, we focus on the assumptions about *(i)* differential consumption experiences of East and West Germans, and *(ii)* the theoretical role of prices.

With regard to *(i)* and previous consumption experiences: We assume that, at the time of the reunification ($t = 0$), the consumption experiences with novel and familiar food were different in East and West Germany. Specifically, in East Germany, the food consumption experiences with novel and familiar food were, respectively, $N_0^E = 0$ and $F_0^E > 0$. In West Germany, instead, they were $N_0^W > 0$ and $F_0^W > 0$.[7] This main first assumption is based on the historical facts that are discussed in detail in Section 3.2. Until the fall of the Wall, Western products were only available on the black market in the GDR, or via personal connections; sometimes they were also available in official stores but at horrendous prices or transaction costs.

[7] As it will become clearer below, the assumption of $N_0^E = 0$ is not essential for our results as it is the relative comparison between East and West Germans at a point in time that matters. For the same reason, we allow for the possibility that, at the time of the reunification, consumption experiences with familiar food were different in the two parts of Germany, i.e., $F_0^E \gtreqless F_0^W$.

With regard to *(ii)* and the role of prices: Our flexible parsimonious model conceptualizes the reunification as an unexpected negative price shock of novel food. This approach allows us to concisely summarize in a single economic variable—the price—the variety of changes that typically accompany economic development. These include decreases in prices relative to disposable income, the launching of new products for the mass market thanks to technological innovation or to the removal of trade barriers, structural changes in the food industry, decreases in transaction costs due to the diffusion of supermarkets and grocery stores, and changes in distribution networks. Due to taste for variety, such price decreases should increase demand among East Germans. Whether this results in higher, equal or lower consumption as compared to western levels depends on the price differences for novel food in East and West Germany.

The model assumes that, following the initial negative price shock for novel food in East Germany, food prices quickly converged to West German levels as a result of competitive markets and the law of one price. In reality, during the adjustment period, prices for western novel food products were most likely *higher* in East Germany. The assumption of equal or higher prices for novel food during the price convergence period is supported by anecdotal evidence and by the fast diffusion of discounters and western supermarket chains in East Germany (Seidel, 2009; Schmalhaus, Daniel, 2014). Official regional price statistics also support this assumption—1999 was the last year when (the much broader) separate consumer price indices for East and West Germany were published. According to the German Statistical Office, full price convergence had been achieved by then (Ströhl, 1994; Statistisches Bundesamt, 2002, 2016).

Absent separable time preferences, compared to West Germany, higher prices for novel food in East Germany would lead to lower consumption levels of novel food. However, empirically, we observe *higher*, not lower, consumption levels of novel food in the East. This paper claims that non-separable time preferences are the driving force for this higher novelty consumption.[8]

In sum, our model of endogenous preferences is powerful enough to explain the empirically observed consumption dynamics after the fall of the Wall—in East as compared to West Germany, and to provide a consistent explanation in terms of habit formation in consumption preferences.

4.3 Consumption Patterns with Non-Separable Intertemporal Preferences

This section derives the analytical expressions for the equations that will be empirically estimated from the theoretical model (5)-(8). The Hamilton-Jacobi-Bellman equation associated to problem (5)-(8) is

$$\rho \mathcal{V}\left(N_t, F_t, A_t\right) = \max_{\{n_t, f_t, g_t\}} \left\{ U\left(n_t, f_t, g_t, N_t, F_t, Z\right) + \mathcal{V}_N \dot{N}_t + \mathcal{V}_F \dot{F}_t + \mathcal{V}_A \dot{A}_t \right\} \tag{9}$$

where $\mathcal{V}\left(N_t, F_t, A_t\right)$ is the optimal value function. For analytical tractability, and to provide linear closed-form solutions that can be empirically estimated, we follow Becker and Murphy (1988) and

[8] As seen in Figure 1, under habit formation novelty consumption would be higher in the East (whereas it would be lower under taste formation). If prices for novel food were higher in the convergence period, then higher novelty consumption in the East would still indicate habit formation, but represent a lower bound.

consider a second-order linear approximation of the utility function,

$$U\left(n_t, f_t, g_t; N_t, F_t, Z\right) = f_t\left(\hat{f} - \frac{f_t}{2}\right) + n_t\left(\hat{n} - \frac{n_t}{2}\right) + g_t\left(\hat{g} - \frac{g_t}{2}\right) + U_{fF} f_t F_t + U_{nN} n_t N_t. \tag{10}$$

Note that we do not make any *a priori* assumption about whether preferences feature habit formation or taste formation. These are properties that will be inferred from the empirical exercise.[9] As shown in Appendix C, the following holds:

Proposition 1 (Policy functions)**.** *At each point in time, optimal consumption of novel and familiar food can be expressed as a linear function of consumption experience at time* 0

$$n_t = \alpha_t + \beta_t N_0 \tag{11}$$

$$f_t = \kappa_t + \phi_t F_0 \tag{12}$$

Note that the equations above are not just the first order conditions for optimal consumption, but the policy functions which represent the optimal trajectory of consumption leading to the steady state. Equations (11) and (12) will be estimated in the empirical section. They can also be used to estimate the differences in consumption levels at two different points in time, t and s, with $t > s$, as shown below:

$$\Delta n_{ts} = n_t - n_s = \alpha_{ts} - \beta_{ts} N_0 \tag{13}$$

$$\Delta f_{ts} = f_t - f_s = \kappa_{ts} + \phi_{ts} F_0. \tag{14}$$

4.4 Inferring Habit or Taste Formation from Post-Reunification Cross-Sectional Data

Equations (11) and (12) can be used to measure differences in consumption levels between East and West Germans at a given point in time t after the reunification:[10]

$$\Delta n_t^{EW} = n_t^E - n_t^W = -\beta_t N_0^W \tag{15}$$

$$\Delta f_t^{EW} = f_t^E - f_t^W = \phi_t\left(F_0^E - F_0^W\right). \tag{16}$$

The coefficients β_t and ϕ_t depend on time and on individual characteristics. Notably, the following holds:

Remark 1 (Inferring non-separable time preferences)**.** *The coefficients β_t and β_{ts} are positive if novel food features taste formation ($U_{nN} > 0$), and they are negative if it features habit formation ($U_{nN} < 0$). The coefficients ϕ_t and ϕ_{ts} are positive if familiar food features taste formation ($U_{fF} > 0$), and they are negative if it features habit formation ($U_{fF} < 0$).*

[9] The positive parameters $\hat{f}, \hat{n}$ and $\hat{g}$ depend on individual characteristics and they represent, absent budget constraints and past consumption experiences, the (exogenously given) bliss consumption point of n, f and g. Non-satiation can be guaranteed, if necessary, by assuming that the bliss points are large enough to be economically unfeasible. One could imagine that Germans underwent different phases of taste-formation and habit-formation. This case is not excluded by the general specification of the model, nor by the local second-order approximation that we use to derive linear policy functions. However, assuming no habit/taste formation switch during the adjustment period allows to provide a solid benchmark for the empirical analysis. This simplifying assumption is a good starting point to study non-separable time preferences, and it allows to derive closed-form solutions that can be directly estimated. Note that our linear empirical specification can be considered as a linear approximation of a different (but undefined) policy function associated to a utility function which allows for switches.

[10] Analogously, β_{ts} and ϕ_{ts} measure differences-in-differences between consumption levels in East and West Germany between times t and s, as $\Delta n_{ts}^E - \Delta n_{ts}^W = -\beta_{ts} N_0^W$ and $\Delta f_{ts}^E - \Delta f_{ts}^W = \phi_{ts}\left(F_0^E - F_0^W\right)$.

Remark 1 implies that, depending on the empirically observed food consumption patterns, the signs of the estimated β and ϕ allow us to infer whether consumers' preferences feature habit formation or taste formation, as shown in the following proposition.

Proposition 2. *Suppose the observed differences in East and West Germans' consumption behavior are due to the exposure to socialism. Immediately after the reunification, consumption of novel food increases. Moreover, during the transition to the long run equilibrium:*

1. *East Germans consume as much novel food as West Germans if it is neither habit nor taste forming:* $U_{nN} = 0 \Rightarrow n_t^E = n_t^W$
2. *East Germans consume more novel food than West Germans if and only if it is habit forming:* $U_{nN} < 0 \Leftrightarrow n_t^E > n_t^W$,
3. *East Germans continue to consume less novel food than West Germans if and only if it is taste forming:* $U_{nN} > 0 \Leftrightarrow n_t^E < n_t^W$.

East and West Germans consume the same amount of novel food when they reach the new long-run equilibrium.

Proposition 2 implies that empirically estimating post-reunification East-West differences in consumption levels and consumption dynamics allows us to infer whether (unobservable) time preferences feature habit or taste formation. It is noteworthy to mention that it focuses on East-West differences in consumption *at a given point in time*; hence it does not require tracking individuals over time. This considerably relaxes the need of using panel data and just requires repeated representative cross-sections to test for non-separable intertemporal preferences.

[Insert Figure 1 about here]

Figure 1 illustrates dynamic consumption patterns of novel food ($n_t^E - n_t^W$) for East and West Germans. This is the sufficient statistic for the empirical test. Before the reunification, the consumption differential is negative because novel food consumption was essentially zero in East Germany. After the reunification, novelty consumption unambiguously increases in East Germany.

Under habit formation, the desirability of novel goods is high when consumption experience is low. Hence, post-reunification consumption levels would be higher in East than in West Germany. Over time, when consumption experiences have accumulated, and the 'surprise effect' vanishes, eastern consumption would *decrease* and converge to western levels. In contrast, under taste formation, the demand for novel goods is low when consumption experiences are low, as it takes time to learn about the new good. Hence, post-reunification consumption in East would be lower than in West Germany, but demand would *increase* over time (see Figure 1).

In both cases, in the long-run, the good will no longer be novel and consumption in the East will equal consumption in the West.[11]

[11] Our theoretical results are related to Becker and Murphy (1988)'s finding that present consumption is positively related to past consumption if reinforcement is large enough (which, in Becker and Murphy (1988) requires $U_{nN} > -U_{NN}/(2\delta + \rho)$) and negatively related otherwise. In the former case, the literature speaks of 'adjacent complementarity' while the latter case is labeled 'distant complementarity' (Ryder and Heal, 1973). Note that in our setup $U_{NN} = 0$.

[Insert Figure 2 about here]

Figure 2 illustrates dynamic consumption patterns of familiar food ($f_t^E - f_t^W$) for East and West Germans. In analogy to Proposition 2, we distinguish between three cases: When the pre-reunification consumption of familiar food was lower in East as compared to West Germany (which is the relevant case for sugar), then habit forming preferences for familiar food would be revealed by higher post-reunification consumption in East Germany. In contrast, taste forming preferences would be revealed by comparatively lower post-reunification consumption. The following propositions consider the two remaining cases: higher (potatoes) or equal (meat) pre-reunification consumption of familiar food in the East.

Proposition 3. *Suppose that pre-reunification consumption of familiar food was higher in East than in West Germany:* $f_0^E > f_0^W$. *During the transition to the long run equilibrium:*

1. *East Germans consume less familiar food than West Germans if and only if it is habit forming:* $U_{fF} < 0 \Leftrightarrow f_t^E < f_t^W$,
2. *East Germans continue to consume more familiar food than West Germans if and only if it is taste forming:* $U_{fF} > 0 \Leftrightarrow f_t^E > f_t^W$.

East and West Germans consume the same amount of familiar food when they reach the new long-run equilibrium.

Proposition 4. *If the pre-reunification consumption of familiar food is equal in East and in West Germany,* $f_0^E = f_0^W$, *no consumption difference should be observed after the reunification:* $f_t^E = f_t^W$.

Hence, equal pre-reunification levels in consumption of familiar food provide sufficient information to predict that no difference will be observed afterwards. If, instead, differences in pre-reunification consumption levels do exist, then one can exploit the subsequent consumption dynamics to infer the underlying intertemporal preferences for food consumption, as shown in Figure 2.

5 Linking the Theory and the Available Data

5.1 Representative East-West German Consumption and Body Weight Data

German National Health Survey East-West 1991 (*GNHSEW91*)

The first dataset is the *German National Health Survey East-West 1991* (*GNHSEW91*), a representative cross-sectional survey that was in the field in East and West Germany between 1990 and 1992 (Robert Koch Institut, 2012b). A large share of the elicited information is nutrition and health-related. Excluding individuals with missings on relevant variables, the sample consists of 2,160 East and 4,390 West German respondents. We do not restrict the sample further.

We exploit a battery of food consumption and body mass measures, along with additional measures for mechanisms and for robustness checks. As shown in the descriptive statistic in Table B1 (Appendix), we group the main variables of interest into different categories.

Self-Reported Measures of Food Consumption. In the empirical analysis, our main focus is on food consumption. The *GNHSEW91* contains two types of self-reported food consumption measures.

