

# Non-Separable Time Preferences, Novelty Consumption, and Body Weight: Evidence from the East German Transition to Capitalism <sup>‡</sup>

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## Abstract

Non-separable intertemporal preferences and “novelty consumption” can explain the persistent correlation between economic development and obesity. Employing the German reunification as a fast motion natural experiment of economic development, we study how the sudden availability of novel food products impacts individual consumption patterns and body weight. Immediately after the reunification, East Germans consumed more novel western food and gained more weight than West Germans. The following long-run persistence of food consumption and body weight patterns among Eastern Germans cannot be explained by taste for variety, and it provides evidence for habit formation in intertemporal consumption preferences.

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

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 rapidly increasing in all industrialized countries over the last decades (Sassi, 2010; World Health Organization, 2015, see Figure A1). 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 as well as non-health related undesired consequences, such as lower labor market productivity and worse social outcomes (Cawley, 2004; Cawley et al., 2007; Puhl and Heuer, 2009; Cawley and Meyerhoefer, 2012; Fontaine et al., 2003).

One explanation proposed in the literature suggests that economic development has been playing a crucial role in determining the positive obesity trend in industrialized countries (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 the German reunification to shed light on the relationship between the availability of new food products, food consumption and body weight.

Our basic hypothesis is that past consumption experiences persistently affect current food consumption patterns. We formally present this hypothesis through a demand-driven model where consumers have a taste for variety and non-separable intertemporal preferences. The latter assumption implies that past consumption experiences can affect current consumption choices, which may essentially occur in two alternative ways. Under habit formation, the marginal utility of consumption decreases with past consumption experiences while, with taste formation, it increases. When testing our theoretical model exploiting the German real-world setting, we distinguish between two categories of food. *Novel Food* defines food that the East Germans could not consume before the reunification—either

because of trade barriers or because of extremely high prices of western goods on the East German black market. This category includes both newly developed and engineered food, such as processed or convenience food, but also exotic high quality food (formerly luxury goods), such as exotic fruits. The main point is that East Germans had virtually no previous consumption experience with such novel food when it suddenly became available after the reunification. In contrast, they were used to consume *Familiar Food*, such as potatoes, meat and eggs, which had always been available in both parts of Germany.

The empirical application focuses on the special case of the German reunification that, over night, made a large set of novel consumption goods available and affordable for the general population. New food products becoming available and affordable to population masses is a generalizable and pervasive fact 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).<sup>1</sup> Simultaneously, international trade and technological innovation have made delicatessen that were previously not affordable to the masses—such as exotic fruit and fresh exotic fishery products like salmon, oysters, or caviar—available in discount grocery chains around the corner.<sup>2</sup> The increased availability of new products is also witnessed by the incredibly large variety of products on sale in modern supermarkets. 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).<sup>3</sup> While a significant number of food items sold at supermarkets are certainly substitutes, the fact that the average supermarket carries four times more products than in the 1970s, and seventeen times more than in 1946, underlines the idea that novelty consumption is a characterizing feature of economic growth.

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<sup>1</sup>In the US, the number of food chemistry patents has tripled from 668 to 2134 between 1980 and 2012 (World Intellectual Property Organization (WIPO), 2014). As an example from specific ingredients for functional food, probiotic patents increased from 4 to 61 between 1999 and 2009 (Bornkessel et al., 2014), and phytosterol (“plant sterols”) patents increased from 35 to 180 in the same time period worldwide (Curran et al., 2010).

<sup>2</sup>Before commercial salmon farming was established in the 1970s, (wild) salmon was very expensive, a delicacy that would cost around \$5 per quarter pound (in nominal terms in the US), and that was only available in specialized delicatessen stores (Fishman, 2006; Henson, 2008). Today, ALDI supermarkets sell pink salmon fillets for \$4.84 per pound (as on November 14, 2014 in the ALDI store in Ithaca, NY) while household income has increased by a factor 3.5. Whether Atlantic salmon raised under aquaculture conditions is of lower quality is controversial (US Food and Drug Administration, 2014). As another example, in 1978 a pineapple cost \$0.29 in Illinois and an average US household had to spend 4.5% of its daily income to buy a pineapple. Today, ALDI sells them for \$1.29 each, and the relative price has decreased to 1.3% of the daily income (assuming that taxes and deductions add up to 30% of the gross wage (United States Census Bureau, 1980, 2014).

<sup>3</sup>Walmart, the world’s largest company, stands representative for the success of supermarket chains offering more and more food products under one roof. On their web page, Walmart posts ingredients for 20,000 different food products offered in more than 3,000 stores all over the US (Blatt, 2014).

This paper’s theoretical part provides general predictions for the demand of novel and familiar food. 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 no taste nor habit formation, *ceteris paribus*, East and West Germans would display the same consumption patterns after the reunification. Second, if preferences feature habit formation, novel food consumption would be higher in East than in West Germany after the reunification. Third, if preferences feature taste formation, novel food consumption would be lower in East than in West Germany. Analogously, empirical evidence on differences in familiar food consumption also reveal whether intertemporal preferences feature habit formation, taste formation, or neither of the two. Notably, these theoretical predictions can be tested using representative cross-sectional data on East and West Germany. This is a great advantage as it relaxes the requirement of using panel data to track and characterize individual consumption choices over time.

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 a lot of effort to develop such tests has been invested in the last decades, the findings have been inconclusive. Early study based on aggregated data typically find evidence for habit formation (e.g. Braun et al. (1993)), whereas some individual panel-data based studies tend to find the opposite (Dynan, 2000; Kuusmanen and Pistaferri, 2006) although other micro-based studies also find support for habit formation (Carrasco et al., 2005; Collado and Browning, 2007). This paper’s theory develops a test for the existence of non-time separable preferences when applied to the unique historical case of the German reunification. Moreover, the test can discriminate between habit and taste formation.

The second part of the paper carries out the empirical test by exploiting three cross-sectional datasets that are all representative in East and West Germany. These datasets include a battery of current and retrospective information on food consumption (and also objective body weight measures). We find that, shortly after novel western food products became available in the GDR, a significant share of East Germans persistently changed their diet and started to consume these products. Specifically, East Germans’ consumption of novel food—which they could not consume in the GDR—significantly increased. More importantly, novelty consumption even exceeded West German levels in 1991. This ‘novelty effect’ holds for both healthy novel food, such as exotic fruits, and unhealthy novel food, such

as convenience food. In contrast, East Germans' potato consumption was three times higher before the reunification and fell below West Germans' level after the reunification. According to our theoretical model, all these consumption patterns are consistent with non-separable time preferences featuring habit formation. Importantly, the observed consumption patterns cannot be explained by taste for variety alone. Interestingly, the changes in eating habits are persistent and still detectable one decade after the reunification.

Although consumption choices of novel and familiar food are theoretically optimal because they maximize the consumer's intertemporal objective function, they may not necessarily optimize body weight, which is just a component of overall utility (Cawley et al., 2014). Hence, how and whether body weight changes in response to a 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 overproportional weight gain cannot be explained by less physical activity and calorie output, nor is it the result of a 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 increase in body weight is persistent as well. Even 15 years after the reunification, the (positively selected) group of East Germans who migrated to West Germany still shows significantly higher BMIs than native West Germans.

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 provides the empirical evidence. The last section 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 reasons for the obesity epidemic in the developed world, 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 the role of 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).<sup>4</sup> Strulik (2014) argues that being obese is more acceptable the higher the population obesity rate, which would create social multiplier effects fostering the obesity epidemic even when the initial triggers (e.g., decreasing prices) have become less relevant. Our concept of novelty consumption also proposes a possible explanation for the fact that obesity rates continues to rise even though real food prices have been very stable since the 1990s (Ruhm, 2012). This paper builds upon and specifies Philipson and Posner (1999), Lakdawalla et al. (2005) and Lakdawalla and Philipson (2009)’s main idea but considers the joint effects of more food availability as well as previous consumption experiences on food consumption.

Our theoretical approach builds on, and contributes to, the literature on habit formation (see, e.g., Abel, 1990; Dynan, 2000; Overland et al., 2000; Carroll, 2000; Carrasco et al., 2005; Collado and Browning, 2007), 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 food 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. On the contrary, taste formation implies undershooting and monotonic paths of consumption over time.

Our empirical strategy is complementary to the one adopted in the literature that uses microdata to identify and carve out the causal impact of single specific factors on obesity, such as increased avail-

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<sup>4</sup>The analogous numbers for the general inflation rates were 5.3 and 2.9%, i.e., almost identical and also almost perfectly correlated.

ability 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), decreases in gas prices (Courtemanche, 2011), increase in cigarette taxes (Courtemanche, 2009), decreases in food prices (Grossman et al., 2014; Courtemanche et al., 2015; Dubois et al., 2014), or changes in physical activity (Cawley et al., 2013; Sarma et al., 2014).<sup>5</sup> These studies are all econometrically 'clean' and allow focusing on a sophisticated causal identification of one single, specific factor (often related to the supply-side of the market). However, these clean causal reduced form studies typically find 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 source of variation.

The existing literature exploiting the 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), social norms (Brosig-Koch et al., 2011), trust (Rainer and Siedler, 2013), 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 nature as a natural experiment of economic development which lead to greater product choice. 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.

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<sup>5</sup>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 War II (Kesternich et al., 2014, 2015), famines in the 20<sup>th</sup> century (Lindeboom et al., 2010; van den Berg et al., 2015), 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). The last related literature strand studies the phenomenon that people seems to be healthier during recessions (Ruhm, 2000, 2005).

### 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.<sup>6</sup> Between 1950 and 1961, about 3.6 million refugees migrated from the GDR to the FRG (Bethlehem, 1999).

To stop the mass exodus, on August 13, 1961, the communist GDR regime started erecting 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)."

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<sup>6</sup>Henceforth, we use the terms GDR and East Germany, and the terms as FRG and West Germany interchangeably.



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 21<sup>st</sup> 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](#)). However, 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.<sup>7</sup> 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, we see that 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 extremely low prices of potatoes, the demand elasticity of potatoes is very low. [Hsieh et al. \(2009\)](#) use US Nielsen Scanner data and show that the own price elasticity for the most popular potato consumed at home, the Russell potato, is -0.1 and not statistically different from zero. It is very likely that the availability of substitute food, not prices, account 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 the FRG consumption was slightly below 5 kg. Although absolute prices for meat were slightly higher in West Germany (€ 6.63 vs. € 5.19 per kg)—since net household income was about 50% higher in the West—relative meat prices were lower in West Germany.<sup>8</sup>

Third, although comparable, egg and sugar consumption was higher in West as compared to East Germany. According to official data, egg and sugar consumption was 22% and 32% higher in West Germany (25.4 vs. 31 eggs, and 1.18 vs. 1.56 kg sugar per person/month).

<sup>7</sup>Official state rationing on food was abolished in the 1960s in the GDR ([Bochniak, 2009](#)).

<sup>8</sup>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](#)).

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 partially 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)

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 dramatically lower in the GDR as compared to the FRG.

## 4 A Theory of Novelty Consumption

Consider an intertemporal optimization problem where a consumer has a taste for variety and non-separable time preferences. We provide closed-form expressions for the equations to be estimated. Depending on the empirically observed food consumption pattern, and based on the predictions of the theoretical model, we will be able to infer whether consumers’ preferences feature habit formation or taste formation. Consider the following instantaneous utility function:

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

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 fast food. However,  $n_t$  has always been available in West Germany. In contrast, vector  $f_t$  denotes familiar food

that has always been available in both parts of Germany, e.g. potatoes, meat, sugar or eggs. Non-food activities, such as physical exercise, and non-food consumption, such as cars, are represented by  $g_t$ . The utility function is assumed to be concave in the choice variables to ensure that the consumer has a taste for variety.

Non-separability in intertemporal preferences comes from the assumption that past consumption experience with novel and familiar food—which we denote by  $N_t$  and  $F_t$ , respectively—affects 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  $\mathcal{U}_N$  and  $\mathcal{U}_F$  are different from zero. A second, and more interesting case, 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  $\mathcal{U}_{fF}$ .