The first battery of questions asks respondents *"How often do you consume the following food products?"* and then lists categories of food like meat, fresh fruits or wholegrain bread. Respondents have six answer categories to choose from: *(i)* daily, *(ii)* several times a week, *(iii)* once a week, *(iv)* 2-3 times a month, *(v)* once a month, *(vi)* never. We collapse these categories and generate binary food consumption variables indicating 'daily consumption [(i)],' 'regular consumption [(i)+(ii)],' and 'weekly consumption [(i)-(iii)]'.

Table B1 in the Appendix lists the descriptive statistic of these food consumption measures. As seen, 54% eat wholegrain bread daily, 26% eat non-processed (boiled, baked or smashed) potatoes daily, and 57% eats fresh fruits daily. Meat is consumed by 75% 'regularly' (more than once a week); pie and cookies (36%) are also regularly consumed by a significant share of the population.

The second battery of food consumption questions asks respondents about *changes* in their diet during the past three years. East Germans were interviewed between September 1991 and October 1992, which means that consumption changes in the past three years refer exactly to changes since the fall of the Wall in 1989.[12] Specifically, respondents were asked: *"When you think back about the last three years: Compared to the time before, have you changed your diet?"* Those 40% who respond 'yes' are then asked specifically about whether they eat more, less, or the same amount of meat, fresh fruits, whole grain etc. Panel A of Table B1 shows that only 2% ate more meat, but 34% more fresh fruits and 25% more wholegrain.

Finally, respondents who changed their diet are asked whether, *overall*, they consumed more, the same amount, or less food in the past three years.

Objective and Subjective Body Weight Measures. One strength of the *GNHSEW91* is that medical examinations are conducted and several health-related measures are collected. For example, objective height and weight measures are taken. Table B1 shows an average BMI of 27, that 61% of all respondents are overweight (BMI>25), and that 21% are obese (BMI>30).[13]

In addition, similar to eliciting nutritional changes in the past three years as discussed above, respondents are asked whether their body weight has changed in the last three years. Overall, 27% of all respondents indicated that they gained weight in the past three years, on average six kilograms conditional on gaining weight. Fifteen percent indicated that they lost weight in the past three years, on average seven kilograms conditional on losing weight.

Other Health-Related Measures. We use additional health-related measures to test for the robustness of the findings and provide evidence on mechanisms.

The category *Diet-related objective health conditions* includes measures that are associated with an unhealthy unbalanced diet, such as a high blood pressure (21%) or high blood cholesterol level (44%) (Niinikoski et al., 1996; American Heart Association, 2001; Pasanisi et al., 2001; Brinkworth et al., 2006; Nagashima et al., 2010; American Heart Association, 2014). The category *Unawareness and medical check-up measures* reveals that only 25% had their blood pressure taken within the last year,

[12] However, as one referee has correctly pointed out, this remains a noisy measure. In addition to recall biases, respondents interviewed in September 1991 would report changes in diet between September 1988 and September 1991.

[13] A person is considered to be overweight if the BMI is between 25 and 30, and obese if it is above 30.

but 44% had their blood cholesterol checked. Fifty-six percent got weighted and 87% received dietary advice within the last year. Contrasting clinical diagnoses and respondents' self-reports, we find that 9% are unaware of their high blood pressure, 29% are unaware of their high cholesterol, and 7% are unaware that they are obese.

Measuring GDR Socialization. One great advantage of the *GNHSEW91* is that it was in the field immediately after the fall of the Wall, between September 1991 and October 1992. The dataset contains an indicator that identifies respondents who lived and East and West Germany *at the time of the interview*. Accordingly, we generate a binary variable *East German*. However, according to the official statistics (Statistisches Bundesamt, 2001), about 1.1 million East Germans had migrated from East to West Germany between 1989 and 1992. In contrast, less than 230 thousand migrated from West to East Germany. Given the sampling scheme of about 1:12,500 the *GNHSEW91* thus contains about 90 respondents who migrated from East to West Germany and about 18 respondents who migrated from West to East Germany. Although movers are a selective subsample, these case numbers of potential migrants represent a small share of just 1.5% of all *GNHSEW91* respondents—quantitatively, they should not severely bias our estimates. If anything, the bias should provide us with a lower bound of the true East-West consumption differentials because it seems plausible to assume that East Germans who migrated to West Germany immediately after the fall of the Wall were more likely to conform to the western lifestyle and diet. Finally, robustness checks that exclude recent movers confirm the robustness of our findings (see Table B4, Online Appendix).

Covariates. Additional sample adjusters include the categories *Demographics*, *Education*, and *Employment*. All mean values are reported in Table B1. Demographics includes the dummies *Single* and *Private Health Insurance*, in addition to *Age*, *# Household Members*, and *# Kids*. The list of covariates also includes three educational dummies and seven employment measures, such as *Blue Collar Worker*, *White Collar Worker*, *Unemployed*, or the *Net Household Income* in ten categories.

Next, we describe the 1998 follow-up survey to the *GNHSEW91*. This follow-up survey elicits the same measures of food consumption in 1998. In the empirical part, we pool both cross sections in order to assess *levels* of food consumption in East and West Germany in 1991 and 1998, as well as changes between 1991 and 1998.

German National Health Interview and Examination Survey 1998 (GNHIES98)

Although technically a different dataset, the *German National Health Interview and Examination Survey 1998* (GNHIES98) can be seen as a follow-up survey of the *GNHSEW91* given that most of the questions asked are identical. The *GNHIES98* is also a nationwide cross-sectional survey designed to be representative in East and West Germany, with self-reports on food consumption, as well as objective height and weight measures. More information is provided by the Robert Koch Institut (2012a). The sample used here consists of 2,216 East and 4,203 West Germans. All interviews were carried out between October 1997 and March 1999.

Self-Reported Measures of Food Consumption. We generate categories of dependent variables, analogously to the ones for the *GNHSEW91* above. However, some food-related questions slightly changed as compared to the *GNHSEW91*. In addition, the retrospective questions on food consumption changes were no longer asked. The descriptive statistic of all variables are in Table B2 (Appendix).

As above, the first set of dependent variables includes measures on the current consumption of meat, (boiled) potatoes, fresh fruits, wholegrain, and pie. Newly elicited food consumption measures that are useful for estimating our model of novelty consumption include *Convenience Food* and *Snacking*.[14]

Measuring GDR Socialization. While the *GNHSEW91* was in the field shortly after the fall of the Wall but includes no explicit indicator of where current East and West German residents were socialized before 1989, the *GNHIES98* contains such an explicit measure of weather respondents where socialized in the former GDR or FRG. Accordingly, we generate the variable *East German*.

Covariates. Because identical or very similar questions were asked in the *GNHIES98*, as Table B2 shows, the list of control variables has been selected and generated according to the categorization in the *GNHSEW91*.

5.2 Estimating the Model Empirically

Equations (11) and (12) as well as equations (13) and (14) provide the theoretical framework for the empirical models and the test on non-separable time preferences. Section 4 has shown that non-monotonic consumption patterns, which overreact to exogenous price shocks, identify habit formation. Taste formation, instead, produces a smoother response to the shock; consumption underreacts at the time of the shock and is then followed by a monotonic adjustment to the long-run equilibrium.

In each of the equations (11), (12), (13) and (14), the first term $(\alpha_t, \kappa_t, \alpha_{ts}, \kappa_{ts})$ represents the relationship between individual characteristics—our covariates, such as *Demographics* , *Education*, *Employment* and *Income*—and consumption levels. The second term $(\beta_t, \phi_t, \beta_{ts}, \phi_{ts})$ indicates different consumption experiences of East and West Germans. Recall that both the *GNHSEW91* and the *GNHIES98* elicit levels of food consumption in East and West Germany at the time of the surveys in 1991 and 1998. Also recall that the proposed test on non-separable time preferences only requires representative cross-sectional data in East and West Germany (Section 4.4). As illustrated in Figures 1 and 2, given the post-reunification consumption dynamics, one can then infer whether preferences feature habit or taste formation depending on the signs of β and ϕ (see Remark 1).

Pooling the *GNHSEW91* and the *GNHIES98*, we empirically estimate equations (11) and (12):

$$\begin{aligned} y_{it} \quad = \quad & \alpha + \beta EastGerman_i + \psi EastGerman_i \times y1998_t \\ & + \gamma Demographics_i + \delta Education_i + \theta Employment_{it} + \omega Income_{it} + \rho_t + \epsilon_i \end{aligned} \tag{17}$$

where y_{it} stands for the food consumption measures in 1991 and 1998, as discussed in Section 5.1 above.

The main variable of interest is the dummy $EastGerman_i$, which is the empirical counterpart of the theoretically modeled 'consumption experience' with novel and familiar food at time 0. It indicates whether the respondent was living in East or West Germany prior to 1989. The corresponding coefficient β represents East-West level differences in food consumption in 1991. It represents the relationship between y_{it} (food consumption) and transitioning from socialism to capitalism, from a limited socialist

[14] Some types of convenience food had also existed in the GDR, for example canned beans, but the number of available items in this food category clearly increased after the fall of the Wall.

food basket to a much larger capitalistic one. Most importantly, when considering novel and familiar food consumption, the sign of β will be informative of whether intertemporal preferences feature habit or taste formation, according to Propositions 2, 3 and 4.

In addition, the interaction term $EastGerman_i \times y1998_t$ and the coefficient ψ measure the change in food consumption for East Germans between 1991 and 1998, as the the dummy variable $y1998_t$ is equal to one when $t = 1998$.

Since employment, individual income and other socio-demographic factors are potentially related to the demand for food, the model corrects for $Demographics_i$, a vector of six socio-demographic covariates, $Education_i$, a vector of three educational dummy variables, and $Employment_i$, a vector of seven labor market related controls (see Tables B1 and B2 in the Appendix). Month and year fixed effects are included to control for the interview month and year (ρ_t). As usual, ϵ_i is the error term.

Recall that the *DesStatGNHSEW91* also directly elicits self-reported *changes* in food consumption (by food categories) in the last three years before the survey in 1991/1992. The generated dependent variables, Δy_{it}, then measure an *increase* in meat, wholegrain or fresh fruit consumption. When the dependent variable directly indicates changes in food consumption, rather than levels, the corresponding theoretical equations that we estimate are (13) and (14). The empirical model can then be written as:

$$\begin{aligned} \Delta y_{it} \quad = \quad & \tilde{\alpha} + \tilde{\beta} EastGerman_i \\ & + \tilde{\gamma} Demographics_i + \tilde{\delta} Education_i + \tilde{\theta} Employment_i + \tilde{\omega} Income_i + \rho_t + \epsilon_i \end{aligned} \tag{18}$$

In this case, the empirical coefficient $\tilde{\beta}$ can be interpreted as an East-West difference-in-differences (DD) estimator because changes in food consumption for East Germans between 1991/1992 and the past three years are contrasted with changes in food consumption for West Germans over the same time horizon. Recall that self reported changes in consumption were only elicited in the *DesStatGNHSEW91* but not in the *GNHIES98*.

5.3 Identifying Assumptions of the Empirics

There exists a rich empirical literature exploiting the German reunification as a natural experiment (Frijters et al., 2004b,a, 2005; Fuchs-Schündeln and Schündeln, 2005; Alesina and Fuchs-Schündeln, 2007; Fuchs-Schündeln, 2008; Brosig-Koch et al., 2011; Rainer and Siedler, 2013; Pfarr et al., 2013; Heineck and Süssmuth, 2013; Friehe and Mechtel, 2014; Friehe et al., 2015). It rests on a set of standard assumptions which have been widely accepted. Basically all of these studies can solely rely on post-reunification data without the possibility to explicitly test for differences in pre-treatment characteristics or trends, e.g., the common time trend assumption. In addition to the core identifying assumption of the theory (see Section 4.2), below we discuss empirical identification challenges related to *(i)* the treatment 'socialism', *(ii)* selective migration in reunified Germany, *(iii)* potential differences in purchasing power and prices as well as *(iv)* in food quality.

First, with regard to *(i)* and the treatment 'socialism' in a natural experiment: *The* main identification assumption is that the outcome measures of interest would have been the same, i.e., not statistically different, for East and West Germans at any point in time after 1989—had Germany not been divided

in 1961 and reunified in 1989. This means that the quasi-exogenous treatment 'socialism' causally generated significant outcome differences that the researcher observes after 1989.

Related to this main assumption, we assume (consistent with the literature) that both the division and reunification of Germany were unexpected and quasi-random events that divided an otherwise united and similar population (Bleich et al., 2008). In one part, the GDR, a socialist regime, established a centrally-planned economy with limited food variety. In the other part, the FRG, a western capitalist economy, offered a large variety of Western food products. The Berlin Wall divided the GDR and the FDR from 1961 until 1989 for 28 years (see Section 3.1).

An implication of our main assumption is that, post-reunification, unobservables did not affect the outcomes differentially for East and West Germans. More precisely, if such unobservables existed (e.g. trust or uncertainty about the future) then they should be correlated with the treatment 'life under socialism.' If that is the case, then post-reunification differences in the outcome variable of interest can be interpreted as an overall reduced form 'intention-to-treat' effect of the transition from socialism to capitalism.

Second, with regard to *(ii)* and selective migration: selective migration is a potential threat to causal identification. As discussed in Section 3.1, while it was basically impossible to migrate during the Cold War, an estimated 3.4 million mostly young and well-educated East Germans migrated to West Germany between 1989 and 2004 (Statistisches Bundesamt, 2001; Hunt, 2009). Although the *GNHSEW91* was in the field shortly after the reunification (in 1991/1992), as discussed in Section 5.1, we miss about 1.1 million East-West migrants between 1989 and 1992 because the *GNHSEW91* only elicits the *current* residency of the respondents at the time of the interview. However, 1.1 million East-West migrants only translate into about 90 misclassified West Germans in the *GNHSEW91*. We are able to identify and exclude them in robustness checks without recent movers (Table B4 in the Online Appendix). Fortunately, the *DesStatGNHIES98* allows us to unambiguously identify and assign inner-German East-West and West-East migrants.

With regard to *(iii)* and differences in purchasing power: Differences in purchasing power and prices could lead to differences in consumption that are unrelated to previous consumption experience and preferences. Section 4.2 contains an extensive discussion on the role of prices and identifying assumptions of the theoretical part. In short, we plausibly assume that the prices for western novel products (significantly) fell in East Germany when the Wall fell. For all food products, we assume a quick convergence to western price levels due to intense competition in the grocery market and the quick diffusion of supermarket chains in East Germany. This is consistent with the available evidence as discussed in Section 4.2. Also note that the empirical models control for employment, income, and other socio-demographics.

The empirical analysis (and the model) cannot include thousands of specific measures of food quality and prices, but captures changes in these two factors in a reduced-form manner by the variable $EastGerman_i$. It is obvious that food availability dramatically increased over night in the GDR. Since it is impossible to model the very complex simultaneous changes in quality, prices and availability, we opted for a flexible, parsimonious, but still comprehensive, model of intertemporal preferences in which we assume a price decrease for novel food in the GDR when the Wall fell, and then a quick price convergence to western levels. In addition, to shut down as many potential confounding channels as possible, in the empirical part, we focus on consumption of selected food items that stand representative for familiar

food (such as boiled potatoes and meat) and for novel food (such as exotic fruits and convenience food). In addition to providing the best available information on pre-reunification prices and consumption of select food in the GDR and FRG, it is noteworthy that, for most staple familiar food items, price effects are unlikely to play a major confounding role due to arguably inelastic demand (Hsieh et al., 2009).

Finally, with regard to *(iv)* and food quality: we consider it reasonable to assume that the quality of familiar food did not change significantly after the reunification, and that the quality of western novel food did not differ in both Germanies after 1989.

6 Testing for Non-Separable Time Preferences in Food Consumption

6.1 Short-Run Post-Reunification Changes in Food Consumption

Specific Food Consumption Changes. Using solely the *GNHSEW91*, we start with the regression framework formalized by equation (18). The dependent variables are based on *changes* in food consumption in the last three years, as reported by respondents at the time of the survey in 1991/1992. The framework empirically assesses whether and how East Germans changed their diet in the transition period from socialism to capitalism, compared to West Germans over the same time period. Identifying assumptions are discussed in Section 5.3.

Panel A of Table 2 reports the results. Each column represents one regression model as in equation (18) where the dependent variables are indicated in the column header. Column (1) shows that the share of East Germans who reported eating more fresh fruits between 1988/1989 and 1991/1992 is a highly significant 16 percentage points (ppt) higher than among West Germans. Relative to the mean of 34%, the East-West gap is substantial. Consistent with anecdotal evidence, East Germans have consumed fresh exotic fruits at a much higher rate right after the fall of the Wall. Because we know that that the availability of fresh exotic fruits was very limited in East Germany, and consumption experience was low, the observed 'overshooting' is consistent with the habit formation case presented in Figure 1, and predicted by Proposition 2.

In contrast, columns (2) and (3) do not provide any evidence that East Germans consumed *more meat* or *more wholegrain* as compared to West Germans shortly after the reunification. Due to these apparently flat consumption differentials between East and West, we cannot infer habit or taste formation.

[Insert Table 2 about here]

General Changes in Diet. The last three columns of Panel A directly test for general dietary changes. Respondents reported in 1991/1992 whether they changed their diet in the last three years prior to the interview, and whether they ate more or less food in the last three years. As above, the estimated models can be interpreted as variants of DD models because the identified coefficients represent the double difference between changes over time for East Germans and changes over time for West Germans (equation (18)). Obviously, the main identification assumption is that, without the separation and reunification, reported changes over time had not been significantly different in East and West Germany.

Interestingly, and in line with the findings above, East Germans were significantly more likely to have changed their diet between 1988/1989 and 1991/1992 (column (4)): the *East German* coefficient is

13.3ppt and significant at the one percent level. Column (5) provides an imprecisely estimated coefficient for *More Food* which is, however, large in size. The *Less Food* coefficient is smaller but still of relevant size and marginally significant. Overall, the findings suggest that a significant larger share of East Germans (50% vs. 36% without adjustment for covariates) changed their diet in the transition period from life under socialism to capitalism, where some consumed quantitatively more and some consumed quantitatively less food.

While all models in Table 2 include socio-demographic control variables, all findings are very robust and close in size when solely controlling for the clearly exogenous covariates gender, age, month and year fixed effects. This strengthens the credibility of the identification assumption according to which the *East German* status is exogenous, because socio-demographics are obviously not correlated with both, changes in nutrition and being being East German. Table B6 (Online Appendix) reports the results of this robustness check for Table 2. In another robustness check, Table 2 replicates Table B5 with weights as provided by the Robert Koch Institut (2012b).

6.2 Short-Run Post-Reunification Changes in Body Weight

Next we study how and whether East Germans' body weight changed in the course of the reunification when East Germans changed their diet. On theoretical grounds, recall that body weight is produced according to $W_t = W\left(n_t, f_t, \gamma_t, N_t, F_t, Z\right)$ (equation (3)). The idea is to empirically elicit the sign of the following expression at time t, shortly after the fall of the Wall:

$$\frac{\partial W_t}{\partial p_n} = \frac{\partial W}{\partial n_t}\frac{\partial n_t}{\partial p_n} + \frac{\partial W}{\partial f_t}\frac{\partial f_t}{\partial p_n} + \frac{\partial W}{\partial \gamma_t}\frac{\partial \gamma_t}{\partial p_n} \gtreqless 0 \tag{19}$$

Since the overall effect on body weight depends on how caloric input and output adjust after novel food becomes available, the following holds:

Proposition 5. *The impact of novel food on body weight is theoretically ambiguous.*

Although the effect on body weight is theoretically ambiguous, we can address this issue empirically. Panel B of Table 2 tests whether *(a)* East Germans' self-reported body weight changed similarly to those of West Germans between 1988/1989 and 1991/1992, *(b)* whether weight loss intentions differed, and *(c)* whether the objectively measured BMI distribution differed in 1991/1992.

Column (1) of Panel B in Table 2 shows indeed that, on average, not only did more East Germans change their diet but they also gained weight at higher rates. The weight gain differential to West Germans is a significant 5.9ppt, or 22% relative to the baseline. In contrast, there is not much evidence that East Germans lost weight at higher or lower rates than West Germans (column (2) of Panel B). Column (3) shows that 46% of all respondents reported that they are planning to lose weight in 1991/1992. Interestingly, this share is 6.7ppt higher among East Germans and complements the finding in column (1) according to which East Germans gained more weight than West Germans around the time of the reunification.

In refined analyses in Section 7, we link specific quantities of food consumption to weight gains and weight losses (Figures 4 to A4): People who gained weight are those who ate more food, in particular more fat and meat, are overweight and obese, and are planning to lose weight. Analogously, weight

losers ate less food in general, but more wholegrain and fruits, are mostly overweight, and plan to lose even more weight in the future. Interestingly, East German weight gainers were predominantly better educated white-collar men, and East German weight losers were predominantly employed women.

Figure 3a plots the entire BMI distribution for East and West Germans using objective height and weight measures taken by professional health care interviewers in 1991/1992 (see Section 5.1). The distributions suggests that less East Germans had normal weight, and that more East Germans were overweight and obese. Correcting the BMI distributions for differences in socio-demographics, columns (4) and (5) of Panel B formally test whether East Germans had a higher BMI and whether more East Germans were obese in 1991/1992. Whereas the average BMI was only slightly, but significantly, higher among East Germans (0.7 index points), the obesity rate was a substantial 6.7ppt higher.

[Insert Figure 3 about here]

The body mass is determined by the net calorie intake, the difference between calorie input and output. One potential explanation for higher eastern body mass levels is more calorie intake. Another is less physical activity (Kämpfen and Maurer, 2016). We test calorie output differences using a detailed physical activity assessment contained in the *GNHSEW91*. Respondents had to estimate their weekly time spent for 20 different physical activities. Summing over all categories, one finds that Germans spend on average 80 minutes per day on physical activities such as hiking, walking or practicing sports. Figure 3b demonstrates that East Germans were *more* physically active than West Germans in 1991/1992. This is confirmed in column (6) of Panel B which shows that the difference amounts to a highly significant 233 minutes per week (33 minutes per day), even after considering differences in socio-demographics. Hence, higher calorie expenditures can not explain the body mass differential between East and West Germans in 1991. If—*ceteris paribus*—physical activity levels had been comparable between the two Germanies, the body mass differentials would have been even larger.

We conjecture that the East German change in diet and increase in body weight was primarily driven by an overshooting of novel food consumption, in particular snacks and novel high energy density food. As will be shown in the next section, the *GNHIES98* contains information on snacking and convenience food consumption which allows us to provide empirical evidence in line with this conjecture.

6.3 Medium-Run Dynamics in Food Consumption and Non-Separable Time Preferences

Pooling the *GNHSEW91* and *GNHIES98*, we now formally test for consumption dynamics as formalized by equation (17). Our consumption measures indicate consumption quantities in levels by specific good categories in 1991/1992 and 1998. Table 3 shows the main results (one column represents one model with the full set of control variables); Table B7 (Appendix) shows that the results hold up when excluding socio-demographic controls.

The $EastGerman_i \times y1998_t$ interaction term indicates changes in consumption for East Germans between 1991/1992 and 1998. The plain $EastGerman_i$ coefficient, by contrast, yields the East-West consumption differential in 1991/1992. Together with the information on pre-1989 consumption levels in Table 1, and as derived by our theoretical framework in Section 4, the empirical patterns let us infer whether consumption of these products feature habit formation or taste formation, and whether time

preferences are separable or not. Table 4 provides an overview of the different food types, their consumption dynamics, and our conclusion about whether preferences are separable in time or not.

We start with the consumption dynamics for *Fresh Fruits*, *Pie*, *Juice*, *Convenience Food* and *Snacks*. While all these categories can, in principle, be considered mixed categories, it seems reasonable to classify them as 'novel food'.

Novel food. The evidence is very clear for *Fresh Fruits* and entirely in line with column (1) of Table 2: Fresh fruit consumption increased sharply in the East after 1989, and then remained at a significantly higher level (as compared to West Germany) at least until 1998.[15] This suggests *(a)* that fresh fruits feature habit formation (Proposition 2), and *(b)* that the long-run equilibrium had not been reached by 1998, even nine years after the reunification.

Interestingly, we find a similar pattern for *Daily Juice Consumption*. Similar to fresh fruits, the availability of juice made from exotic fruits was limited in the GDR (except for apple juice or orange juice with oranges imported from Cuba). Column (3) of Table 3 shows that, in 1991/1992, the share of respondents who consumed juice daily was 9.1ppt higher among East Germans (28.9% vs. 20.5% without controls). Between 1991 and 1998, the significantly higher share of daily juice consumers decreased significantly in East Germany, by 5.7ppt. Apparently, following an initial overshooting shortly after new consumption opportunities had opened up, consumption in East and West Germany converged to the new equilibrium by the end of the 1990s. Already in 1998, the juice consumption differential between East and West Germans was not significantly different any more.

The consumption of presumably less healthy novel food, *Pies and Cookies*, *Convenience Food*, and *Snacks* follows very similar patterns: In East Germany, consumption was higher after the reunification (we lack specific data on pre-1989 consumption, but it is a historic fact that these food products were rarely available in GDR grocery stores). Although *Convenience Food* and *Snack* consumption were only elicited in 1998, not in 1991, we can conclude the following: If our theoretical model as represented by Figure 1 applies, then we can infer that the *Convenience Food* and *Snack* consumption of East Germans increased after the reunification—because eastern consumption remained at significantly higher levels at least until 1998 when East Germans snacked at an 8ppt higher rate (column (5)) and consumed convenience food at a 3ppt higher rate (column (4)). In contrast, the data are not precise enough to assess whether *Pies and Cookie* consumption remained significantly elevated or had decreased to western levels by 1998[16] However, all consumption dynamics observed are consistent with habit formation and persistent novelty consumption effects up to almost ten years after the Iron Curtain fell (Table 4).