We can distinguish three cases. First, when the cross derivative is negative, 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,  $\mathcal{U}_{nN}, \mathcal{U}_{fF} < 0$ , as *habit formation*. Second, when 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](#)). Finally, when  $\mathcal{U}_{nN} = \mathcal{U}_{fF} = 0$  preferences are neither habit forming, nor taste forming, although past consumption can still affect the level of current utility (depending on the sign of  $\mathcal{U}_N$  and  $\mathcal{U}_F$ ). Past consumption experiences are assumed to evolve according to the following linear dynamics:

$$\dot{N}_t = n_t - \delta N_t, \quad \dot{F}_t = f_t - \delta F_t \quad (2)$$

The term  $W_t$  denotes body weight, which depends on current and past eating behavior ([Levy, 2002](#); [Dragone, 2009](#)), on physical exercise  $\gamma$  (which is one component of vector  $g$ ), and on individual characteristics  $Z$ :

$$W_t = W(n_t, f_t, \gamma_t, N_t, F_t, Z). \quad (3)$$

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

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

To ease the notation, the utility function  $\mathcal{U}(n_t, f_t, g_t, N_t, F_t, W(n_t, f_t, \gamma_t, N_t, F_t, Z), Z)$  can be rewritten as  $U(n_t, f_t, g_t, N_t, F_t, Z)$ . The consumer chooses the path of food and non-food consumption that solves the following dynamic programming problem:

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

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

$$\dot{N}_t = n_t - \delta N_t \quad (7)$$

$$\dot{F}_t = f_t - \delta F_t \quad (8)$$

given the intertemporal discount factor  $\rho$ . As noted in the previous section, at the time of the reunification ( $t = 0$ ), the consumption experiences with novel and familiar food were different in East and West Germany. Denote with  $N_0^E$  and  $F_0^E$  the initial food consumption experiences in East Germany, and with  $N_0^W$  and  $F_0^W$  the corresponding ones in West Germany. Recall that  $N_0^E = 0$  in East Germany and  $N_0^W > 0$  in West Germany. Familiar food experience is instead positive in both parts of Germany,  $F_0^E > 0$  and  $F_0^W > 0$ , although possibly different for different types of familiar food.

The Hamilton-Jacobi-Bellman equation associated to problem (5)-(8) is

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

where  $\mathcal{V}(N_t, F_t, A_t)$  is the optimal value function. The following first order conditions must be satisfied by optimal food and non-food consumption:

$$U_n = p_t^n \mathcal{V}_A - \mathcal{V}_N, \quad U_f = p_t^f \mathcal{V}_A - \mathcal{V}_F, \quad U_g = p_t^g \mathcal{V}_A, \quad (10)$$

With non-separable intertemporal preferences, the optimal consumption choices at each point in time depend not only on prices and income, but also on the impact that current choices have on future utility via the accumulation of consumption experiences and assets.

The terms  $\mathcal{V}_N$  and  $\mathcal{V}_F$  are the shadow prices of  $N_t$  and  $F_t$  and 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.  $\mathcal{V}_A$  is the shadow price of assets.

#### 4.1 Consumption Patterns with Non-Separable Intertemporal Preferences

For analytical tractability, and to provide linear closed-form solutions that can be empirically estimated, we follow [Becker and Murphy \(1988\)](#) and consider a quadratic representation of the utility function:

$$U(n_t, f_t, g_t; N_t, F_t, Z) = f_t \left( \hat{f} - \frac{f_t}{2} \right) + n_t \left( \hat{n} - \frac{n_t}{2} \right) + g_t \left( \hat{g} - \frac{g_t}{2} \right) + U_{fF} f_t F_t + U_{nN} n_t N_t. \quad (11)$$

Note that we do not make any *a priori* assumption on whether preferences feature habit formation or taste formation, which are properties that will be inferred from the empirical exercise.<sup>9</sup> As shown in Appendix C, the following holds:

**Proposition 1.** *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*

$$n_t = \alpha_t + \beta_t N_0 \quad (12)$$

$$f_t = \kappa_t + \phi_t F_0 \quad (13)$$

The coefficients  $\alpha_t$  and  $\kappa_t$  depend, among other factors, on market prices, available income and wealth, as well as on individual characteristics and time. The coefficients  $\beta_t$  and  $\phi_t$  only depend on individual characteristics and on time, and they measure differences in consumption levels between East and West Germans at a given point in time  $t$ :

$$\Delta n_t^{EW} = n_t^E - n_t^W = -\beta_t N_0^W \quad (14)$$

$$\Delta f_t^{EW} = f_t^E - f_t^W = \phi_t (F_0^E - F_0^W). \quad (15)$$

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<sup>9</sup>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.

Equations (12) and (13) will be estimated in the empirical section. In addition, we will estimate the differences in consumption levels at two different points in time,  $t$  and  $s$ , with  $t > s$ . Using (12) and (13), this amounts to estimate

$$\Delta n_{ts} = n_t - n_s = \alpha_{ts} - \beta_{ts} N_0 \quad (16)$$

$$\Delta f_{ts} = f_t - f_s = \kappa_{ts} + \phi_{ts} F_0 \quad (17)$$

where  $\beta_{ts}$  and  $\phi_{ts}$  measure differences-in-differences between consumption levels in East and West Germany at time  $t$  and  $s$  :

$$\Delta n_{ts}^E - \Delta n_{ts}^W = -\beta_{ts} N_0^W \quad (18)$$

$$\Delta f_{ts}^E - \Delta f_{ts}^W = \phi_{ts} (F_0^E - F_0^W). \quad (19)$$

Note that detecting differences in post-reunification consumption levels, either over time, or between East and West Germany, reveals whether preferences feature habit or taste formation. The possibility of detecting differences crucially depends on the speed of convergence to the equilibrium and on the time-window of observation. When the adjustment paths approach the long-run equilibrium, all post-reunification differences in consumption vanish and we cannot make any specific inference about non-separable intertemporal preferences.

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

We conceptualize the impact of the reunification on consumers via the sudden availability of novel food. Moreover, we formalize the sudden availability as a negative price shock making novel consumption goods available and affordable for the general population. In the case of East Germany, a novel good conceptualization in form of a price decrease is appropriate because, technically, products that existed in capitalist countries were also available on the black market in the GDR, via personal connections, or even in official stores but at horrendous prices or transaction costs.

The approach allows us to focus on a preference-driven explanation of consumption patterns after the reunification. It also allows us to concisely summarize in a single economic variable—the price—

the variety of changes that typically accompany economic development, such as a decrease 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.

As virtually implied by any economic model, a preference for variety would predict that consumption of novel food increases when its price decreases.<sup>10</sup> The magnitude of this increase in consumption, however, depends on the impact of past consumption on current preferences. In the following, we make the standard assumption that East and West Germans would have exhibited the same consumption behavior if they had not experienced the division of Germany. What's more, in the long-run, they would exhibit the same consumption behavior in unified Germany, which implies that the law of one price holds in reunified Germany. Consequently, observed differences in consumption levels would only be due to the exposure to socialism. In our model, we formalize life under socialism as differences in consumption experiences and whether time preference feature habit or taste formation.

For familiar food, we additionally assume that the pre-reunification consumption levels represent their pre-reunification steady states. These could differ in the GDR and FRG due to differences in, e.g., prices or relative incomes. Note that we empirically control a rich set of socio-demographic characteristics, including household income, in our econometric models.

**Proposition 2.** *Immediately after the reunification, consumption of novel food increases. 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.*

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<sup>10</sup>An obvious exception are Giffen goods.

Proposition 2 implies that the simple measurement of post-reunification East-West differences in consumption levels—after adjusting consumption for wage and socio-demographic differences—is sufficient to infer whether (unobservable) time preferences feature habit or taste formation.<sup>11</sup>

[Insert Fig. 1 about here]

Figure 1 illustrates dynamic consumption pattern of the novel food differential between East and West Germans,  $n_t^E - n_t^W$ . 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, under habit formation, post-reunification consumption levels would be higher in East than in West Germany. Over time, when consumption experiences have accumulated, eastern consumption would decrease and converge to western levels. However, under taste formation, the desirability of novel goods is low when consumption experience is low. Post-reunification consumption in the East would be lower than in the West but the consumption of the novel good *increases* with consumption experiences 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 converge to consumption in the West.<sup>12</sup>

Figure 1 illustrates dynamic consumption pattern of familiar food in East and West Germany,  $f_t^E - f_t^W$ . In analogy to Proposition 2: 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 continuously lower post-reunification consumption.

[Insert Fig. 2 about here]

In the following propositions, we consider the two remaining cases: higher (e.g. potatoes) or equal (e.g. meat) pre-reunification consumption of familiar food in the East:

<sup>11</sup> Similar consumption levels can be observed for three main reasons: (i) preferences are time separable (ii) preferences are non-separable, but  $U_{nN}, U_{fF} = 0$ , (iii)  $U_{nN}, U_{fF}$  are non nil, but the long run equilibrium has been reached. For this reason,  $U_{nN} = U_{fF} = 0$  is a sufficient, but not a necessary condition for the absence of differences in consumption levels.

<sup>12</sup> 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  $U_{NN} = 0$ .



**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.** *Suppose that pre-reunification consumption of familiar food was equal in East and in West Germany:  $f_0^E = f_0^W$ . Then 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.

To summarize, habit formation is revealed by consumption pattern that overreact to exogenous shocks in prices and are non-monotonic in time. Taste formation, instead, features a smoother response to the shock, as consumption reacts less at the time of the shock, and is followed by a monotonic adjustment to the long-run equilibrium.

In the following section, we test our theoretical predictions. Because consumption differences between East and West Germans at a given point in time provide sufficient statistics, repeated cross-sections are sufficient to test for non-separable intertemporal preferences.

## 5 Empirical Analysis

### 5.1 Estimating the Model Empirically

Equations (12) and (13) and equations (16) and (17) provide the theoretical underpinning for the empirical models. In each of these equations, the first term  $(\alpha_t, \kappa_t, \alpha_{tS}, \kappa_{tS})$  represents the effect of individual

characteristics, such as *Demographics*, *Education*, *Employment* and *Income*, on consumption levels. The second term represents the different consumption experiences at the time of the reunification, which proxies having lived in the GDR vs. the FRG. In this section we estimate two empirical models. The first model empirically estimates equations (12) and (13), and reads:

$$y_{it} = \alpha + \beta EastGerman_i + \psi EastGerman_i \times y1998_t + \gamma Demographics_i + \delta Education_i + \theta Employment_{it} + \omega Income_{it} + \rho_t + \epsilon_i. \quad (20)$$

Variable  $y_{it}$  stands for the following dependent variables (see Table B1 for the corresponding summary statistics):

- Food consumption by individual  $i$  at time  $t$ ,  $t=[1991, 1998]$ ,
- Objective Body Mass Index (BMI), overweight and obesity measures of individual  $i$  at time  $t$ ,  $t=[1991, 1998, 2005]$ .

Our 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  $\beta$  represents East-West level differences in food consumption and body mass in 1991. It represents the relationship between  $y_{it}$ , e.g. food consumption, and transitioning from socialism to capitalism, from a limited socialist food basket to a much larger capitalistic one. Most importantly, when considering novel and familiar food consumption, the sign of  $\beta$  will be informative of whether intertemporal preferences feature habit or taste formation, according to Propositions 2, 3 and 4.

When  $t = 1998$ , the dummy variable  $y1998_t$  is equal to one. Its coefficient  $\psi$  measures the change in food consumption for East Germans between 1991 and 1998.

Since employment, individual income and other socio-demographic factors could affect the demand for food, we also consider  $Demographics_i$ , a vector of six socio-demographic covariates,  $Education_i$ , a vector of three educational dummy variables, and  $Employment_{it}$ , a vector of seven labor market related controls (see Tables B1 and B2 in the Appendix). We also include month and year fixed effects to control for the interview month and year ( $\rho_t$ ). As usual,  $\epsilon_i$  is the error term.

When the dependent variable elicits *changes*, rather than levels, in food consumption, the corresponding theoretical equations that we estimate are (16) and (17). The empirical model can then be written as:

$$\Delta y_{it} = \alpha + \tilde{\beta}EastGerman_i + \tilde{\psi}EastGerman_i \times y1998_t + \tilde{\gamma}Demographics_i + \tilde{\delta}Education_i + \tilde{\theta}Employment_i + \tilde{\omega}Income_i + \rho_t + \epsilon_i \quad (21)$$

where  $\Delta y_{it}$  represents:

- Change in food consumption by individual  $i$  between  $t-3$  and  $t$ ,  $t=[1991]$ , i.e., between 1988 and 1991.
- Change in body weight of individual  $i$  between  $t-3$  and  $t$ ,  $t=[1991, 1998]$ , i.e., between 1988 and 1991, and between 1995 and 1998.

The empirical coefficient  $\tilde{\beta}$  can then be interpreted as an East-West difference-in-differences (DiD) estimator. Coefficient  $\tilde{\psi}$  has a similar interpretation, although it assesses the medium term effects of a treatment where East Germans are the treatment and West Germans the control group.

## 5.2 Identification

The 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; Heineck and Süßmuth, 2013; Burchardi and Hassan, 2013; Friehe and Mechtel, 2014) rests on a set of assumptions which are now standard and widely accepted (see Appendix 8 for a detailed discussion). A main assumption is that both the division and reunification of Germany were unexpected and quasi-random events that divided an otherwise united, and thus similar, population (Bleich et al., 2008). In addition, one assumes that post-reunification unobservables have not affected the outcomes differentially in East and West Germany. More precisely, if those unobservables exist, e.g. trust or uncertainty about the future, then they should at least 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 “life under socialism” to capitalism. Given our focus on individual

preferences and demand for food consumption, differences in purchasing power could bias our estimates. For this reason, we explicitly consider individual income and assets in the theoretical model. In the empirical exercise, we control for employment, income, and other socio-demographics.