[Insert Table 3 about here]

Familiar food. When considering familiar food consumption dynamics, only potato consumption underwent significant changes between 1991and 1998. While consumption was three times as high in 1989 (Table 1), East Germans ate less potatoes than West Germans in 1991/1992 (column (7) of Table 3: -0.0587***). Subsequently, potato consumption increased and had converged to western levels by 1998. Again, this consumption pattern is consistent with habit formation (Panel B of Figure 2 and Proposition

[15] The results are very robust when using *Fruits regularly* (i.e. more than once a week) as dependent variable: While the interaction term remains insignificant, the *East German* coefficient is significant at the one percent level and a large 0.1028 relative to a mean of 0.8605.

[16] $EastGerman_i \times y1998_t$ is an imprecise -0.04 following a significant $EastGerman_i$ 0.06 in 1991/1992 (column (2).

3), and with the long-run equilibrium being reached between 1991 and 1998. For meat consumption, instead, we find no differences before or after the reunification.

7 Mechanisms and Robustness Checks

7.1 Who Changed Their Diet and Body Weight?

This section further investigates who changed their diet and gained or lost weight. When running regressions of the three *GNHSEW91* outcome variables *Change In Diet*, *Weight Gain*, and *Weight Loss* on our rich set of socio-demographics and their interactions with *East German* dummy we find the following:

Relatively few socio-demographics and interaction terms are significantly correlated with the outcome variables. We do find a correlation for *EastGerman*×*Unemployed*, and the sign may be surprising. *A priori* one could have guessed that unemployment in East Germany may be one confounding factor for the reported dietary changes. However, unemployed East Germans were significantly *less* likely to have changed their diet (as were East German singles) and also to lose weight. Moreover, white (and not blue) collar workers in East Germany predominantly changed their diet. East German females, by contrast, lost weight at a higher rate after the reunification. All other determinants do not differ by East and West. Dragone and Ziebarth (2015) report the detailed results.

Next, we nonparametrically plot the self-reported weight gains and losses in kilograms, along with sets of consumption measures. This exercise also serves as falsification test to check whether people who reported to have gained weight are truly those who ate more and changed their diet. Moreover, it double checks the potential for measurement errors, under- or overreporting.

[Insert Figures 4 and 5 about here]

Figure 4 illustrates that weight gain is indeed, almost linearly, associated with *(a)* an increase in food consumption, *(b)* an increase in the body mass index (which crosses the 30 BMI threshold for weight gains of more than 10 kilograms), and *(c)* a strong increase in the intention to lose weight. In addition, one *(d)* fails to find an association with calorie expenditures. This is additional evidence that weight gains result from changes in diet, not changes in caloric expenditures. All four findings reinforce the validity of the research design and do not yield evidence for significant measurement issues in the self-reported data.

Figure 5 has a similar setup, but the outcomes on the y-axis are *More Fat*, *More Meat*, *More Wholegrain*, and *More Fruit Consumption* (in the last three years prior to the interview). It is easy to observe, intuitively plausible, and reassuring that people who gained weight also consumed more fat and meat, whereas there exists no relationship between weight gain and wholegrain or fruit consumption.

Figures A4 and A3 in the Appendix repeat the exercises above with weight loss. Figure A3 reinforces what we found above and shows that people who lost weight also ate *(a)* less food. Moreover, *(b)* their average body mass falls into the overweight category, but they are not obese, and *(c)* they are planning to lose even more weight. Again, as in the weight gain case, there *(d)* is no relationship between physical activity and weight loss, strongly suggesting that people lost weight due to both a change in diet and because they ate less. The last statement is reinforced by Figure A4 which shows that, in contrast to the

weight gainers, weight losers were clearly more likely to eat more whole grain and fruits, but not fat and meat.

7.2 Diet-Related Health and Awareness about Conditions

Table B8 in the Appendix sheds light on the hypothesis that dietary changes and weight gains are reflected in worse diet-related health conditions. Nutritional science has clearly shown that an unbalanced diet leads to higher blood pressure, higher blood cholesterol, and may eventually result in diabetes (Appel et al., 1997; Trayhurn and Beattie, 2001; Mohn et al., 2005; Buettner et al., 2007). The *GNHSEW91* surveyed the objective blood pressure and blood cholesterol levels of the respondents, who were also asked if they were diagnosed with diabetes.

Panel A of Table B8 shows that, in 1991, East Germans were 7ppt more likely to have high blood pressure. Related to a population mean of 0.21, this equals an East-West blood pressure gap of 34%. A similarly large percentage point gap is found for high cholesterol. In contrast, no East-West differential for diabetes can be identified in 1991/1992. Note that diabetes typically develops slowly over time and typically breaks out after years of an unbalanced diet (Kahn et al., 2009).

An interesting question that we investigate next is whether East and West Germans with diet-related health conditions were aware of their conditions. One possibility is that awareness among East Germans was lower due to institutional barriers and worse access to the health care system. Another possibility is that they were more likely to be unaware since their health condition had recently developed.

Concerning the first hypothesis, one can note that the GDR had a surprisingly well integrated health care system with regular check-ups and a high degree of preventive care (Busse and Riesberg, 2004). When investigating respondents' self-reports about their last check-up, one finds that all indicators are much better for East Germans: In 1991, they were significantly more likely to have their blood pressure taken (32% vs. 22%). They were also more likely to have their cholesterol checked (49% vs. 42%) and their body weight measured (62% vs. 54%). Lastly, although this difference is not statistically significant, East Germans were more likely to have received dietary advice. Dragone and Ziebarth (2015) provides all detailed results.

However, a recent change in the medical condition can also explain why a person is unaware of it. Hence, unawareness in the East would be consistent with the notion that East Germans developed their medical condition very recently, potentially as a result of their recent change in diet and weight gain. Indeed, Panel B of Table B8 clearly shows that, in 1991, the unawareness levels among East Germans were significantly higher, despite the better health care access. East Germans were 6ppt more likely to be not aware of their high blood pressure and 18ppt more likely to be unaware of their high cholesterol levels. Finally, the unawareness gap between obese East and West Germans was 7ppt, as column (3) shows.[17]

[17] Note that, theoretically, BMI rates above 30 could also be due to an abnormal level of muscular mass, not body fat (Burkhauser and Cawley, 2008). However, even professional bodybuilders rarely have BMIs above 30 (Biggly.com, 2014).

8 Discussion and Conclusion

This work contributes to a growing economic literature aiming to identify the driving forces behind a strong increase in body weight in industrialized countries. One main strand of research exploits narrow, but very cleanly identified, causal impact factors of obesity such as a higher density of fast-food restaurants, larger portion sizes, or changes in gasoline prices. The identified contributions of these single factors to the overall rise in body weight are, however, typically very small. Another strand of research does not identify causal effects in a reduced form manner, but exploits aggregated data and correlations to theoretically argue that technological change is the main driving force of the obesity epidemic.

This paper bridges both approaches and investigates how the availability of novel food—a characteristic of economic growth and development—can persistently change consumption patterns and body weight. Under socialism in the GDR, trade opportunities and consumption choices were limited. When the Berlin Wall unexpectedly and suddenly fell, East Germany became a capitalist economy, obtaining immediate access to international markets and free trade. Formerly unavailable western food products became available overnight.

To interpret empirically observed changes in food consumption and body weight at the time of the reunification, we develop a 'Theory of Novelty Consumption' based on non-separable time preferences. We propose a model where consumers' preferences depend on past consumption experiences and where the reunification is conceptualized as a negative price shock for novel commodities. We denote such goods as 'novel goods', and we make predictions about consumers' 'novelty consumption', both at the time of the reunification and in subsequent years, when the novelty effect progressively fades away.

Our parsimonious model describes how consumption patterns change when novel commodities become available and affordable to the general population. Under habit formation, consumption of novel food first overshoots its equilibrium level due to a 'surprise effect', and then converges to an equilibrium after an adjustment period. This persistent overshooting in novelty consumption is able to explain the change in diet and the increase in body weight that we observe in developed countries. Consequently, our theory complements the existing literature on the obesity epidemic—which has primarily focused on the supply-side and technological change—by suggesting a demand-driven explanation based on endogenous preferences. The theoretical model generates policy functions that can be estimated. It also provides a theoretical microfoundation for an empirical test that has the power to discriminate between habit and taste formation in consumption. Notably, the empirical test does not require individual panel data of consumption, but simply representative cross-sectional data.

When empirically implementing our proposed test, we exploit two different datasets that are representative for East and West Germany. The data include unique self-reported food consumption measures. They also elicit changes in body weight in addition to objective clinical height, weight and diet-related health measures. Our empirical findings can be summarized as follows:

In the transition phase from limited food availability under communism to a rich basket of western commodities under capitalism, East Germans were significantly more likely to change their diet (as compared to West Germans). Although some East Germans ate healthier and lost weight, the majority gained weight. Whereas weight losers consumed more fresh fruits and wholegrain products, weight gainers consumed more fat and meat. We show that physical activity and calorie expenditures played no relevant confounding role.

Second, digging deeper and investigating specific food categories, we find that consumption of cheap staple familiar food (boiled potatoes) decreased significantly after the fall of the Wall, but rebounded subsequently and converged quickly to the long-run western equilibrium. In contrast, East Germans consumed more previously unavailable and unaffordable novel food products, such as exotic high-quality food (exotic fruits) or industrial processed food (convenience food, snacks). Because we observe that East Germans consumed industrial processed food at much higher rates (than West Germans) even nine years after the reunification, we hypothesize that snacking and convenience food represent an important mechanism in understanding why East Germans gained body weight overproportionally.

The empirical implementation of our theory strongly supports the notion of non-separable time preferences. Moreover, the consumption patterns of both novel and familiar food suggest that habit formation is an explanation for the observed differences between East and West Germans. The empirically observed intertemporal consumption dynamics cannot simply be explained by preferences featuring taste for variety—the time-persistent effects can only be explained by a *time-varying* driving force. Our theory proposes that past consumption experiences and non-separable intertemporal preferences represent this driving force.

However, complementary alternative mechanisms could also be consistent with the observed evidence, even in the absence of non-separabilities: Time-varying and differential trajectories of prices and income between East and West Germans could potentially generate the same consumption patterns. For example, the finding that the consumption of exotic fruits and convenience food has been persistently higher in East Germany after the reunification would also be consistent with the corresponding prices being persistently *lower* in the East. However, the rebound consumption of potatoes would need to be rationalized with an opposite price trajectory—higher potato prices in East Germany in 1991 and a subsequent price convergence to West German levels.

Although regional and product-specific price changes (in combination with income dynamics) could in principle explain these consumption patterns, we consider it very unlikely that these are the driving mechanisms. First of all, we control for nominal income in all regressions. Second, anecdotal evidence suggests that—immediately after the reunification—prices for novel western commodities were the same or even *higher* in East as compared to West Germany (Seidel, 2009). In that respect, the strong increase in consumption of novel commodities can rather be considered a lower bound estimate. Third, price and income effects for staple food are likely to be of minor relevance due to arguably inelastic demand (Hsieh et al., 2009). Fourth, as a result of competitive retail grocery markets, our assumption of a quick convergence of food prices in East and West Germany appears to be reasonable and well-grounded. According to the German Statistical Office, full price convergence—of the *entire* living cost index including rents—had been achieved by 1999 (Statistisches Bundesamt, 2001, 2016).

When considering the exciting and stressful events surrounding the reunification, one could also conjecture that our results are driven by physiological channels related to situational stress and its role in fostering overeating (to gain energy reserves for survival, see, e.g., Adam and Epel, 2007). This mechanism, however, would produce a general increase in consumption of *all* types of food which is not consistent with the observed empirical patterns.

In sum, our findings are very consistent with a rational theory of habit formation in food consumption. Due to the 'surprise effect' after the fall of the Wall, consumption of novel food exceeded its

equilibrium level which led to a change in diet and higher body weight among East Germans. This finding provides empirical support for the conclusion that non-separable time preferences—in conjunction with the availability of novel consumption goods—are a possible candidate explanation for the spread of the obesity epidemic in developed countries.