Finally, East Germans who migrated between 1989 and 1991 to West Germany are not captured in the surveys and introduce measurement error which likely attenuates our estimates. To the extent that the (mostly young and healthy) migrants were more responsive to novel food consumption, our estimates represent a lower bound.

## 5.3 Data Description

### 5.3.1 German National Health Survey East-West 1991 (GNHSEW91)

The first dataset used 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 lot of information surveyed is food consumption and health-related. Excluding individuals with missing responses on relevant variables, the sample consists of 2,160 East and 4,390 West German respondents. We do not restrict the sample further.

**Dependent variables.** We exploit a battery of food consumption and body mass variables, in addition to measured variables exploited for robustness checks and to test for mechanisms. Overall, we group the dependent variables into 4 main categories (see Table B1 in the Appendix). The first category comprises self-reported measures of *Current Food Consumption Levels*. Table B1 shows that 54% of the population eat wholegrain bread daily, 26% eat non-processed—i.e. boiled, baked or smashed—potatoes daily, and 57% eat fresh fruits daily. Meat is consumed by 75% on a weekly basis; eggs (23%) as well as pie and cookies (36%) are consumed by a significant share more than once a week. We exploit these categories of *Current Food Consumption Levels* to estimate equation (20).

The second category elicits *Changes in Food Consumption in the last 3 Years*. We use these dependent measures to estimate equation (21). East Germans were interviewed between September 1991 and October 1992, which means the consumption changes in the past three years refer exactly to consumption changes around the fall of the Wall in 1989. A quarter of all respondents consumed more wholegrain, but only 2% more meat. As seen in Table B1, 34% consumed more fresh fruits—an effect that is largely driven by East Germans.

The second category also includes objective weight and height measures, as well as self-reports on whether respondents *Changed Diet* and *Gained Weight* in the last three years. Objectively measured height and weight shows that the average BMI is 27, that 61% of all respondents are overweight, and that 21% are obese (Table B1).<sup>13</sup> These values are close to those for the US population at that time (Burkhauser and Cawley, 2008; Ogden et al., 2014).

The third and fourth category of outcome variables are mainly used to test for the robustness of the findings and mechanisms. The third category includes *Clinical Diet-Related Objective Health Conditions* which have been found to be associated with an unhealthy unbalanced diet (Niinikoski et al., 1996; American Heart Association, 2001; Pasanisi et al., 2001; Brinkworth et al., 2006; Nagashima et al., 2010; American Heart Association, 2014). These clinical measures are blood pressure (21% hypertension) and blood cholesterol (44% high blood cholesterol).

The fourth category consists of generated measures of respondents' *Unawareness and Medical Check-Up Measures*. Only 25% had their blood pressure taken within the last year, but had 44% their blood cholesterol checked. Fifty-six percent got weighted and 87% received dietary advice within the last year. Contrasting clinical diagnoses based on the objective measures taken, 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.

**Covariates.** The covariates can be sub-classified into three main categories: *Demographics*, *Education*, and *Employment*. All mean values are reported in Table B1. Demographics includes the dummy variables *East German*, *Single*, and *Private Health Insurance*, in addition to *Age*, *# Household Members*, and *# Kids*. The second group of covariates includes three educational dummies and the third group seven employment measures, such as *Blue Collar Worker*, *White Collar Worker*, *Unemployed*, or the *Net Household Income* in ten categories.

### 5.3.2 German National Health Interview and Examination Survey 1998 (GNHIES98)

The second dataset, the *German National Health Interview and Examination Survey 1998* (GNHIES98), is very similar to the *GNHSEW91* described above. In fact, although technically a different dataset, it can be seen as a follow-up survey of the *GNHSEW91*; most of the questions asked are identical. Consequently, the *GNHIES98* is also a nationwide cross-sectional survey designed to be representative in East and West Germany, with self-reports on food consumption and objective clinical measures and

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<sup>13</sup>A person is considered to be overweight if the BMI is between 25 and 30, and obese if it is above 30.

height and weight. More information is provided by the [Robert Koch Institut \(2012a\)](#). The sample used in this paper consists of 2,216 East and 4,203 West Germans. All interviews were carried out between October 1997 and March 1999.

**Dependent Variables.** We generate categories of dependent variables, analogously to the ones for the *GNHSEW91* above. However, some food-related questions slightly changed. In addition, the retrospective questions on food consumption were no longer asked. The descriptive statistic of all variables are in Table [B2](#) in the Appendix. As above, the first set of dependent variables includes measures on the current consumption of *Meat, (boiled) Potatoes, Fruits, Wholegrain, Eggs, and Pie*.

A second set of dependent variables includes the exact clinical height, weight, and other diet-related health measures. Analogously to the *GNHSEW91*, we generate the four dummies *Overweight, Obese, High Cholesterol* and *High Blood Pressure*. In addition, we exploit self reported measures on weight gain in the last three years as well as diagnosed diabetes.

**Covariates.** Since identical or very similar questions were asked in the *GNHIES98* six years later, as Table [B2](#) shows, the list of control variables is selected and generated according to the categorization in the *GNHSEW91*.

### 5.3.3 German Microcensus 2005

The third and final dataset exploited is the *German Microcensus 2005*. It is a mandatory representative survey of 1% of the German population. Currently 380,000 households with 820,000 respondents participate every year. We make use of the survey year 2005.

This third survey helps us to assess the long-term effects of transitioning from life under socialism to capitalism on East German's body mass. In addition, since the survey is compulsory, it minimizes potential biases due to differential East-West non-response rates. A final argument for using the Microcensus is that the large number of observations, along with the type of questions asked, allows us to disentangle potential selection effects due to migration. We compare the body mass of (i) individuals who were socialized in the GDR and then migrated to West Germany with (ii) those who were socialized under capitalism, and (iii) those who were socialized in the GDR and stayed in East Germany.

**Dependent Variables.** We use self-reported weight and height measures and calculate the respondents' BMI. The mean BMI is 25. Almost half of the sample is overweight and 33% are obese (see Table B3 in the Appendix)

To disentangle selection effects due to East-West German migration pattern, we employ two main dummy variables and their interaction. The first variable, *Living in East Germany*, has a value of one for respondents who currently live in one of the six East German states that formerly belonged to the GDR. This applies to 22% or 69,818 respondents (Table B3). The second binary variable, *Educational Degree GDR*, elicits respondents' educational degrees. Educational degrees are surveyed precisely in the Microcensus. Obtaining a GDR educational degree implies that the respondent was socialized in the GDR and hence between the age of 15 and 20 before the Wall came down. 24,584 respondents or 8% of the sample fall into this category.

**Covariates.** The list of covariates is also in Table B3. We correct the sample composition for factors such as age (mean: 49 years), gender (51% female), labor market status (6.2% unemployed), household composition (62% with partner in household) and marital status (27% single).

## 6 Results

Using our three datasets, we will distinguish between short-run changes in food consumption and body weight (measured in 1991/1992), medium-term patterns in food consumption and body weight (measured in 1998) and long-run patterns in body weight (in 2005).

### 6.1 Short-Run Post-Reunification Changes in Food Consumption

Using the *GNHSEW91* and the regression framework formalized by equation (20), we empirically assess whether and how East Germans' diet changed in the transition period from socialism to capitalism. The results are reported in Table 2. In Panel A we report the regression results on food consumption levels in 1991 using as dependent variables six selected food categories (meat, boiled potatoes, fresh fruits, wholegrain bread, eggs and pies). The displayed *East German* coefficient in Panel A identifies differences in food consumption between East and West Germans in 1991. The first three columns of Panel B report the regression results using the direct survey questions on changes in the consumption levels of three specific food categories (meat, wholegrain, fruits) in the three years prior to the interview (see Section 5.3.1 for details). In such a case, as formalized in (21), the *East German* coeffi-

cient in Panel B of Table 2 can be interpreted as a DiD estimator indicating the differences in changes between East and West German food consumption.

As commented in the previous sections, before the reunification consumption of novel food was negligible in East Germany (see Table 1). For example, exotic fruit consumption was basically zero in the East, but 1.75 kg/month in the West in 1989. The pattern is reversed after the reunification, as shown in Table 2: The fresh fruits daily estimate in column (3) of Panel A is large in size (16% of the mean) and highly significant at the 1% level. This finding is strongly reinforced by column (3) of Panel B where fruit consumption increases are specifically and directly elicited. The share of East Germans who said that they increased their fruit consumption in the three years prior to the survey is a highly significant 16ppt higher as compared to West Germans. This amounts to a difference of almost 50%. Since exotic fruits were barely available in the GDR, we find strong evidence that East Germans consumed fresh exotic fruits at a much higher rate right after the fall of the Wall.<sup>14</sup> This non-monotonic pattern of consumption is consistent with the habit formation case represented in Figure 1, and formally predicted by Proposition 2.

When considering familiar food, we find that the *East German* 1991 consumption coefficient for (unprocessed) potato consumption is negative, about 10% of the mean and statistically significant (column (2) of Panel A). Since potato consumption was three times higher in East Germany in 1989 (see Table 1), and it sharply decreased in the transition phase from socialism to capitalism, potatoes' consumption patterns are consistent with habit formation (see Panel B of Figure A1)

**[Insert Table 2 about here]**

In contrast, we find no evidence that meat consumption differed between East and West Germans in 1991 (Panel A, column (1)), or that it significantly increased in the course of the reunification (Panel B, column (1)). The *East German* coefficient in column (1) of Panel A is small in size (4% of the mean) and not statistically significant. Similarly, and in line with this finding, also the DiD *more meat* coefficient in column (1) of Panel B is not significant. These findings are not inconsistent with our theoretical predictions, but they do not allow us to infer whether meat consumption features habit or taste formation.

**wholegrain bread** ?Egg consumption levels did not differ between East and West in 1991 (columns (4) and (5) of Panel A) and are unlikely to have changed after the fall of the Wall (column (2) of Panel

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<sup>14</sup>Anecdotal evidence, such as the one reported in the above quotations, is consistent with the reported results.



B). The coefficient sizes are small and not statistically different from zero. This finding does not allow us, *per se*, to infer whether habit or taste formation matter for the demand for eggs. Note, however, that raw sugar consumption, which mostly includes raw sugar for home-baked pie, was about 30% lower in East Germany before the reunification (see Table 1), as well as was eggs consumption (which was 22% higher in the West). Moreover, the pre-1989 availability of industrial sweets (not baked at home) was certainly significantly lower in East Germany, but in 1991 pie and cookie consumption was a significant 6.7ppt higher in East Germany.<sup>15</sup> Accordingly, it seems reasonable to conclude that pie and cookie consumption increased in East Germany after the Fall of the Wall between 1989 and 1991, thereby suggesting that pie and cookies feature habit formation (see Panel A of Figure 2).

The last three columns of Panel B in Table 2 directly elicit general dietary changes reported by respondents in 1991. Specifically, they reported whether they changed their diet in general, and whether they ate more or less food in the last three years. The identified coefficients for these models can be interpreted as DiD model variants since changes for East Germans are contrasted to changes for West Germans (cf. equation (21)).

Interestingly, and in line with the findings above, East Germans were much more likely to have changed their diet in the years around the reunification (column (4)): the *East German* coefficient is 13.3ppt (33%) and significant at the 1% level. Column (5) provides an imprecisely estimated *East German* coefficient for *More Food* which is, however, large in size (40%). The *Less Food* coefficient is smaller but still of relevant size (22%) and marginally significant. Overall, these findings suggest that significantly more East Germans changed their diet in the transition phase from life under socialism to capitalism, although with heterogeneous responses.

## 6.2 Short-Run Post-Reunification Changes in Body Weight

We now want to study the impact of the reunification on body weight. On a theoretical ground, recall that body weight is produced according to  $W_t = W(n_t, f_t, \gamma_t, N_t, F_t, Z)$  (see eq. 3). The impact of the reunification on body weight requires assessing, at a given time  $t$ , the sign of the following expression:

$$\frac{\partial W_t}{\partial p_n} = \frac{\partial W}{\partial n_t} \frac{\partial n_t}{\partial p_n} + \frac{\partial W}{\partial f_t} \frac{\partial f_t}{\partial p_n} + \frac{\partial W}{\partial \gamma_t} \frac{\partial \gamma_t}{\partial p_n} \gtrless 0 \quad (22)$$

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<sup>15</sup>Labeling this category of food is somehow ambiguous since the wording of the survey question potentially allows for familiar as well as for novel food.

If, after the reunification, novel food consumption increases while familiar food consumption decreases (which is the pattern empirically observed for fruit and potatoes, respectively), the effect on body weight is ambiguous. This conclusion holds *a fortiori* when considering the reaction of physical exercise to the reunification, as represented by the term  $\partial\gamma_i/\partial p_n$ . Since the overall effect on body weight depends on how eating behavior and physical activity adjust after the reunification, the following holds:

**Proposition 5.** *The impact of the reunification on body weight is theoretically ambiguous.*

Although theoretically we cannot predict whether body weight would decrease or increase shortly after the reunification, we can address this question empirically. Panel C of Table 2 tests whether, in 1991, East Germans gained and lost weight at a higher rate than their West German counterparts, and whether their weight loss intentions differed (columns (1) to (3)). The findings show indeed that, on average, more East Germans not only changed their diet but also gained more weight. The weight gain differential to West Germans is a significant (and remarkable) 5.9ppt, or 27%. This is reinforced by a similarly high weight loss *Intention* differential (6.7ppt or 46%), which is likewise significant at the 5% level. The statistical power of our model in column (2) of Panel C is not high enough to claim that a large share of East Germans also lost weight.

Below, in further refined analyses, we will link individual quantities of food consumption, weight gains, and weight loss intentions to specific food categories. The findings show that people who gained weight are indeed those who ate more—in particularly more fat but not more fruits (Figure 6), are overweight and obese, and are planning to lose weight (Figure 5). Analogously, weight losers ate less food—but more wholegrain and fruits (Figure A4), are mostly overweight, and plan to even lose more weight in the future (Figure A3). Interestingly, East German weight gainers were predominantly better educated white-collar men, and East German weight losers were predominantly non-unemployed women (see Table B5).

Columns (4) and (5) of Panel C formally test whether East Germans had a higher BMI and whether more East Germans were obese in 1991. Note that these findings are based on objective clinical height and weight measures which were carried out by professional health care interviewers. Figure 3a plots the entire BMI distribution for East and West Germans; the unconditional picture strongly suggests that less East Germans had normal weight, and that more East Germans were overweight and obese in 1991 and 1992 with respect to West Germans. Columns (4) and (5) of Panel C provide the results when correcting the BMI distributions for differences in socio-demographics. The body masses of East and

West Germans indeed differed significantly in 1991. The average BMI among East Germans was only slightly, but significantly, higher (0.7 index points) than the average BMI for West Germans (column (4)). However, the obesity rate was significant 6.7ppt higher.

**[Insert Figure 3 about here]**

Since body mass is determined by the net calorie intake, i.e., the difference between input and output, one potential explanation for higher body mass levels is more calorie intake. Another is less physical activity. We test calorie output differences using the detailed physical activity assessment contained in the *GNHSEW91*. Respondents had to estimate their weekly time spent for 20 different physical activities (see Section 5.3.1 above). Summing over all categories we find that Germans spend on average 560 minutes per week (80 minutes per day) on physical activities such as hiking, walking or practicing sports. Interestingly, Figure 3b illustrates that East Germans were definitely *more* physically active than West Germans in 1991. This is confirmed in column (6) of Panel C which shows that the difference amounts to a highly significant 233 minutes per week (33 minutes per day), even after considering socio-demographic differences and differences in the employment structure. 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 in the two Germanies, the body mass differentials would have been even larger after the reunification.

We also construct a measure of calorie expenditure, *Minutes Active per Week*, and show that the weight gains are not driven by a lower degree of physical activity and calorie expenditures among East Germans, but by a change in their diet. The *GNHSEW91* specifically asks respondents how many hours and minutes they spent on 20 different physical activities per week. The list of activities include, among others, walking (to go to work, for the pleasure of walking, for grocery shopping...), gardening, hiking, biking and different sports categories such as dancing, going to the gym, playing soccer, basketball, etc. For each respondent, we summed over the weekly minutes spent for each of the 20 categories. As seen in Table B1, Germans engage in 560 minutes of such physical activities per week, or 80 minutes per day.

### 6.3 Medium-Run Post-Reunification Patterns in Food Consumption and Body Weight

**Food Consumption Dynamics.** Because the *GNHIES98* survey was in the field in 1998/1999 (see Section 5.3.2), we can pool the *GNHSEW91* and *GNHIES98* and formally test changes in consumption between 1991 and 1998 within a regression model as in equation (20).

[Insert Table 3 about here]

Panel A of Table 3 reports consumption changes for specific food categories over time. The evidence is very clear for *Daily Fresh Fruit*: consumption increased sharply in the East after 1989, and remained at a significantly higher level than in West Germany in 1998. This suggests that fresh fruits feature habit formation (Proposition 2), and that the long-run equilibrium had not been reached by 1998, even nine years after the reunification.<sup>16</sup>

Consumption of a presumably less healthy novel food category, *Pies and Cookies* followed a very similar pattern. It increased in the East after 1989 and remained at a significantly higher level in 1998, which is again consistent with a habit formation and persistence of novelty effects.

Lastly, *Convenience Food* consumption was only elicited in 1998 in the *GNHIES98*. Processed convenience food—pre-prepared food for home consumption that only needs to be warmed up—was not available in the GDR, but it was available in the West and also marketed in Western television. According to survey data, western households spent € 50 per capita and month on it in 1983—a value that increased to € 80 in 1993 (Gedrich and Albrecht, 2003). According to the *GNHIES98*, in 1998, 13% of all West Germans consumed processed food once a week but 16% of all East Germans. This differential remains stable, even increases slightly, when considering socio-demographics in the regression framework in column (6) of Panel A. The 4ppt differential is highly significant at the 1% level. Hence we can infer that, among East Germans, convenience food consumption must have sharply increased after the reunification and was still higher than in West Germany in 1998. This is again consistent with novel food featuring habit formation.

When considering familiar food, only potatoes display significant changes in consumption between 1991 and 1998. In 1991 East Germans significantly ate less potatoes than West Germans, but in 1998 this pattern reversed and eastern potato consumption converged to western consumption levels. This

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<sup>16</sup>As mentioned before, fresh fruits are particularly consumed by weight losers and, interestingly, in East German weight losers were primarily working women.

finding, together with the evidence that East Germans used to eat more potatoes before the reunification, is consistent with non processed potatoes featuring habit formation (see Panel B of Figure 2 and Proposition 3), and with the equilibrium being reached at some point after 1991 and before 1998.

Finally, all other familiar food types—meat, eggs, and wholegrain—show no significant changes between the short- and the medium-run, as if the long-run equilibrium were already reached by 1991 (see Table 4).

To sum up, when economic development makes novel food available and affordable to the masses, consumption increases in the short-run (See Panel B of Table 4) and it remains significantly higher nine years after the unexpected transition to capitalism. According to the theoretical model in Section 4—this Novelty Effect can be explained by non separable intertemporal preferences featuring habit formation. We argue that this kind of preferences may have played a crucial role in the persistent correlation observed between economic development and obesity. However, as a cautionary note, our findings on novel food may not be generalizable since the food categories surveyed are endogenous. The surveys that we exploit are explicitly designed to elicit and compare East-West consumption patterns. Hence popular food categories are more likely to be surveyed. Many new products are introduced in the market every year, and the less popular ones often disappear. It is however important to highlight the possibility that Novelty and habit formation lead to persistent increases in consumption levels above the long-run equilibrium, and possibly to persistent body weight increases.

**Patterns in Weight, BMI, and Diet-Related Health.** Panel C of Table 3 shows that the East-West weight gain differential disappears in 1998. This is not the case for the other diet-related measures, such as *Obesity*, *High Cholesterol*, and *Diabetes*. The East-West obesity gap as well as obesity levels remained basically constant over time: The share of obese East Germans only very slightly decreased, despite the higher weight loss intentions among East Germans in 1991 (Panel C of Table 2). For cholesterol, we observe that the East-West gap remained in 1998 as large as it was in 1991. While diabetes levels were comparable in East and West in 1991, they shot up in East Germany between 1991 and 1998 and produced a significant East-West gap. Higher rates of diet-related medical conditions in the East, as indicated by high cholesterol or body weight, may have manifested themselves in higher diabetes rates over time. This would be consistent with the medical literature, and the finding that type-II diabetes slowly develops over time due to an unhealthy diet (Trayhurn and Beattie, 2001; Kahn et al., 2009).

## 6.4 Long-Run Post-Reunification Patterns in BMI

To investigate post-reunification patterns over a longer time horizon, we exploit the information contained in the *Microcensus 2005* about East Germans migrating to West Germany after the reunification. In addition to the large and representative number of observations, and the opportunity to study potential long-term effects 16 years after the fall of the Wall, we exploit a unique additional feature of the Microcensus: it elicits in a remarkably precise manner the educational degrees of the respondents, so that it is clearly identifiable whether the degrees were earned in the GDR or the FRG prior to 1990. This allows us to not only identify the respondents' current residency status, but also those respondents who were socialized and educated in the GDR and then migrated to West Germany where they lived as of 2005.

[Insert Figure 4 about here]

As an illustration, Figure 4 plots BMI distributions by East-West socialization and migration pattern. The BMI distribution that is most shifted to the left is the one for respondents living in West Germany without a GDR degree, i.e., people socialized under capitalism. The next BMI distribution, from left to right, belongs to those who were socialized in the GDR but now live in West Germany. Note that these migrants are younger, better educated, healthier, and obviously more mobile than East Germans who stayed in East Germany despite higher unemployment rates (Hunt, 2009). Still, it is remarkable to observe that their BMIs seem to exceed those of 'native' West Germans. The BMI distribution that is the most rightward shifted stems from people who currently live in the GDR and who were also socialized in the GDR.

Table B4 in the Appendix shows the regression results using as dependent variables a (continuous) BMI and the *Obesity* and *Overweight* dummies. The empirical model is similar to the one in equation (20). The socio-demographic control variables can be found in Table B3. The *Living in East Germany* coefficient provides results for people who currently live in East Germany but did not obtain a GDR degree, which could be due to several reasons, e.g., age or migration to East Germany. The most saturated specifications show that this coefficient is highly significant at the 1% level for all models. East German residents without a GDR degree are 5% more likely to be overweight and 17% more likely to be obese than "native" West Germans. The plain *Educational degree of GDR* coefficient identifies people who were definitely socialized in the GDR and earned their educational degree there. However, sometime between 1989 and 2005, they migrated to West Germany and still live there. The

stunning finding shows that—although this is a positively selected group in the sense that they are younger, healthier and better educated—their body mass lies significantly above the body mass of West Germans who were socialized under capitalism. Their BMI is 0.34 index points higher and they are 8.5% more likely to be overweight and an imprecisely estimated 7% more likely to be obese. Adding up both coefficients, *Living in East Germany* and *Educational degree of GDR*, and also adding their interaction, informs about the body mass for people who were educated in the GDR and still live in East Germany. Their body mass is by far the highest, which is likely due to a combination of socialization and selection effects, and the impact of the transition and adjustment from socialism to capitalism over 16 years.

## 7 Mechanisms and Robustness Checks

### 7.1 Who Changed Diet and Gained Weight?

Individual heterogeneity is likely to influence the outcomes we are studying. To further investigate who changed their diet and gained or lost weight, we run regressions of the three outcome variables, *Change In Diet*, *Weight Gain*, and *Weight Loss*, on our rich set of socio-demographics. In addition, we interact several socio-demographics with the *East German* dummy in order to assess whether different socio-demographic groups underwent dietary changes in East and West.

Table B5 in the Appendix shows the results and let us conclude that relatively few socio-demographics and few interaction terms are significantly correlated with the outcome variables. In particular, this is the case for the interaction *EastGerman* × *Unemployed*, and the sign may be surprising **not reported in table!**. *A priori* one could have guessed that unemployment in East Germany may be one confounding factor for the dietary changes found. However, unemployed East Germans were significantly *less* likely to have changed their diet (as were East German singles), and also to lose weight, whereas white (and not blue) collar East Germans predominantly gained weight. East German females, by contrast, lost weight at a higher rate after the reunification. All other determinants do not differ by East and West.

Next, we nonparametrically plot the self-reported weight gains and losses in kilograms, along with a set of dietary outcome variables. This exercise also serves as a falsification test to see whether people who reported having gained weight are truly those who ate more and changed their diet. It also double checks the potential for measurement errors, under- or overreporting.

[Insert Figure 5 and 6 about here]

Figure 5 nicely shows 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 strong evidence for the notion that weight gains resulted 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 6 has a similar setup, but the outcomes on the y-axis are *More Fat*, *More Meat*, *More Wholegrain*, and *More Fruit Consumption*. 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 above exercises 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 even lose more weight. Again, as in the weight gain case, there (d) is no relationship between physical activity and weight loss, strongly suggesting that those people indeed lost weight due to a change in diet and because they ate less. The last statement is strongly 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 Conditions

Table B6 in the Appendix sheds light on the hypothesis that dietary changes and weight gains are reflected in worse diet-related health measures. 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. The *High Blood Pressure* and *High Cholesterol* dummy variables were constructed according to official medical definitions (Section 5.3.1).