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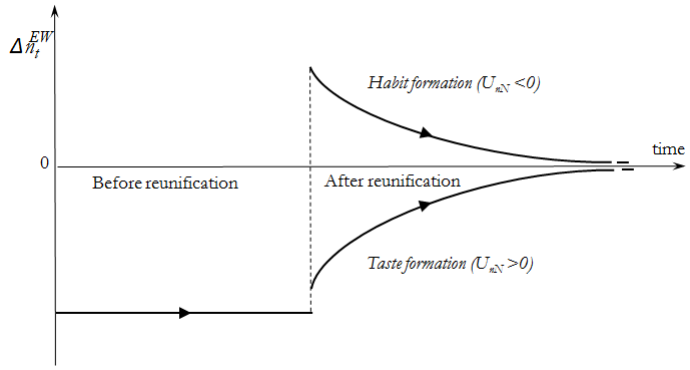
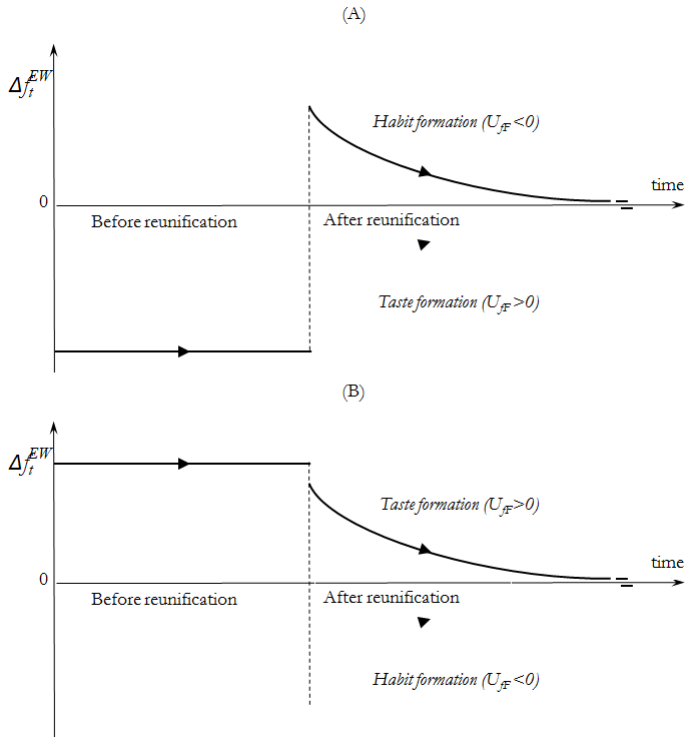
Figure 1: East-West Difference in Novel Food Consumption Before and After the Reunification



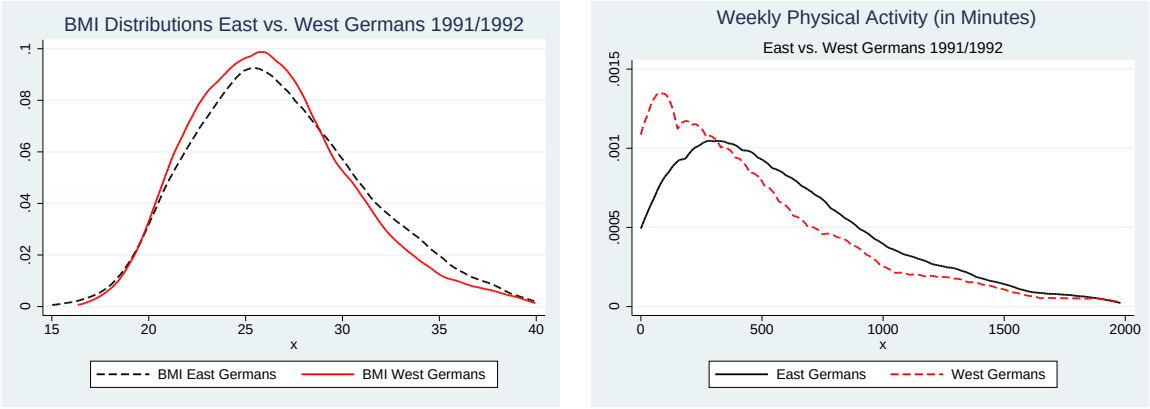
Note: Novel food consumption is zero in East Germany before the reunification. After the reunification, East Germans consume more novel food if it is habit forming, and less novel food if it is taste forming. With cross-sectional data, the vertical distance from the horizontal axis represents $-\beta_t$. In the long-run, consumption differences vanish.

Figure 2: East-West Difference in Familiar Food Consumption Before and After the Reunification



Note: Familiar food consumption could either be lower or higher in East Germany before the reunification. Panel A represents the former case (e.g. sugar) and Panel B represents the latter case (e.g. potatoes), see Table 1. With cross-sectional data, the vertical distance from the horizontal axis represents $-\phi_t$. Given the identifying assumptions, the post-reunification consumption dynamics let us then infer whether familiar food is habit or taste forming.

Figure 3: Distributions of (a) BMI (Objective Measures), (b) Minutes of Physical Activity in 1991/1992



Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (*GNHSEW91*)

Figure 4: Weight Gain and (a) More Food, (b) BMI, (c) Weight Loss Planned, (d) Physical Activity (1991/1992)

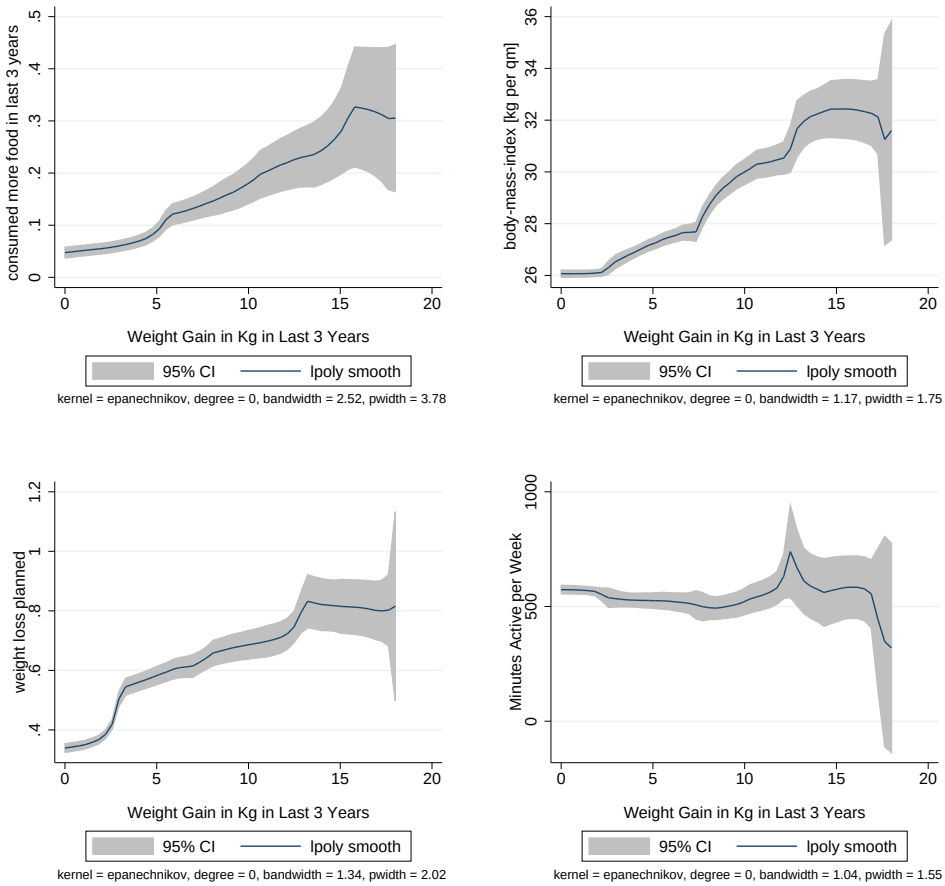


Figure 5: Weight Gain and More Consumption of (a) Fat, (b) Meat, (c) Fruit, (d) Wholegrain (1991/1992)

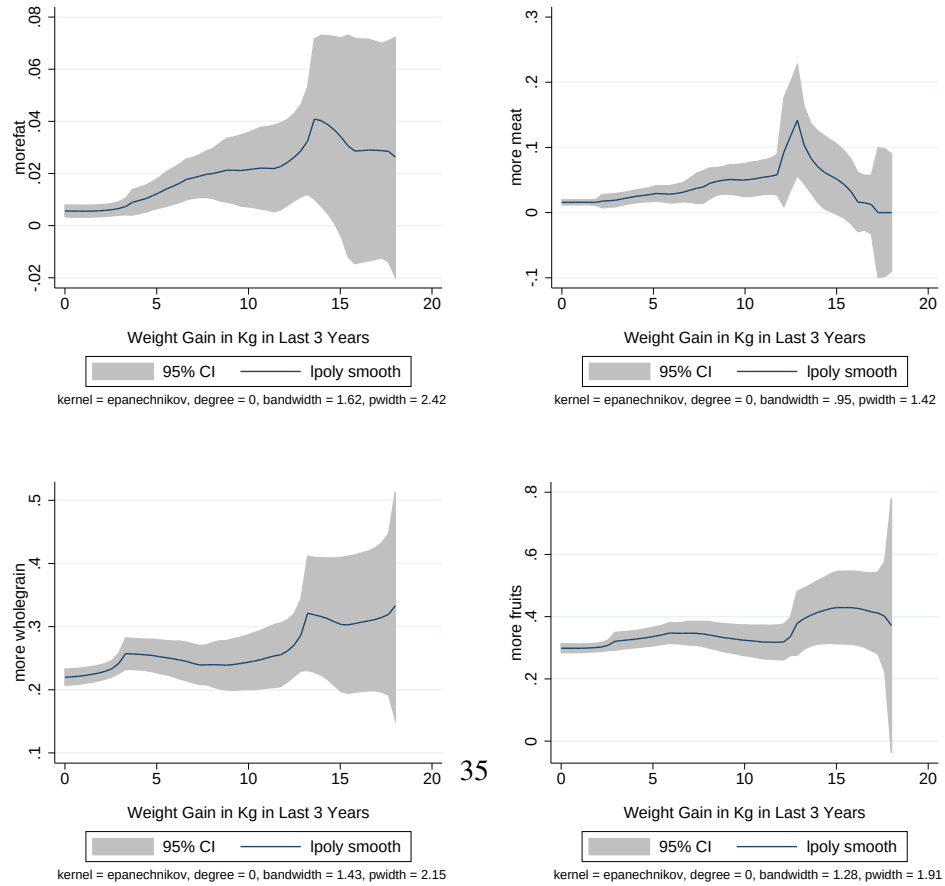


Table 1: Prices and Monthly per Capita Consumption of Selected Food Categories in 1988/1989

Food Category	***GDR/East Germany (1989)***			***FRG/West Germany (1988)***		
	Consumption per month *(in kg)* (1)	**Price per kg *(in 2000 €)* (2)**	**Price per kg *(in % of net HH income)* (3)**	**Consumption per month *(in kg)* (4)**	**Price per kg *(in 2000 €)* (5)**	**Price per kg *(in % of net HH income)* (6)**
Potatoes	*9.7*	0.11	0.02%	*3.03*	0.6	0.04%
Meat	*5.25*	5.19 (pork chop)	0.8%	*4.49*	6.63	0.5%
Sugar	*1.18*	1.00	0.15%	*1.56*	1.10	0.08%
Exotic fruits	*0 (N/A)*	11.67 (pineapple can)	1.8%	*1.75*	1.59	0.1%

Source: Böhme (1971); Zentralverwaltung für Statistik der DDR (1988, 1990, 1991); Schwarzer (1999); Grabka (2000); Gedrich and Albrecht (2003); Woll (2012); Maecker (2013), own calculations and illustrations. Consumption is per capita and month. GDR net household income is taken from Zentralverwaltung für Statistik der DDR (1991) and refers to a one-person household in 1988. FRG household income is taken from Grabka (2000) and refers to equivalent disposable household income according to the SOEP in 1988 (in 1995 prices). Food prices are taken from Zentralverwaltung für Statistik der DDR (1988, 1990); Gedrich and Albrecht (2003); Woll (2012); Maecker (2013). Prices and income have been inflated assuming an annual inflation rate of 2%, an East-West German exchange rate of 1:1 and a €-DM exchange rate of 1:1.95883. One kilogram (kg) equals 2.2 pounds (lbs).

Table 2: Short-Run Post-Reunification Changes in Food Consumption and Body Weight (between 1991/1992 and past 3 years)

Panel A: Change in diet in last 3 years						
	more fruits	**more meat**	**more whole-**	**change in diet**	**more food**	**less food**
	(1)	**(2)**	**grain(3)**	**(4)**	**(5)**	**(6)**
East German	0.1622***	0.0251	0.0105	0.1330***	0.0111	0.0472*
	(0.0310)	(0.0288)	(0.0096)	(0.0323)	(0.0109)	(0.0266)
Mean	0.34	0.02	0.25	0.40	0.028	0.21
Δ (=coefficient/mean)	48%	52%	10%	33%	40%	22%
Panel C: Weight and weight changes in last 3 years						
	weight gain	**weight loss**	**weight loss**	**BMI**	**obese**	**minutes active**
	(1)	**(2)**	**planned (3)**	**(4)**	**(5)**	**(6)**
East German	0.0589**	0.0072	0.0676**	0.6838**	0.0668**	232.79***
	(0.0295)	(0.0240)	(0.0330)	(0.2909)	(0.0262)	(37.7708)
mean	0.27	0.15	0.46	27.7	0.21	560
Δ (=coefficient/mean)	22%	5%	15%	2%	33%	42%

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header and a full set of control variables as listed in Table B1. In Panel B, all self-reported dependent variables are dummy variables. The original questions have more than two answer categories: The dependent variables in Panel B, columns (1) to (3), are based on answer categories *(i)* more, *(ii)* same, *(iii)* less [consumption of food category X in last 3 years]. The dependent variables in Panel B, columns (4) to (6), elicit self-reports on whether respondents changed their diet, consumed more, or less food in the last 3 years. The dependent variables in Panel C, columns (1) to (3), elicit self-reports on weight gains and weight losses in the last 3 years as well as planned weight losses. Columns (4) and (5) of Panel C are based on objective height and weight measures, and column (6) sums over the amount of hours and minutes typically spent per week for 20 different physical activities. Section 5.1 provides more information on the variables. The number of observations for all columns and panels is 6,550. The "mean" refers to the mean of the dependent variable in the column header.