Panel A of Table B6 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, but since the population prevalence of this condition was 0.44, the East-West gap in percent is 'only' 12%. In contrast, no East-West differential for diabetes can be identified in 1991. Note that diabetes typically develops slowly over time and only breaks out after years of an unbalanced diet (Trayhurn and Beattie, 2001; Kahn et al., 2009).

### 7.3 Health Care Access and Awareness About Health Conditions

An interesting question we can tackle is whether East and West Germans with unhealthy diet-related health conditions were aware of their conditions. This is obviously a crucial first step in order to decide the appropriate lifestyle. One possibility is that awareness among East Germans was lower due to institutional barriers and a worse access to the health care system. Another alternative is that they were not aware because their health condition had recently and rapidly 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). This is reflected in Figure A5 (Appendix) where we plot the answers given by respondents about their last check-up by a physician or health care worker. Interestingly, and maybe surprisingly, all health care indicators are much better for East Germans: In 1991, it was significantly more likely that East Germans had their blood pressure taken (32% vs. 22%, Figure A5a). They were also more likely to have their cholesterol checked (49% vs. 42%, Figure A5b) and their body weight measured (62% vs. 54%, Figure A5c). Lastly, East Germans were more likely to have received dietary advice (although this difference is not statistically significant). We conclude that health care system access barriers were not responsible for a possible unawareness about East Germans' health conditions.

The second hypothesis concerns recent changes in the medical condition, which can possibly explain why a person is unaware of her medical condition. Hence, unawareness in the East would be consistent with the notion that East Germans developed their medical condition only recently, potentially as a result of their recent weight gain. Indeed, Panel B of Table B6 clearly shows that, in 1991, the unawareness levels in East Germany were significantly higher, despite the better health care access. About 7% of East Germans were not aware of their high blood pressure, while this is the case for only about 3% of West Germans. This is a huge—highly significant—differential, particularly in light of

the better health care access in the East. As for high cholesterol, the percentage point gap is even 18ppt—the unawareness rate among East Germans was almost 40%, while it was below 25% in the West (column (2)). Finally, the obesity unawareness gap between obese East and West Germans was 7ppt as column (3) shows.<sup>17</sup> It fits nicely that the East-West obesity differential is also 7ppt, and that 6ppt more East Germans gained weight in the transition phase from socialism to capitalism (Panel C of Table 2).

## 8 Discussion and Conclusion

This work builds upon and merges a growing, recent economic literature aimed at carving out driving forces of the strong increase in body mass in industrialized countries. One main strand of research exploits narrow, but very cleanly identified, causal impact factors of obesity such as an increased density of fast-food restaurants, larger portion sizes, or changes in gasoline prices. The cleanly 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 products persistently changes food consumption and body weight. Under socialism, trade opportunities and consumption choices were limited in the East. When the Berlin Wall unexpectedly and suddenly fell, East Germany became a capitalist economy, obtaining immediately access to international markets and free trade. Formerly unavailable western food products became available over night to East Germans. We develop a theory of novelty consumption that provides preference-based arguments to interpret the changes in consumption patterns observed after the German reunification.

More specifically, we propose a model where consumers’ preferences depend on past consumption experiences. This allows us to explicitly consider that Eastern Germans could suddenly consume a variety of new goods without for which they had no consumption experience. 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. We illustrate the corresponding intertemporal dynamics, which cannot be simply explained by a taste for

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<sup>17</sup>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).

variety. Moreover, we derive predictions and an empirical test to discriminate whether preferences featuring habit or taste formation. One special feature of this empirical test is that representative cross-sectional consumption data are sufficient to carry it out.

When empirically implementing the test, we exploit three different representative datasets for East and West Germany. The data include unique and rich self-reported dietary information, and information on dietary changes. Moreover it contains self-reports on recent body weight changes in addition to objective height and weight and other diet-related health measures. Our empirical findings can be summarized as follows.

First, in the transition period from limited food choice under communism to unlimited food choice 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. Surprisingly, weight gainers were not the unemployed or blue collar workers, but employed male white collar workers and the better off. Whereas weight gainers consumed more fat and meat, weight losers consumed more fresh fruits and wholegrain products. Physical activity and calorie expenditures played no relevant confounding role.

Second, digging deeper and assessing the change in consumption of specific food, we find that the consumption pattern for both novel and familiar food are consistent with habit formation. One observes significant increases in the consumption of previously unavailable and unaffordable novel food, such as exotic high-quality food (e.g., exotic fruits) or western processed food (e.g. convenience food). In contrast, one observes sharp immediate decreases in the consumption of cheap staple familiar food—like nonprocessed potatoes—which rebounded in the medium-run and converged quickly to the long-run equilibrium. Other staple familiar food consumption—e.g., of meat, eggs, and wholegrain—remained remarkably stable over time, as predicted by the theory. Overall, the application of our theoretical test strongly supports the notion and assumption of habit formation in consumption and non-separable time preferences.

Third, on average, East Germans gained weight. Their BMI levels and obesity rates lay significantly above those of West Germans in 1991. The body mass differential persisted until 1998, despite the higher rate of weight loss intentions in the East in 1991, which underscores the importance of self-control issues. The East-West BMI gap persisted at least until 2005. We show that even the positively selected group of East Germans who migrated to West Germany were more likely to be overweight than “native” West Germans.

Our study illustrates in a remarkably precise way how consumption patterns and the body mass of the population change when novel food products become available and affordable to the general population. Our theory provides an intertemporal framework to provides an an empirical test that discriminates between habit and taste formation in consumption. Overall, the theory provides a demand-driven explanation for the obesity epidemic that complements the existing focus on supply-side factors. An important topic of future inquiry would be to study how growth-driven consumption and body mass changes affect socio-demographic inequality and segregation.

a country, thanks to free trade or technological innovation, undergoes economic development. We explain the large increase of novel food consumption after the reunification as a consequence of a Novelty Effect which makes previously unavailable food particularly appealing, and we explain the persistence of the higher consumption of novel food, even after ten years from the fall of the Wall, in terms of accumulation of food consumption experience and the corresponding impact on current demand.

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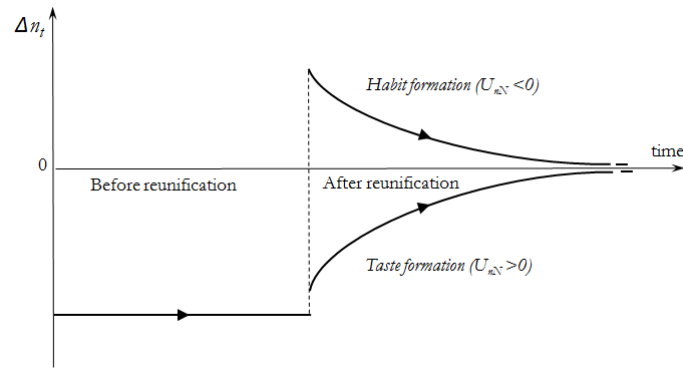
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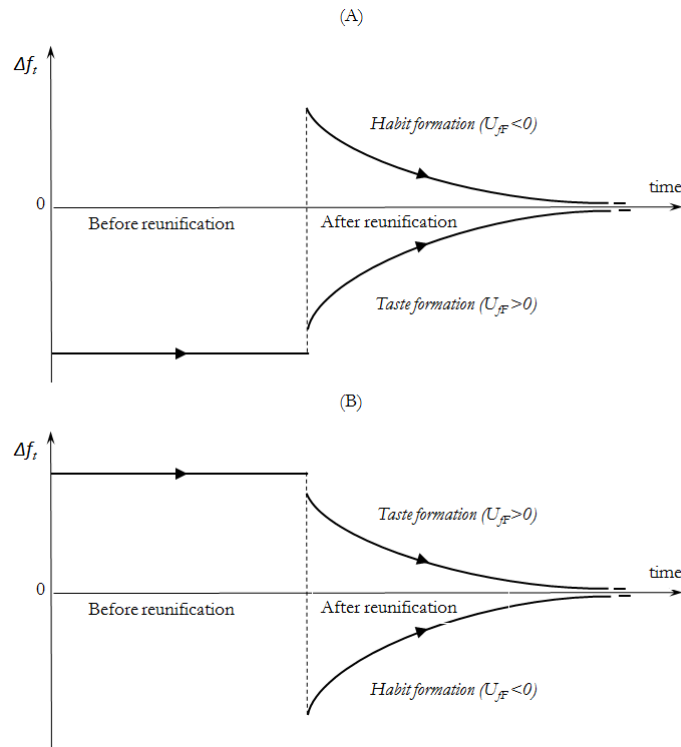
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**Figure 1: East-West Difference in Novel Food Consumption Before and After the Reunification**



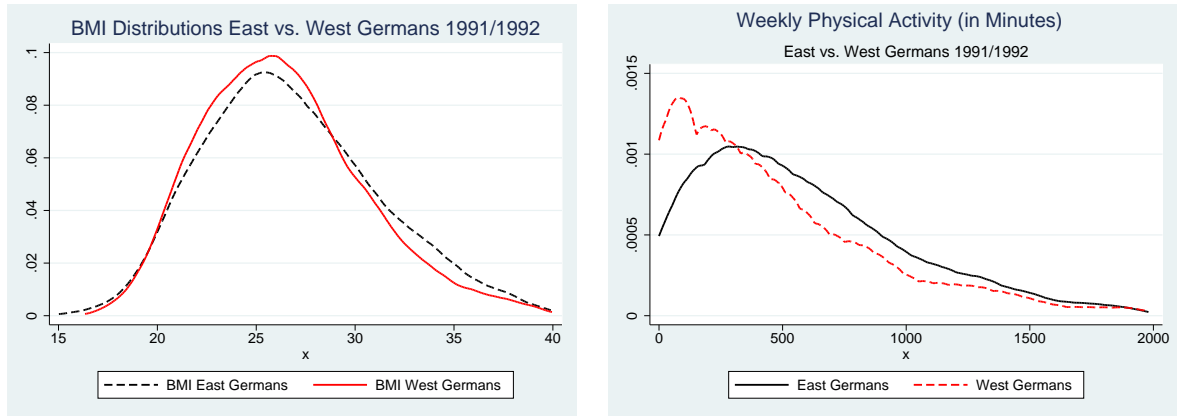
*Note:* Novel food consumption is zero in East Germany before the reunification. After the reunification, the consumption differential to West Germany is positive if novel food is habit forming, and negative if it is taste forming. In the long-run, the differential vanishes.

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



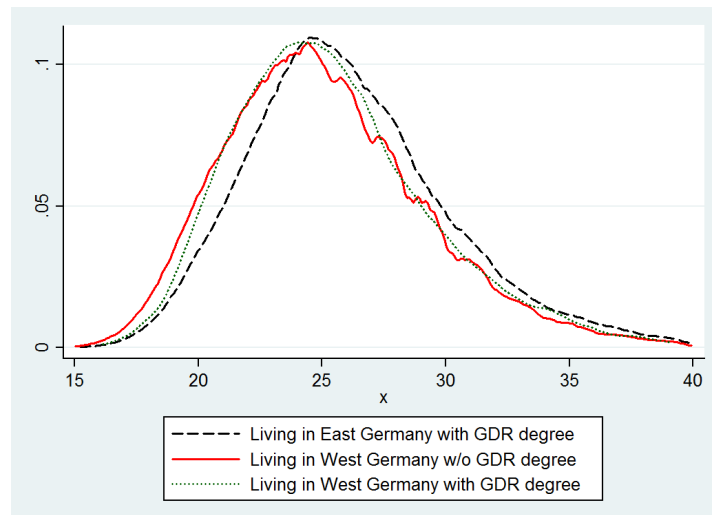
*Note:* Panel A represents the case where familiar food consumption is lower in East than in West Germany before the reunification (e.g. sugar and eggs). Panel B represents the opposite case (e.g. potatoes). Empirically observing East-West consumption differences before and after the reunification allows to 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**