Table 3: Food Consumption Dynamics between 1991 and 1998

	fresh fruits daily (1)	**pie regularly (2)**	**juice daily (3)**	**convenience food weekly (4)**	**snack weekly (5)**	**meat regularly (6)**	**(boiled) potatoes daily (7)**
East German×1998	0.0211	-0.0405	-0.0574**	0.0300***	0.0834***	-0.0205	0.0995***
	(0.0287)	(0.0294)	(0.0257)	(0.0101)	(0.0143)	(0.0262)	(0.0251)
East German	0.1163***	0.0623**	0.0913***			0.0257	-0.0587***
	(0.0254)	(0.0260)	(0.0227)			(0.0232)	(0.0222)
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Month fixed effects	yes	yes	yes	yes	yes	yes	yes
Socio-demographics	yes	yes	yes	yes	yes	yes	yes
Employment	yes	yes	yes	yes	yes	yes	yes
Education	yes	yes	yes	yes	yes	yes	yes
Mean	0.58	0.22	0.23	0.14	0.42	0.74	0.48

Source: Robert Koch Institut (2012b,a), German National Health Survey East-West 1991 (GNHSEW91) and German National Health Interview and Examination Survey 1998 (GNHIES98) pooled, own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1 and B2). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header and the full set of control variables as listed in Table B1 and B2. More details on all variables can be found in Tables 2 and B8 as well as in Section 5.1. The number of observations for all columns and panels is 12,969, except for columns (4) and (5) that are only based on the DesStatGNHIES98data (N=6,419). Consequently, we cannot estimate an effect for *East German* in columns (4) and (5). The 'mean' refers to the mean of the dependent variable in the column header. As indicated, all models include a full set of 12 calendar month fixed effects and a separate set of 6 calendar year fixed effects. The six year fixed effects are for the years 1990, 1991, 1992, 1996, 1997, and 1998. Note that the interaction term variable labeled "1998" represents a dummy variable for the GNHIES98 dataset.

Table 4: Does Food Feature Habit Formation or Learning in Consumption?

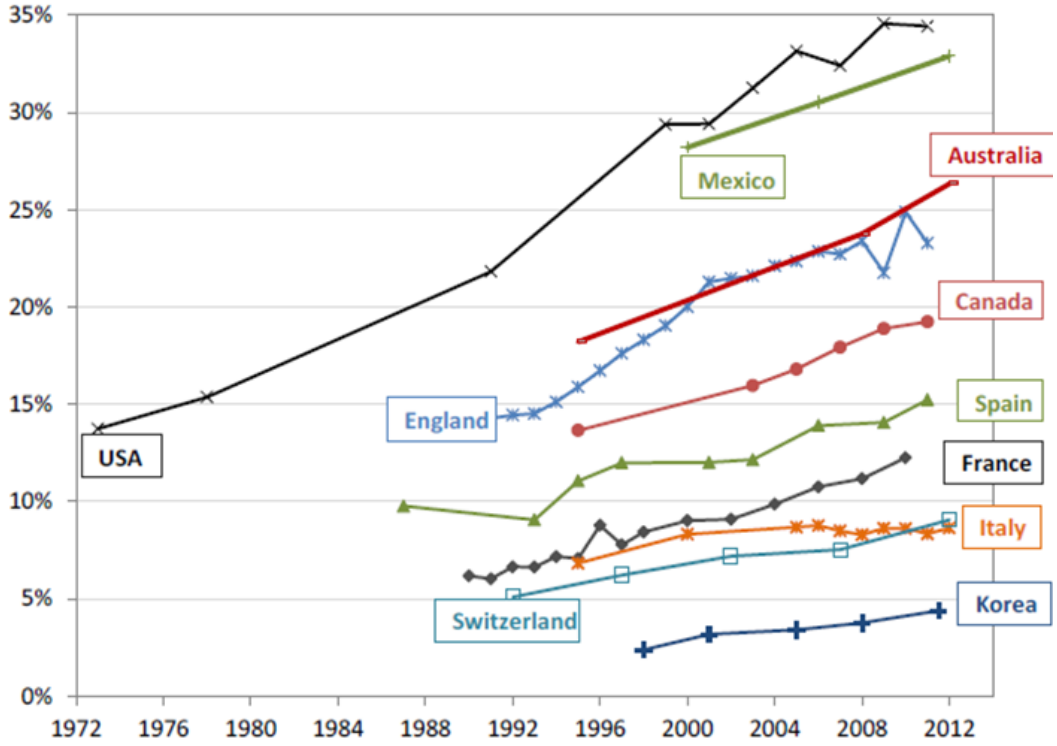
	Pre-1989 to 1991	1991 to 1998	Consumption Dynamics	Inference from Theory
Panel A: Novel Food				
Fresh fruit	sharp increase in East	higher level in East	sharp increase	habit formation
Juices	increase in East	decrease to West equilibrium	increase, then decrease	habit formation
Pies and cookies	increase in East	(imprecise) decrease to West equilibrium	increase, then likely decrease	habit formation
Convenience food	N/A (likely sharp increase)	higher level in East	sharp increase	habit formation
Snacks	N/A (likely sharp increase)	higher level in East	sharp increase	habit formation
Panel B: Familiar Food				
Meat	same in East and West	same in East and West	flat, no changes	N/A
Boiled potatoes	sharp decrease in East	increase to West equilibrium	decrease, then increase	habit formation

Own illustration derived from from empirical and theoretical models. In reality, most of the depicted food categories include a mix of novel and familiar food. We categorized them into 'novel' and 'familiar food' based on our intuition and whether we suspect the majority of food to be familiar or novel. For example, 'pies and cookies' certainly includes familiar (home-baked) products. However, in the transition phase from socialism to capitalism, many western industrially produced pies and cookies became newly available in East Germany.

For Online Publication

Appendix A: Figures

Figure A1: Development of obesity rates in OECD countries



Source: OECD, 2014

Figure A2: Division of Germany, 1961

Source: IEG-Maps, Institute of European History, Mainz; available at http://germanhistorydocs.ghi-dc.org/, last accessed on March 6, 2013.

Figure A3: Weight Loss and (a) Less Food, (b) BMI, (c) Weight Loss Planned, (d) Physical Activity (1991/1992)

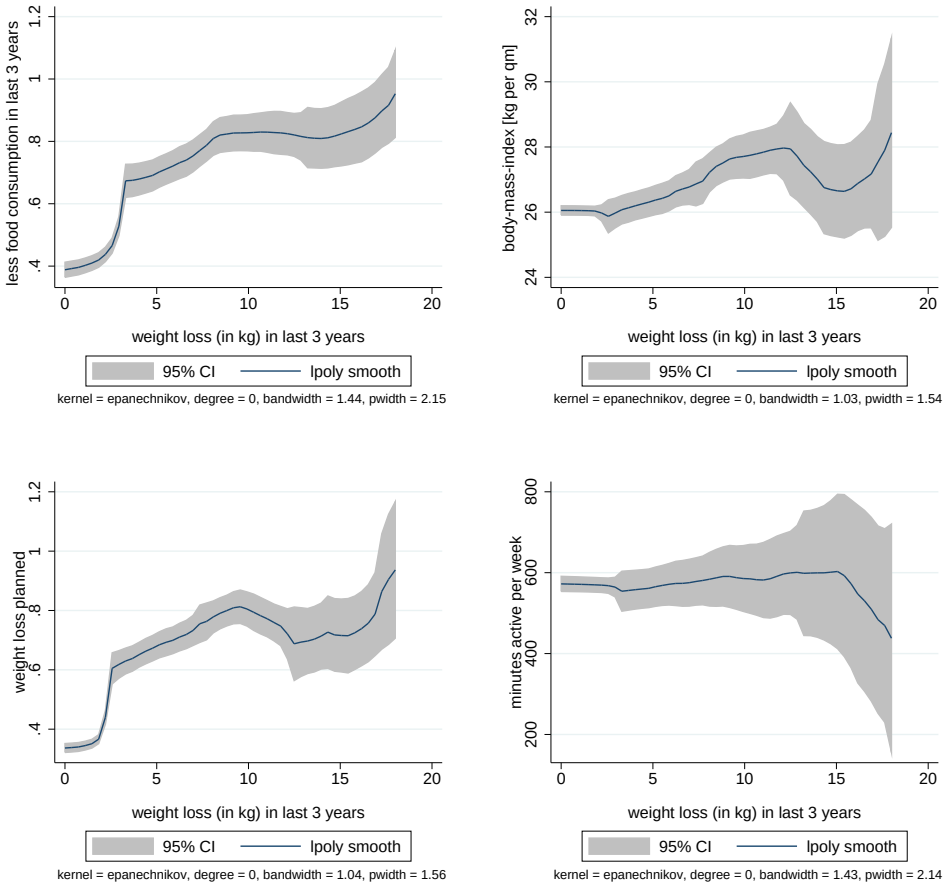
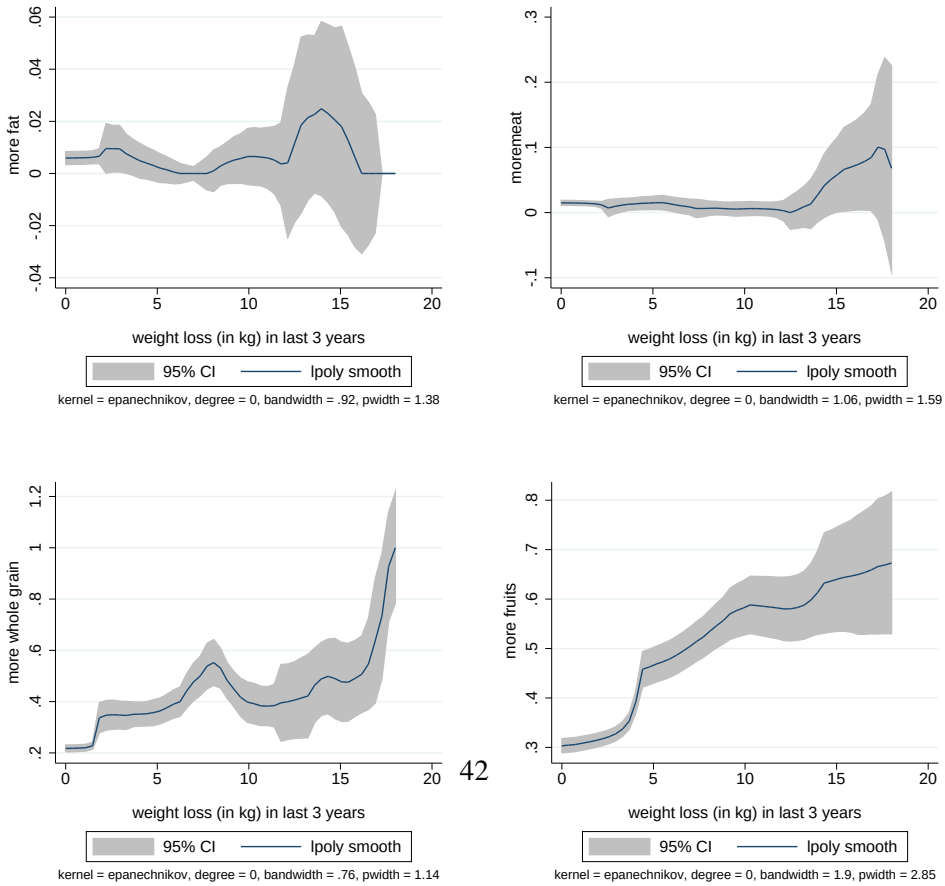


Figure A4: Weight Loss and More Consumption of (a) Fat, (b) Meat, (c) Fruit, (d) Wholegrain (1991/1992)



Appendix B: Tables

Table B1: Descriptive Statistics German National Health Survey East-West 1991 (*GNHSEW91*)