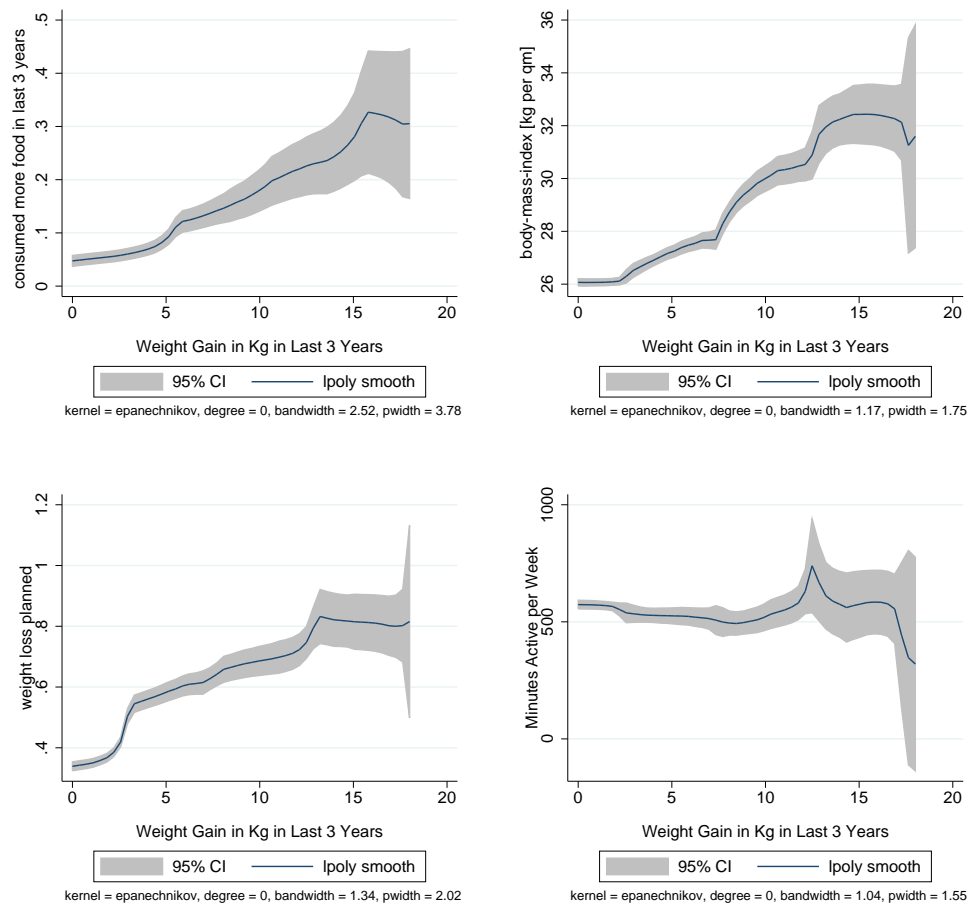
Source: Robert Koch Institut (2012b), German National Health Survey East-West 1991 (GNHSEW91)

**Figure 4: East-West BMI Distributions 2005, Disentangled by East-West Migration**

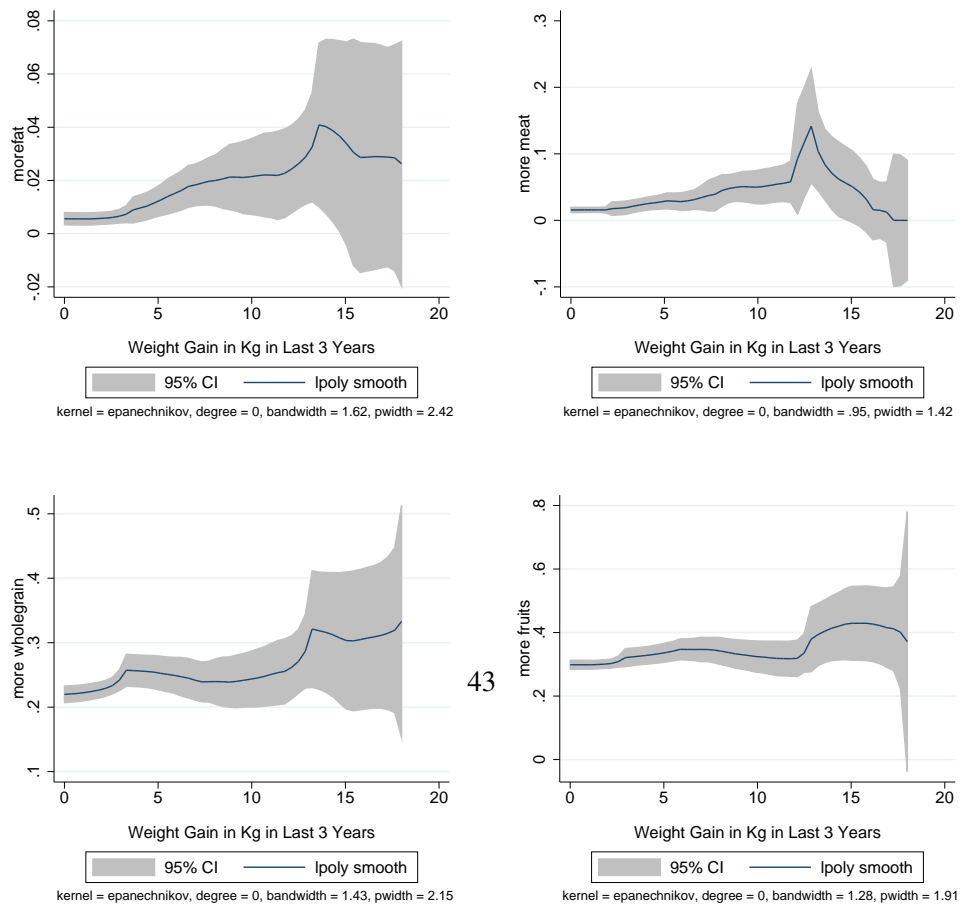


Source: German Microcensus 2005

**Figure 5: Weight Gain and (a) More Food Consumption, (b) BMI, (c) Weight Loss Planned, (d) Physical Activity (1991/1992)**



**Figure 6: Weight Gain and More Consumption of (a) Fat, (b) Meat, (c) Fruit, (d) Wholegrain (1991/1992)**



**Table 1: Pre-Reunification Monthly per Capita Consumption and Prices of Selected Food Categories**

Food Category	GDR/East Germany (1989)			FRG/West Germany (1988)		
	Consumption per month ( <i>in kg</i> ) (1)	Price per kg ( <i>in 2000 €</i> ) (2)	Price per kg ( <i>in % of net HH income</i> ) (3)	Consumption per month ( <i>in kg</i> ) (4)	Price per kg ( <i>in 2000 €</i> ) (5)	Price per kg ( <i>in % of net HH Income</i> ) (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%
Eggs	25.4 eggs	0.22	0.03%	31	0.13	0.01%
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 and 1997 (in 1995 prices). Food prices are taken from [Zentralverwaltung für Statistik der DDR \(1988, 1990\)](#); [Gedrich and Albrecht \(2003\)](#); [Woll \(2012\)](#); [Maecker \(2013\)](#). Time values of prices and income have been adjusted assuming an 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 (1991/1992)**

<i>Panel A: Current diet</i>						
	<b>meat weekly (1)</b>	<b>(boiled) potatoes daily (2)</b>	<b>fresh fruits daily (3)</b>	<b>wholegrain bread daily (4)</b>	<b>eggs regularly (5)</b>	<b>pie regularly (6)</b>
East German	0.0280 (0.0285)	-0.0266** (0.0282)	0.0928*** (0.0313)	-0.0053 (0.0331)	0.0248 (0.0277)	0.0671** (0.0319)
mean	0.74	0.26	0.57	0.54	0.23	0.36
$\Delta$	4%	-10%	16%	-1%	11%	19%
<i>Panel B: Change in diet, last 3 years</i>						
	<b>more meat (1)</b>	<b>more whole- grain(2)</b>	<b>more fruits (3)</b>	<b>change in diet (4)</b>	<b>more food (5)</b>	<b>less food (6)</b>
East German	0.0251 (0.0288)	0.0105 (0.0096)	0.1622*** (0.0310)	0.1330*** (0.0323)	0.0111 (0.0109)	0.0472* (0.0266)
mean	0.02	0.25	0.34	0.40	0.028	0.21
$\Delta$ (coefficient/mean)	52%	10%	48%	33%	40%	22%
<i>Panel C: Change and differences in body mass</i>						
	<b>weight gain (1)</b>	<b>weight loss (2)</b>	<b>weight loss planned (3)</b>	<b>BMI (4)</b>	<b>obese (5)</b>	<b>minutes active (6)</b>
East German	0.0589** (0.0295)	0.0072 (0.0240)	0.0676** (0.0330)	0.6838** (0.2909)	0.0668** (0.0262)	232.79*** (37.7708)
mean	0.27	0.15	0.46	27.7	0.21	560
$\Delta$ (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 the independent variables as listed in Table B1. In Panel A and B, all self-reported dependent variables are dummy variables. The original questions have more than two answer categories: Panel A: (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 as follows: “Regularly” refers to consumption “several times a week or daily”, i.e., (i) and (ii). The questions exploited in Panel B, columns (1) to (3), have answer categories (i) more, (ii) same, (iii) less [consumption of food category X in last 3 years]. Panel B, columns (4) to (6) exploit whether respondents changed their diet, and consumed overall more or less food. Panel C, columns (1) to (3), are based on self-reports about weight gains or 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 5.3 provides more information on the variables. The number of observations for all columns and panels is 6,550. The R-squared in Panel A lies between 0.02 (column (2)) and 0.11 (column (6)), in Panel B it lies between 0.01 (column (4)) and 0.04 (column (6)) and in Panel C between 0.05 (column (6)) and 0.16 (column (4)). The “mean” refers to the mean of the dependent variable in the column header.

<i>Panel A: Diet</i>						
	<b>meat weekly (1)</b>	<b>(boiled) potatoes daily (2)</b>	<b>fresh fruits daily (3)</b>	<b>eggs regularly (4)</b>	<b>pie regularly (5)</b>	<b>convenience food weekly (6)</b>
East German×1998	-0.0046 (0.0266)	0.1067*** (0.0254)	0.0219 (0.0290)	0.0053 (0.0253)	-0.0385 (0.0298)	
East German	0.0233 (0.0232)	-0.0602*** (0.0222)	0.1157*** (0.0254)	0.0190 (0.0221)	0.0610** (0.0260)	0.0385*** (0.0104)
mean	0.74	0.48	0.58	0.24	0.22	0.14
<i>Panel B: Diet-related objective health measures</i>						
	<b>weight gain (1)</b>	<b>BMI (2)</b>	<b>obese (3)</b>	<b>high blood pressure (4)</b>	<b>high cholesterol (5)</b>	<b>diabetes (6)</b>
East German×1998	-0.0410 (0.0281)	0.0620 (0.2674)	-0.0165 (0.0243)	-0.0504** (0.0245)	-0.0246 (0.0284)	0.0138 (0.0130)
East German	0.0477* (0.0245)	0.3094 (0.2338)	0.0451** (0.0212)	0.1372*** (0.0214)	0.0534** (0.0249)	0.0068 (0.0114)
mean	0.30	26.7	0.21	0.26	0.43	0.49

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. More details on the dependent variables can be found in Tables [2](#) and [B6](#) as well as in Section [5.3](#). The control variables used are listed in Table [B1](#) and [B2](#). The number of observations for all columns and panels is 12,969, except for column (6) in Panel A that is only based on the 1998 data (6,419 obs.). The “mean” refers to the mean of the dependent variable in the column header.

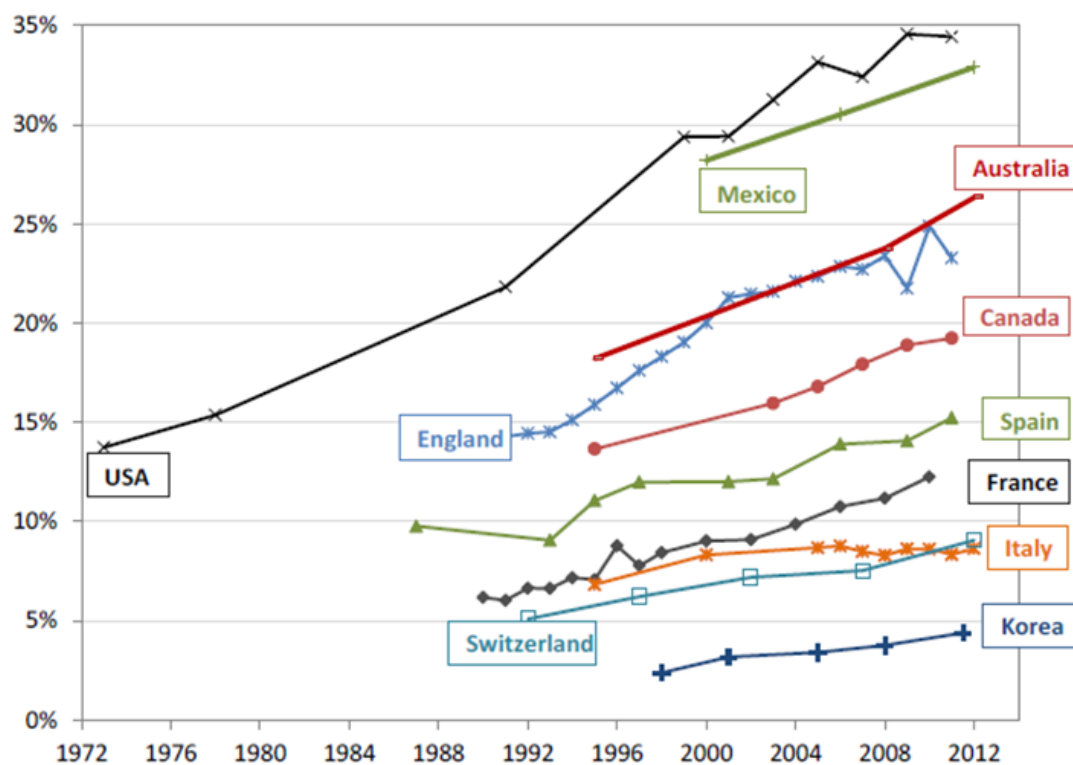
**Table 4: Categorization of Investigated Food Consumption Dynamics in the Short- and Long-Run**

	<b>Pre-1989 to 1991</b>	<b>1991 to 1998</b>	<b>Consumption Dynamics</b>	<b>Inference from Theory</b>
<i>Panel A: Familiar Food</i>				
Meat	same in East and West	same in East and West	flat, no changes	N/A
Boiled potatoes	sharp decline in East	rebound to West equilibrium	decrease, then increase to long-run West equilibrium	habit formation
Eggs	same in East and West	same in East and West	flat, no changes	N/A
Wholegrain	same in East and West (in 1991)	N/A	flat, no changes	N/A
<i>Panel B: Novel Food</i>				
Fresh fruit	sharp increase in East	higher level in East ,	sharp increase	habit formation
Pies and cookies	increase in East	higher level in East	increase	habit formation
Convenience food	N/A (likely sharp increase)	higher level in East	sharp increase	habit formation
Own illustration derived from empirical and theoretical models. Note that 'pies and cookies' can also be familiar food; however many industrially produced products fall into this category and thus many newly available western pie and cookie products entered the eastern market after the fall of the Wall.				



Appendix A: Figures

Figure A1: Development of obesity rates in OECD countries



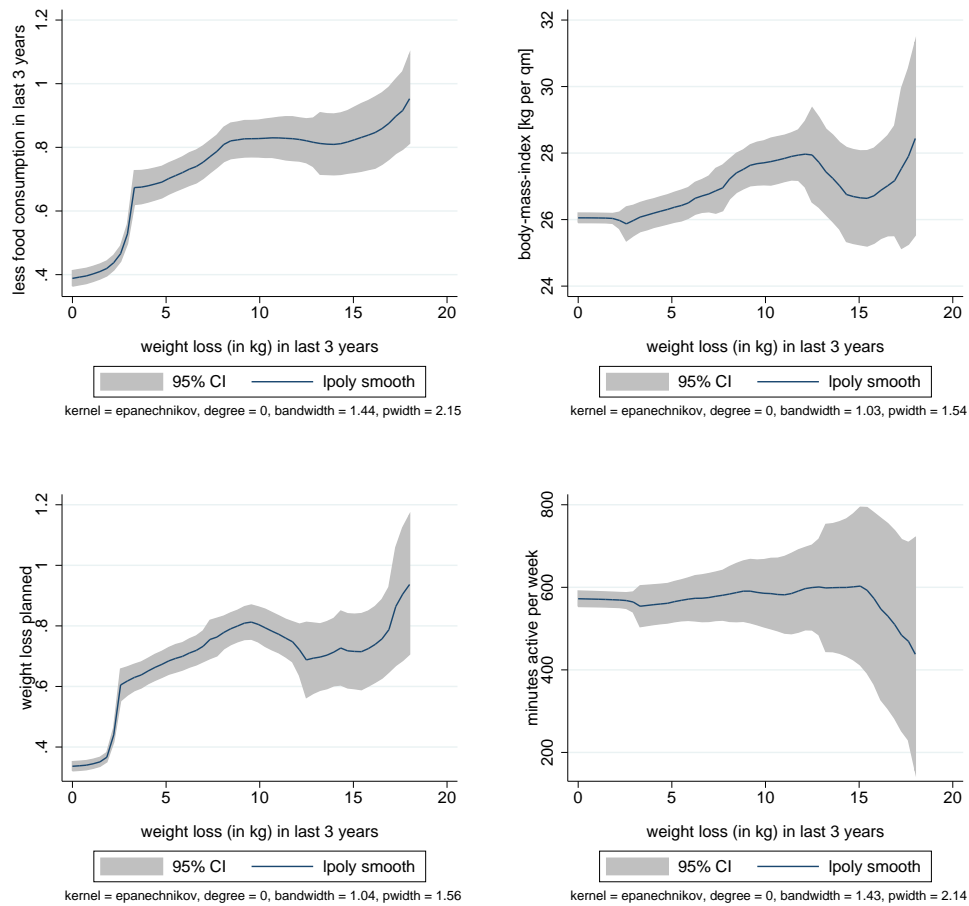
Source: OECD, 2014

**Figure A2: Division of Germany, 1961**

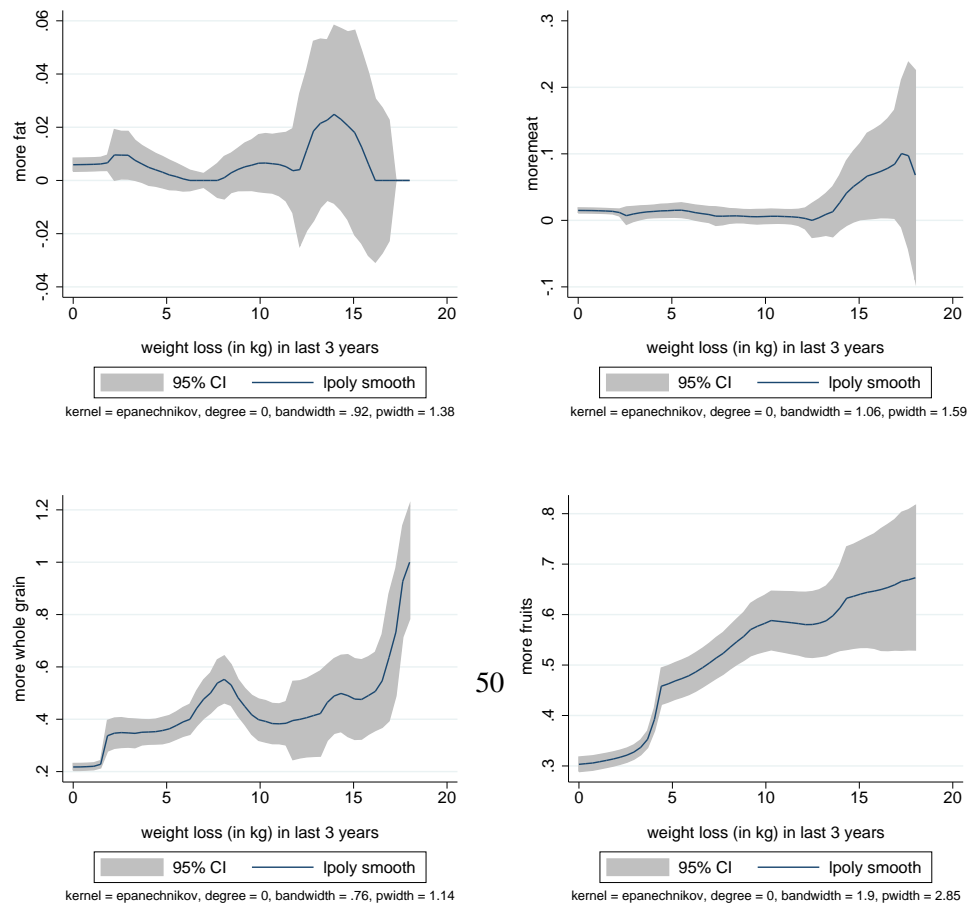


Source: IEG-Maps, Institute of European History, Mainz; available at <http://germanhistorydocs.ghi-dc.org/>, last accessed on March 6, 2013.

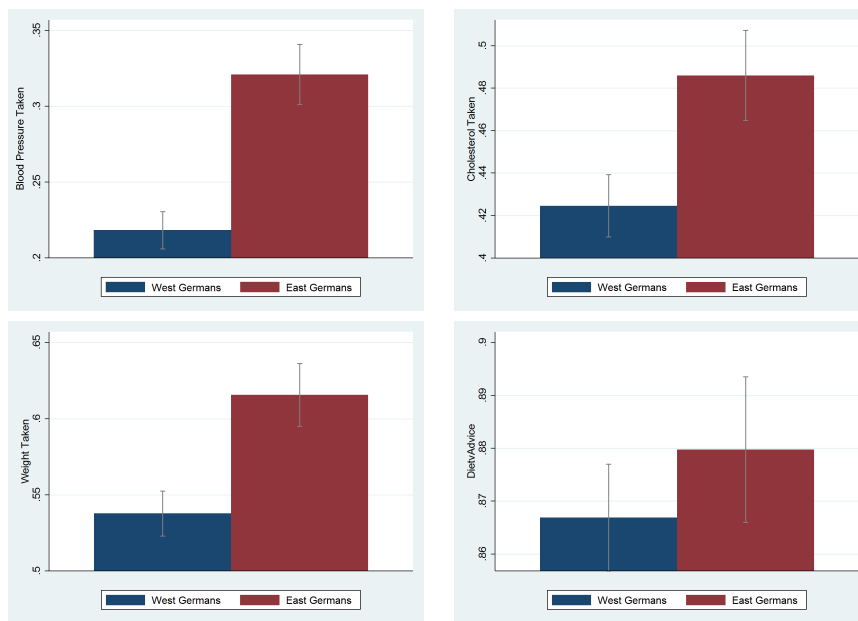
**Figure A3: Weight Loss and (a) Less Food Consumption, (b) BMI, (c) Weight Loss Planned, and (d) Physical Activity (1991/1992)**



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



**Figure A5: East-West Differences in (a) Blood Pressure Taken, (b) Cholesterol Measured, (c) Weighted, and (d) Dietary Advice by Health Care Worker in Last Year (1991/1992)**



## Appendix B: Tables

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

Variable	Mean	Std. Dev.	Min.	Max.	N
<b>A. Outcome Measures</b>					
<b>Current diet</b>					
Meat weekly	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
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
<b>Change in diet and body mass, last 3 years</b>					
More meat (at least once a week)	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	0.2681	0.4430	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
<b>Diet-related objective health conditions</b>					
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
<b>Unawareness and medical check-up measures</b>					
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>B. Covariates</b>					
<b>Demographics</b>					
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

*Continued on next page...*

... table B1 continued

Variable	Mean	Std. Dev.	Min.	Max.	N
# household members	2.838	1.2246	1	18	6,550
# 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
<b>Education</b>					
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
<b>Employment</b>					
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: <a href="#">Robert Koch Institut (2012b)</a> , 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
<b>A. Outcome Measures</b>					
<b>Current diet</b>					
Meat weekly (at least once a week)	0.7267	0.4456	0	1	6,419
Boiled Potatoes daily	0.219	0.4136	0	1	6,419
Fresh fruits daily	0.5788	0.4938	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
<b>Clinical objective health measures</b>					
Weight gain (in last 3 yrs., self-reported)	0.3349	0.472	0	1	6,419
Overweight (BMI>25)	0.6007	0.4898	0	1	6,419
Obese (BMI>30)	0.2083	0.4061	0	1	6,419
High total cholesterol [>6.2 mmol/l]	6.0046	1.2631	2.01	16.8	6,419
High blood pressure	0.2359	0.4246	0	1	6,419
Diabetes (self-reported)	0.0514	0.2208	0	1	6,419
<b>B. Covariates</b>					
<b>Demographics</b>					
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
<b>Education</b>					
8 school years	0.3991	0.4898	0	1	6,419
10 school years	0.1905	0.3927	0	1	6,419
13 school years	0.3664	0.4819	0	1	6,419
<b>Employment</b>					
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	0.2898	0.4537	0	1	6,419
Net household income in DM (13 categories)	6.6235	2.9263	1	13	6,419
Sources: <a href="#">Robert Koch Institut (2012a)</a> , German National Health Interview and Examination Survey 1998					

**Table B3: German Microcensus 2005**

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>	<b>N</b>
<b>A. Outcome Measures</b>					
BMI	25.3578	4.375	7.4651	82.1828	312,983
Overweight	0.4814	0.4997	0	1	312,983
Obese	0.132	0.3385	0	1	312,983
<b>B. Covariates</b>					
<b>Socialized in GDR vs. living in East Germany</b>					
Living in East Germany	0.2231	0.4163	0	1	312,983
Educational degree of GDR	0.0785	0.269	0	1	312,983
Living in East Germany×GDRdegree	0.0688	0.2531	0	1	312,983
<b>Demographics</b>					
Age	49.1783	18.6993	16	95	312983
Female	0.513	0.4998	0	1	312983
Unemployed	0.0629	0.2429	0	1	312983
Partner in household	0.6205	0.4853	0	1	312983
Single	0.2666	0.4422	0	1	312983
<i>Sources: German Microcensus 2005, own illustration</i>					