Variable	Mean	Std. Dev.	Min.	Max.	N
A. Outcome Measures					
Current diet					
Meat regularly (more than once a week)	0.7447	0.436	0	1	6,550
Boiled potatoes daily	0.2557	0.4363	0	1	6,550
Fresh fruits daily	0.5759	0.4942	0	1	6,550
Juice daily	0.2328	0.42266	0	1	6,550
Wholegrain bread daily	0.5359	0.4987	0	1	6,550
Eggs regularly (more than once a week)	0.2252	0.4177	0	1	6,550
Pies and cookies (more than once a week)	0.3602	0.4801	0	1	6,550
Change in diet and body mass, last 3 years					
More meat	0.0211	0.1436	0	1	6,550
More fresh fruits	0.3385	0.4732	0	1	6,550
More wholegrain	0.2544	0.4355	0	1	6,550
Change in diet	0.4044	0.4908	0	1	6,550
More food	0.0276	0.1639	0	1	6,550
Less food	0.2055	0.4041	0	1	6,550
Weight gain	0.2681	0.4430	0	1	6,550
Weight gain (in kg)	1.96	3.84	0	65	5,454
Weight loss	0.1506	0.3577	0	1	6,550
Weight loss (in kg)	1.45	3.79	0	91	4,682
Weight loss planned	0.4586	0.4983	0	1	6,550
Body-mass-index [kg pro qm]	26.6839	4.6293	15.02	75.467	6,550
Overweight (BMI>25)	0.6099	0.4878	0	1	6,550
Obese (BMI>30)	0.2053	0.404	0	1	6,550
Minutes active per week	559.94	572.65	0	6780	6,550
Diet-related objective health conditions					
Total blood cholesterol [>6.2 mmol/l]	6.1306	1.2287	2.33	12.9	6,550
High total blood cholesterol [>6.2 mmol/l]	0.4407	0.4965	0	1	6,550
Hypertension	0.2108	0.4079	0	1	6,550
Diabetes (self-reported)	0.0466	0.2107	0	1	6,550
Unawareness and medical check-up measures					
Blood pressure taken in last year	0.2522	0.4343	0	1	6,550
Cholesterol taken in last year	0.4448	0.4969	0	1	6,550
Weight taken in last year	0.5634	0.4959	0	1	6,550
Dietary advice in last year	0.8711	0.3350	0	1	6,550
Unaware hypertension	0.0936	0.2912	0	1	6,550
Unaware high cholesterol	0.2946	0.4559	0	1	6,550
Unaware obese	0.0748	0.2631	0	1	6,550
B. Covariates					
Demographics					
East German	0.3298	0.4702	0	1	6,550
Age	44.9421	12.626	25	69	6,550
Female	0.5116	0.4999	0	1	6,550
# household members	2.838	1.2246	1	18	6,550

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... table B1 continued

Variable	Mean	Std. Dev.	Min.	Max.	N
# own kids	1.6313	1.2717	0	9	6,550
Single	0.1435	0.3506	0	1	6,550
Private health insurance	0.0933	0.2909	0	1	6,550
Education					
8 school years	0.5379	0.4986	0	1	6,550
10 school years	0.2708	0.4444	0	1	6,550
13 school years	0.1644	0.3707	0	1	6,550
Employment					
Physical work	0.1179	0.3225	0	1	6,550
Blue collar worker	0.4107	0.4920	0	1	6,550
White collar worker	0.4209	0.4937	0	1	6,550
Civil servant	0.0609	0.2392	0	1	6,550
Trained for job	0.4496	0.4975	0	1	6,550
Unemployed	0.0484	0.2146	0	1	6,550
Net household income in DM (10 categories)	5.1685	2.3833	1	10	6,550

Sources: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (*GNHSEW91*)

Table B2: German National Health Interview and Examination Survey 1998 (GNHIES98)

Variable	Mean	Std. Dev.	Min.	Max.	N
A. Outcome Measures					
Current diet					
Meat regularly (more than once a week)	0.7267	0.4456	0	1	6,419
Boiled Potatoes daily	0.219	0.4136	0	1	6,419
Fresh fruits fruits daily	0.5788	0.4938	0	1	6,419
Juice daily	0.2449	0.4301	0	1	6,419
Wholegrain bread daily	0.4161	0.4930	0	1	6,419
Eggs regularly (more than once a week)	0.2074	0.4054	0	1	6,419
Pies and cookies regularly (more than once a week)	0.3912	0.4881	0	1	6,419
Convenience food weekly (at least once a week)	0.1436	0.3507	0	1	6,419
Snacks weekly	0.4153	0.4928	0	1	6,419
B. Covariates					
Demographics					
East German	0.3452	0.4755	0	1	6,419
Age	45.3317	15.6451	17	79	6,419
Female	0.5097	0.4999	0	1	6,419
# household members	2.8032	1.2756	1	12	6,419
# own kids	0.5921	0.9276	0	9	6,419
Single	0.2228	0.4161	0	1	6,419
Private health insurance	0.0469	0.2114	0	1	6,419
Education					
8 school years	0.3991	0.4898	0	1	6,419
10 school years	0.3323	0.4711	0	1	6,419
13 school years	0.2246	0.4174	0	1	6,419
Employment					
Physical work	0.2276	0.4193	0	1	6,419
Blue collar worker	0.3332	0.4714	0	1	6,419
White collar worker	0.4102	0.4919	0	1	6,419
Civil servant	0.0495	0.217	0	1	6,419
Unemployed (in past 5 years)	0.2898	0.4537	0	1	6,419
Net household income in DM (13 categories)	6.6235	2.9263	1	13	6,419

Sources: Robert Koch Institut (2012a), German National Health Interview and Examination Survey 1998

Table B3: Short-Run Changes in Food Consumption and Body Weight (between past 3 years and interview in 1991/1992): No Endogenous Controls

Panel A: Change in diet in last 3 years						
	more fruits (1)	**more meat (2)**	**more whole-grain(3)**	**change in diet (4)**	**more food (5)**	**less food (6)**
East German	0.1622***	0.0251	0.0105	0.1330***	0.0111	0.0472*
	(0.0310)	(0.0288)	(0.0096)	(0.0323)	(0.0109)	(0.0266)
Mean	0.34	0.02	0.25	0.40	0.028	0.21
Panel B: Weight and weight changes in last 3 years						
	weight gain (1)	**weight loss (2)**	**weight loss planned (3)**	**BMI (4)**	**obese (5)**	**minutes active (6)**
East German	0.0589**	0.0072	0.0676**	0.6838**	0.0668**	232.79***
	(0.0295)	(0.0240)	(0.0330)	(0.2909)	(0.0262)	(37.7708)
mean	0.27	0.15	0.46	27.7	0.21	560

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header. Control variables only include age, gender, month and year fixed effects. Section 5.1 and the notes to Table B6 provide more information on the variables. The number of observations for all columns and panels is 6,550. The "mean" refers to the mean of the dependent variable in the column header.

Table B4: Short-Run Changes in Food Consumption and Body Weight (between past 3 years and interview in 1991/1992): No Movers

Panel A: Change in diet in last 3 years						
	more fruits	**more meat**	**more whole-**	**change in diet**	**more food**	**less food**
	(1)	**(2)**	**grain(3)**	**(4)**	**(5)**	**(6)**
East German	0.1675***	0.0178*	0.0283	0.1488***	0.0172	0.0489*
	(0.0319)	(0.0093)	(0.0296)	(0.0332)	(0.0109)	(0.0276)
Mean	0.34	0.02	0.25	0.40	0.026	0.21
Panel B: Weight and weight changes in last 3 years						
	weight gain	**weight loss**	**weight loss**	**BMI**	**obese**	**minutes active**
	(1)	**(2)**	**planned (3)**	**(4)**	**(5)**	**(6)**
East German	0.0662**	-0.0016	0.0632*	0.7160**	0.0726***	227.8331***
	(0.0303)	(0.0247)	(0.0339)	(0.3005)	(0.0273)	(39.2094)
mean	0.27	0.15	0.46	27.7	0.21	564

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. This tables replicates the main Table 2 but excludes all 363 respondents who indicated to have moved between 1988 and 1992. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header and a full set of control variables as listed in Table B1. Section 5.1 and the notes to Table B6 provide more information on the variables. The number of observations for all columns and panels is 6,187. The "mean" refers to the mean of the dependent variable in the column header.

Table B5: Short-Run Changes in Food Consumption and Body Weight (between past 3 years and interview in 1991/1992): Weights

Panel A: Change in diet in last 3 years						
	more fruits	**more meat**	**more whole-**	**change in diet**	**more food**	**less food**
	(1)	**(2)**	**grain(3)**	**(4)**	**(5)**	**(6)**
East German	0.1664***	0.0144	0.0284	0.1303***	0.0136	0.0537**
	(0.0307)	(0.0095)	(0.0288)	(0.0321)	(0.0108)	(0.0264)
Mean	0.32	0.02	0.25	0.39	0.027	0.21
Panel B: Weight and weight changes in last 3 years						
	weight gain	**weight loss**	**weight loss**	**BMI**	**obese**	**minutes active**
	(1)	**(2)**	**planned (3)**	**(4)**	**(5)**	**(6)**
East German	0.0741**	0.0149	0.0660**	0.7038**	0.0706***	259.0151***
	(0.0292)	(0.0240)	(0.0329)	(0.2907)	(0.0259)	(38.2668)
mean	0.26	0.15	0.46	26.6	0.20	550

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column headerand a full set of control variables as listed in Table B1. Section 5.1 and the notes to Table B6 provide more information on the variables. The number of observations for all columns and panels is 6,550. The "mean" refers to the mean of the dependent variable in the column header. All regressions are weighted using the weights provided by the Robert Koch Institut (2012b).

Table B6: Short-Run Changes in Food Consumption and Body Weight (between past 3 years and interview in 1991/1992): Marginal Probit Models

Panel A: Change in diet in last 3 years						
	more fruits (1)	**more meat (2)**	**more whole-grain(3)**	**change in diet (4)**	**more food (5)**	**less food (6)**
East German	0.1358***	0.2385	0.0319	0.0931***	0.1550	0.0835*
	(0.0257)	(0.1637)	(0.0386)	(0.0223)	(0.1366)	(0.0448)
Mean	0.34	0.02	0.25	0.40	0.028	0.21
Panel B: Weight and weight changes in last 3 years						
	weight gain (1)	**weight loss (2)**	**weight loss planned (3)**	**BMI (4)**	**obese (5)**	**minutes active (6)**
East German	0.0734**	0.0167	0.0511**	0.6838**	0.1097**	232.7864***
	(0.0356)	(0.0530)	(0.0245)	(0.2909)	(0.0433)	(37.7708)
mean	0.27	0.15	0.46	27.7	0.21	560

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one probit model (except for Panel B, columns (4) and (6) which are OLS models) with the dependent variable in the column header. Marginal effects are reported. Control variables only include age, gender, month and year fixed effects. Section 5.1 and the notes to Table B6 provide more information on the variables. The number of observations for all columns and panels is 6,550. The "mean" refers to the mean of the dependent variable in the column header.

Table B7: Food Consumption Dynamics between 1991 and 1998: No Endogenous Controls

	fresh fruits daily (1)	**pie regularly (2)**	**juice daily (3)**	**convenience food weekly (4)**	**snack weekly (5)**	**meat regularly (6)**	**(boiled) potatoes daily (7)**
East German×1998	0.0229	-0.0401	-0.0524**	0.0334***	0.0844***	-0.0337	0.0833***
	(0.0286)	(0.0293)	(0.0257)	(0.0092)	(0.0130)	(0.0267)	(0.0252)
East German	0.1158***	0.0673***	0.0838***			0.0121	-0.0413*
	(0.0249)	(0.0255)	(0.0224)			(0.0233)	(0.0219)
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Month fixed effects	yes	yes	yes	yes	yes	yes	yes
Socio-demographics	no	no	no	no	no	no	no
Employment	no	no	no	no	no	no	no
Education	no	no	no	no	no	no	no
Mean	0.58	0.22	0.23	0.14	0.42	0.74	0.48

Source: Robert Koch Institut (2012b,a), German National Health Survey East-West 1991 (GNHSEW91) and German National Health Interview and Examination Survey 1998 (GNHIES98) pooled, own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1 and B2). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header. Control variables only include age, gender, month and year fixed effects. Section 5.1 and the notes to Table B7 provide more information on the variables. The number of observations for all columns and panels is 12,969, except for columns (4) and (5) that are only based on the 1998 data (N=6,419). The 'mean' refers to the mean of the dependent variable in the column header.

Table B8: Diet-Related Health and Awareness about Medical Conditions (1991/1992)

Panel A: Clinical objective diet-related health conditions

	High blood pressure (1)	**High cholesterol (2)**	**Diabetes (3)**
East German	0.0716***	0.0524*	0.0028
	(0.0258)	(0.0310)	(0.0138)
mean	0.21	0.44	0.046
Δ (coefficient/mean)	34%	12%	6.5%

Panel B: Unawareness of hypertension, high cholesterol, and obesity

	Unaware high blood pressure (1)	**Unaware high cholesterol (2)**	**Unaware obese (3)**
East German	0.0619***	0.1813***	0.0739***
	(0.0191)	(0.0296)	(0.0173)
mean	0.09	0.29	0.07
Δ (coefficient/mean)	69%	63%	100%

Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * p<0.1, ** p<0.05, *** p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). Each column in each panel represents one model, estimated by OLS, with the dependent variable in the column header and a full set of covariates as in Table B1. In the first two columns of Panel A, the dependent binary variables are based on objective clinical health measures; the diabetes measure in column (3) is self-reported. In Panel B, the dependent variables measure the difference between the medical indication based on the clinical measures taken and the self-reports about medical diagnoses. For more information on the variables, see Section 5.1. The number of observations for all models is 6,550. The "mean" refers to the mean of the dependent variable in the column header.

Appendix C: Solution of the Theoretical Model

For notational simplicity, we drop the time index and the distinction between East and West German consumption whenever it does not generate confusion. The following first order conditions must be satisfied by optimal food and non-food consumption:

$$U_n = p_t^n \mathcal{V}_A - \mathcal{V}_N, \qquad U_f = p_t^f \mathcal{V}_A - \mathcal{V}_F, \qquad U_g = p_t^g \mathcal{V}_A, \tag{20}$$

With non-separable intertemporal preferences, the optimal consumption choices at each point in time do not only depend on prices and income, but also on the impact of current choices on future utility via the accumulation of consumption experiences and assets. $\mathcal{V}_A$ is the shadow price of assets. The terms $\mathcal{V}_N$ and $\mathcal{V}_F$ are the shadow prices of N_t and F_t—they measure how a marginal change in past consumption affects the intertemporal utility of the agent. When $\mathcal{V}_N = \mathcal{V}_F = 0$, the first order conditions above boil down to the familiar conditions for utility maximization where the marginal rate of substitution equals the relative price: $U_n \backslash U_f = p_t^n \backslash p_t^f$. Due to the linear-quadratic structure of the utility function, we guess the following value function solves the problem:

$$\mathcal{V}(F,N,A) = \alpha_1 F + \alpha_2 F^2 + \alpha_3 N + \alpha_4 N^2 + \alpha_5 + \mu A.$$

From the first order conditions with respect to n, f and q, the optimal consumption of food and non-food is obtained as a function of the (yet unspecified) parameters of the optimal value function:

$$\begin{aligned} n &= \alpha_3 + \hat{n} + (2\alpha_4 + U_{nN})\, N - \alpha_5 p^n, && (21)\\ f &= \alpha_1 + \hat{f} + (2\alpha_2 + U_{fF})\, F - \alpha_5 p^f, && (22)\\ g &= \hat{g} - \mu p^g. && (23) \end{aligned}$$

Notice that μ must be positive to ensure that the marginal utility of the utility function (10) with respect to non-food is positive: $\partial U / \partial g = \hat{g} - g = \mu p^g > 0$.

Replacing the above expressions in the HJB equation yields a function which only depends on state variables and parameters. Let $r = \rho$, $\Omega_f = \sqrt{(\rho + 2\delta)(\rho + 2\delta - 4U_{fF})} > 0$ and $\Omega_n = \sqrt{(\rho + 2\delta)(\rho + 2\delta - 4U_{nN})} > 0$. Using the Method of Undetermined Coefficients yields:

$$\begin{aligned} \alpha_1 &= \frac{\hat{f} - \mu p^f}{\rho + \Omega_f}(2\delta + \rho - \Omega_f), \qquad \alpha_2 = \frac{1}{4}(2\delta + \rho - 2U_{fF} - \Omega_f), && (24)\\ \alpha_3 &= \frac{\hat{n} - \mu p^n}{\rho + \Omega_n}(2\delta + \rho - \Omega_n), \qquad \alpha_4 = \frac{1}{4}(2\delta + \rho - 2U_{nN} - \Omega_n), && (25)\\ \alpha_5 &= \frac{1}{2\rho}\left[\hat{g}^2 + \left(\hat{f} + \alpha_1\right)^2 + (\hat{n} + \alpha_3)^2 + \left((p^n)^2 + (p^f)^2 + (p^g)^2\right)\mu^2\right] && (26)\\ &\quad + \frac{\mu}{\rho}\left[M - p^g \hat{g} - p^f\left(\hat{f} + \alpha_1\right) - p^n(\hat{n} + \alpha_3)\right]. \end{aligned}$$

The coefficient μ represents the shadow value of the assets (the impact of a marginal increase in assets on the consumer's value function) which depends on prices, among other factors. It is determined by replacing the FOCS into $\dot{N}, \dot{F}, \dot{A}$ and solving the corresponding system of linear differential equations. Defining $\Psi_f = \delta(\rho + 2\delta - \Omega_f) - 2U_{fF}(\rho + 2\delta)$ and $\Psi_n = \delta(\rho + 2\delta - \Omega_n) - 2U_{nN}(\rho + 2\delta)$, yields $\mu = \varepsilon_1/\varepsilon_2$, where

$$\begin{aligned}
\varepsilon_1 &= (\rho A_0 + M - p^g \hat{g})(\rho + \Omega_f)(\rho + \Omega_n) \\
&\quad + 2\left[\hat{f} p^f (\rho + \Omega_n) - \hat{n} p^n (\rho + \Omega_f)\right](\rho + \delta) \\
&\quad + 2p^f \Psi_f \frac{\rho + \Omega_n}{(\rho + \Omega_f)^2}\left[\rho(\rho + \Omega_f) F_0 + 2\hat{f}(\rho + \delta)\right] \\
&\quad + 2p^n \Psi_n \frac{\rho + \Omega_f}{(\rho + \Omega_n)^2}\left[\rho(\rho + \Omega_n) N_0 + 2\hat{n}(\rho + \delta)\right], \qquad (27) \\
\varepsilon_2 &= -(p^g)^2(\rho + \Omega_f)(\rho + \Omega_n) - 2\left[(p^n)^2(\rho + \Omega_f) + (p^f)^2(\rho + \Omega_n)\right](\rho + \delta) \\
&\quad + \frac{4(p^f)^2(\rho + \Omega_n)(\rho + \delta)}{(\rho + \Omega_f)^2}\Psi_f + \frac{4(p^n)^2(\rho + \Omega_f)(\rho + \delta)}{(\rho + \Omega_n)^2}\Psi_n. \qquad (28)
\end{aligned}$$

Replacing the values of $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and μ in (21) and (22) and rearranging yields the policy functions (29) and (30):

$$n^* = \frac{2(\rho + \delta)}{\rho + \Omega_n}(\hat{n} - \mu p_t^n) + \frac{1}{2}(\rho + 2\delta - \Omega_n) N_t, \qquad (29)$$

$$f^* = \frac{2(\rho + \delta)}{\rho + \Omega_n}\left(\hat{f} - \mu p_t^f\right) + \frac{1}{2}(\rho + 2\delta - \Omega_f) F_t, \qquad (30)$$

Note that the requirement $\mu > 0$, which we imposed to ensure that the marginal utility of the composite good g is positive, ensures that the law of demand holds for food consumption choices, for any given consumption experience. The sign of the coefficients of N_t and F_t depends on the sign of U_{nN} and U_{fF}, respectively.

In the long-run equilibrium, consumption of novel and familiar food will be:

$$\begin{aligned}
n_{ss} &= \delta N_{ss} = \delta \frac{(\delta + \rho)(\hat{n} - p^n \mu)}{\delta(\delta + \rho) - (2\delta + \rho) U_{nN}}, \qquad (31) \\
f_{ss} &= \delta F_{ss} = \delta \frac{(\delta + \rho)\left(\hat{f} - p^f \mu\right)}{\delta(\delta + \rho) - (2\delta + \rho) U_{fF}}. \qquad (32)
\end{aligned}$$

which depends, among other factors, on market prices, income and wealth. Let $\hat{n} - p^n \mu > 0$ and $\hat{f} - p^f \mu > 0$ to ensure that the steady state levels of consumption are positive (and also ensure that novel steady state consumption respects the law of demand ($\partial N^{ss}/\partial p^n < 0$), which requires $\alpha_5 + p^n \partial \mu / \partial p^n > 0$.)

Replacing the policy functions (29) and (30) in the differential equations $\dot{F}_t$, $\dot{N}_t$ and $\dot{A}_t$, and solving yields the time path of food consumption experiences:

$$N_t = \left(1 - e^{\lambda_n t}\right) N_{ss} + e^{\lambda_n t} N_0 \tag{33}$$
$$F_t = \left(1 - e^{\lambda_n t}\right) F_{ss} + e^{\lambda_n t} F_0 \tag{34}$$

where $\lambda_n := \rho - \Omega_n$ and $\lambda_f := \rho - \Omega_f$ are the two eigenvalues that are required to be negative to ensure saddle point stability. This is equivalent to require $\delta(\delta+\rho) - (2\delta+\rho) U_{nN} > 0$ and $\delta(\delta+\rho) - (2\delta+\rho) U_{fF} > 0$.

Replacing (33) and (34) in (29) and (30), yields the optimal path of food consumption choices reported in Proposition 1:

$$n_t = \alpha_t + \beta_t N_0, \tag{35}$$
$$f_t = \kappa_t + \phi_t F_0. \tag{36}$$

where

$$\alpha_t = \left[\delta - (\delta + \lambda_n) e^{\lambda_n t}\right] N_{ss}, \qquad \beta_t = (\delta + \lambda_n) e^{\lambda_n t} \tag{37}$$
$$\kappa_t = \left[\delta - (\delta + \lambda_f) e^{\lambda_f t}\right] F_{ss}, \qquad \phi_t = (\delta + \lambda_f) e^{\lambda_f t} \tag{38}$$

Taking differences between East and West at each point in time yields

$$\Delta n_t = n_t^E - n_t^W = \beta_t \left(N_0^E - N_0^W\right) = -\beta_t N_0^W \tag{39}$$
$$\Delta f_t = f_t^E - f_t^W = \beta_t \left(F_0^E - F_0^W\right) = \phi_t \left(F_0^E - F_0^W\right) \tag{40}$$

Note that α_t and κ_t depend on the steady state values which reflect market prices, available income, and wealth. The sign of β_t and ϕ_t (which depends on $\delta + \lambda_n$ and $\delta + \lambda_f$, respectively) can either be positive or negative. More specifically $\beta_t > 0$ ($\phi_t > 0$) if and only if novel food (familiar food) features taste formation, $U_{nN} > 0$ ($U_{fF} > 0$) and it is negative if it features habit formation, $U_{nN} < 0$ ($U_{fF} < 0$), as reported in Proposition (2) for novel food, and Propositions (3) and (4).

Since the sign of Δn_t only depends on β_t, we can proxy life under socialism with N_0^W. For the sign of Δf_t, instead, there is no one-to-one relation because, in principle, $F_0^E - F_0^W$ could have any sign. The difference Δf_t is positive if $\phi_t \left(F_0^E - F_0^W\right) > 0$. The term in brackets is positive (negative) depending on whether $F_0^E - F_0^W$ is positive (negative). If, pre-reunification, the consumption of familiar food was at its steady state, then $sign\left(F_0^E - F_0^W\right) = sign\left(f_0^E - f_0^W\right)$. Hence $sign(\Delta f_t) = sign(U_{fF})\, sign(\Delta f_0)$. Since we have empirical information on both consumption of familiar food at the time of the reunification Δf_0, and consumption of familiar food in a subsequent period Δf_t, we can infer the properties of reinforcement or satiation of past consumption experience with familiar food on current preferences. Using (35) and (36) we can compute changes in consumption:

$$\Delta n_{ts} = n_t - n_s = \alpha_{ts} + \beta_{ts} N_0 \tag{41}$$
$$\Delta f_{ts} = f_t - f_s = \kappa_{ts} + \phi_{ts} F_0 \tag{42}$$

where

$$\begin{aligned}
\alpha_{ts} &= \alpha_t - \alpha_s = -(\delta + \lambda_n)\left(e^{\lambda_n t} - e^{\lambda_n s}\right) N_{ss} > 0 \quad \Leftrightarrow \quad U_{nN} < 0 \\
\beta_{ts} &= \beta_t - \beta_s = (\delta + \lambda_n)\left(e^{\lambda_n t} - e^{\lambda_n s}\right) > 0 \quad \Leftrightarrow \quad U_{nN} < 0 \\
\kappa_{ts} &= \kappa_t - \kappa_s = -(\delta + \lambda_f)\left(e^{\lambda_f t} - e^{\lambda_f s}\right) F_{ss} > 0 \quad \Leftrightarrow \quad U_{fF} < 0 \\
\phi_{ts} &= \phi_t - \phi_s = (\delta + \lambda_f)\left(e^{\lambda_f t} - e^{\lambda_f s}\right) > 0 \quad \Leftrightarrow \quad U_{fF} < 0
\end{aligned}$$

Similarly to what we have found above, β_{ts} is positive (negative) if $\delta + \lambda_n > 0$ $(\delta + \lambda_n < 0)$ which holds if and only if $U_{nN} > 0$ $(U_{nN} < 0)$, as stated in Proposition 1. Analogue reasoning holds for ϕ_{ts} and U_{fF}.