**Table B4: Long-Run Post-Reunification Patterns in Body Weight (2005)**

<i>Food Category</i>	<i>BMI</i>			<i>overweight</i>			<i>obese</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Living in East Germany	0.4217*** (0.0177)		0.2660*** (0.0206)	0.0411*** (0.0020)		0.0253*** (0.0024)	0.0260*** (0.0014)		0.0224*** (0.0017)
Educational degree of GDR		0.6620*** (0.0276)	0.1736** (0.0748)		0.0647*** (0.0032)	0.0107 (0.0086)		0.0268*** (0.0022)	0.0023 (0.0061)
EastGermany×GDRdegree			0.3414*** (0.0821)			0.0411*** (0.0094)			0.0097 (0.0067)
Constant	23.3873*** (0.0365)	23.3725*** (0.0366)	23.3560*** (0.0366)	0.2700*** (0.0042)	0.2685*** (0.0042)	0.2670*** (0.0042)	0.0410*** (0.0030)	0.0418*** (0.0030)	0.0403*** (0.0030)
Socio-demographic controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	312,983	312,983	312,983	312,983	312,983	312,983	312,983	312,983	312,983
R-squared	0.1184	0.1185	0.1191	0.1168	0.1168	0.1173	0.0229	0.0223	0.0229

Source: Microcensus2005, 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 B3). Each column in each panel represents one model, estimated by OLS, with the dependent variables in the column header. More details on the dependent body mass variables and the covariates employed can be found in Table B3 and in Section 5.3. The constant identifies the body mass of West Germans who live in West Germany with zeros on all covariates considered (see Table B3). Adding the *Living in East Germany* coefficient yields the body mass for people living currently in East Germany but without a GDR educational degree (e.g., due to age or migration to East Germany). Adding all four coefficients yields the body mass for people living in East Germany with a GDR educational degree. And just adding the *Educational degree of GDR* coefficient yields the body mass for people who were socialized in the former GDR but migrated to West Germany where they currently live.

**Table B5: Who Changed their Diet, Gained and Lost Weight Shortly after the Reunification?**

Variable	change diet (1)	weight gain (2)	weight loss (3)
<b>Personal characteristics</b>			
East German	0.0815 (0.1067)	0.1243 (0.0975)	0.0134 (0.0792)
Agegroup2	0.0131 (0.0192)	-0.0084 (0.0175)	-0.0179 (0.0142)
Agegroup3	0.0167 (0.0260)	-0.0663*** (0.0238)	-0.0107 (0.0193)
East German×Agegroup2	-0.0291 (0.0332)	0.0023 (0.0304)	-0.0047 (0.0247)
East German×Agegroup2	-0.0535 (0.0463)	0.0195 (0.0423)	0.0413 (0.0343)
Female	0.0935*** (0.0155)	0.0813*** (0.0141)	-0.0048 (0.0115)
East German×Female	0.0138 (0.0267)	-0.0135 (0.0244)	0.0346* (0.0198)
Single	0.0236 (0.0231)	0.0074 (0.0211)	-0.0111 (0.0172)
East German×Single	-0.0903** (0.0423)	0.0174 (0.0387)	0.0020 (0.0314)
Household net income	0.0027 (0.0036)	0.0108*** (0.0033)	-0.0021 (0.0026)
East German×HHNetIncome	0.0114 (0.0072)	0.0055 (0.0066)	-0.0044 (0.0053)
<b>Educational characteristics</b>			
8 years of completed schooling	0.0876** (0.0441)	0.0736* (0.0403)	0.0308 (0.0328)
East German×8SchoolYrs.	-0.0250 (0.0836)	-0.0275 (0.0764)	0.0068 (0.0621)
10 years of completed schooling	0.1467*** (0.0470)	0.0761* (0.0430)	0.0484 (0.0350)
East German×10SchoolYrs.	-0.0343 (0.0862)	-0.0605 (0.0788)	-0.0194 (0.0640)
13 years of completed schooling	0.1687*** (0.0484)	0.0838* (0.0442)	0.0263 (0.0360)
East German×13SchoolYrs.	-0.0392 (0.0911)	-0.0842 (0.0832)	0.0095 (0.0676)
<b>Job characteristics</b>			
Blue Collar Worker	0.0058 (0.0247)	0.0408* (0.0226)	0.0293 (0.0183)
East German×BlueCollar	0.0669 (0.0491)	-0.0740* (0.0448)	-0.0068 (0.0364)
White Collar Worker	0.0162 (0.0238)	0.0110 (0.0217)	0.0182 (0.0176)
East German×WhiteCollar	0.0884* (0.0477)	-0.0298 (0.0436)	0.0049 (0.0354)
Unemployed	0.1462*** (0.0484)	-0.0026 (0.0443)	0.0666* (0.0361)
East German×Unemployed	-0.1068* (0.0605)	0.0561 (0.0552)	-0.0909** (0.0450)

Source: [Robert Koch Institut \(2012b\)](#), German National Health Survey East-West 1991 (*GNHSEW91*), own calculation and illustration; \* p<0.1, \*\* p<0.05, \*\*\* p<0.01; standard errors in parentheses. The descriptive statistics are in the Appendix (Table B1). The model is estimated by OLS; the three binary outcome variables are one if respondents indicate to have changed their diet (column (1)), gained weight (column (2)) or lost weight (column (3)) in the last three years. For more information on how the variables were generated, see Section 5.3.1. Not displayed, non-significant, additional control variables and their interactions with *East German* are: # household members, # own kids, private health insurance, civil servant, trained for job, physical work, month fixed effects, and year fixed effects. The number of observations is 6,550 and the R-squared lies between 4 (columns (1)) and 0.7 (column (3)).

**Table B6: Short-Run Post-Reunification Changes in Diet-Related Health and Awareness about Medical Conditions (1991/1992)**

<i>Panel A: Clinical objective diet-related health conditions</i>			
	<b>High blood pressure (1)</b>	<b>High cholesterol (2)</b>	<b>Diabetes (3)</b>
East German	0.0716*** (0.0258)	0.0524* (0.0310)	0.0028 (0.0138)
mean	0.21	0.44	0.046
$\Delta$ (coefficient/mean)	34%	12%	6.5%
<i>Panel B: Unawareness of hypertension, high cholesterol, and obesity</i>			
	<b>Unaware high blood pressure (1)</b>	<b>Unaware high cholesterol (2)</b>	<b>Unaware obese (3)</b>
East German	0.0619*** (0.0191)	0.1813*** (0.0296)	0.0739*** (0.0173)
mean	0.09	0.29	0.07
$\Delta$ (coefficient/mean)	69%	63%	100%
<p>Source: <a href="#">Robert Koch Institut (2012b)</a>, German National Health Survey East-West 1991 (GNHSEW91), own calculations and illustrations; * <math>p &lt; 0.1</math>, ** <math>p &lt; 0.05</math>, *** <math>p &lt; 0.01</math>; 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. All covariates listed in Table B1 are considered. 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 how the variables were generated, see Section 5.3.1. The number of observations for all models is 6,550. The “mean” refers to the mean of the dependent variable in the column header.</p>			

## 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. Due to the linear-quadratic structure of the model, we consider the following value function:

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

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:

$$n = \alpha_3 + \hat{n} + (2\alpha_4 + U_{nN})N - \alpha_5 p^n, \quad (23)$$

$$f = \alpha_1 + \hat{f} + (2\alpha_2 + U_{fF})F - \alpha_5 p^f, \quad (24)$$

$$g = \hat{g} - \mu p^g. \quad (25)$$

Notice that  $\mu$  must be positive to ensure that the marginal utility of the utility function (11) 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:

$$\alpha_1 = \frac{\hat{f} - \mu p^f}{\rho + \Omega_f} (2\delta + \rho - \Omega_f), \quad \alpha_2 = \frac{1}{4} (2\delta + \rho - 2U_{fF} - \Omega_f), \quad (26)$$

$$\alpha_3 = \frac{\hat{n} - \mu p^n}{\rho + \Omega_n} (2\delta + \rho - \Omega_n), \quad \alpha_4 = \frac{1}{4} (2\delta + \rho - 2U_{nN} - \Omega_n), \quad (27)$$

$$\alpha_5 = \frac{1}{2\rho} \left[ \hat{g}^2 + (\hat{f} + \alpha_1)^2 + (\hat{n} + \alpha_3)^2 + ((p^n)^2 + (p^f)^2 + (p^g)^2) \mu^2 \right] + \frac{\mu}{\rho} \left[ M - p^g \hat{g} - p^f (\hat{f} + \alpha_1) - p^n (\hat{n} + \alpha_3) \right]. \quad (28)$$

The coefficient  $\mu$  represents the shadow value of the assets (i.e., 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

$$\varepsilon_1 = (\rho A_0 + M - p^s \hat{g})(\rho + \Omega_f)(\rho + \Omega_n) \quad (29)$$

$$\begin{aligned} & + 2 \left[ \hat{f} p^f (\rho + \Omega_n) - \hat{n} p^n (\rho + \Omega_f) \right] (\rho + \delta) \\ & + 2 p^f \Psi_f \frac{\rho + \Omega_n}{(\rho + \Omega_f)^2} \left[ \rho (\rho + \Omega_f) F_0 + 2 \hat{f} (\rho + \delta) \right] \\ & + 2 p^n \Psi_n \frac{\rho + \Omega_f}{(\rho + \Omega_n)^2} \left[ \rho (\rho + \Omega_n) N_0 + 2 \hat{n} (\rho + \delta) \right], \end{aligned}$$

$$\begin{aligned} \varepsilon_2 = & - (p^s)^2 (\rho + \Omega_f) (\rho + \Omega_n) - 2 \left[ (p^n)^2 (\rho + \Omega_f) + (p^f)^2 (\rho + \Omega_n) \right] (\rho + \delta) \quad (30) \\ & + \frac{4 (p^f)^2 (\rho + \Omega_n) (\rho + \delta)}{(\rho + \Omega_f)^2} \Psi_f + \frac{4 (p^n)^2 (\rho + \Omega_f) (\rho + \delta)}{(\rho + \Omega_n)^2} \Psi_n. \end{aligned}$$

Replacing the values of  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$  and  $\mu$  in (23) and (24) and rearranging yields the policy functions (31) and (32):

$$n^* = \frac{2(\rho + \delta)}{\rho + \Omega_n} (\hat{n} - \mu p_t^n) + \frac{1}{2} (\rho + 2\delta - \Omega_n) N_t, \quad (31)$$

$$f^* = \frac{2(\rho + \delta)}{\rho + \Omega_n} (\hat{f} - \mu p_t^f) + \frac{1}{2} (\rho + 2\delta - \Omega_f) F_t, \quad (32)$$

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:

$$n_{ss} = \delta N_{ss} = \delta \frac{(\delta + \rho) (\hat{n} - p^n \mu)}{\delta (\delta + \rho) - (2\delta + \rho) U_{nN}}, \quad (33)$$

$$f_{ss} = \delta F_{ss} = \delta \frac{(\delta + \rho) (\hat{f} - p^f \mu)}{\delta (\delta + \rho) - (2\delta + \rho) U_{fF}}. \quad (34)$$

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 (31) and (32) in the differential equations  $\dot{F}_t$ ,  $\dot{N}_t$  and  $\dot{A}_t$  and solving yields the time path of food consumption experiences:

$$N_t = (1 - e^{\lambda_n t}) N_{ss} + e^{\lambda_n t} N_0 \quad (35)$$

$$F_t = (1 - e^{\lambda_f t}) F_{ss} + e^{\lambda_f t} F_0 \quad (36)$$

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 (35) and (36) in (31) and (32), yields the optimal path of food consumption choices reported in Proposition 1:

$$n_t = \alpha_t + \beta_t N_0, \quad (37)$$

$$f_t = \kappa_t + \phi_t F_0. \quad (38)$$

where

$$\alpha_t = [\delta - (\delta + \lambda_n) e^{\lambda_n t}] N_{ss}, \quad \beta_t = (\delta + \lambda_n) e^{\lambda_n t} \quad (39)$$

$$\kappa_t = [\delta - (\delta + \lambda_f) e^{\lambda_f t}] F_{ss}, \quad \phi_t = (\delta + \lambda_f) e^{\lambda_f t} \quad (40)$$

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

$$\Delta n_t = n_t^E - n_t^W = \beta_t (N_0^E - N_0^W) = -\beta_t N_0^W \quad (41)$$

$$\Delta f_t = f_t^E - f_t^W = \phi_t (F_0^E - F_0^W) = \phi_t (F_0^E - F_0^W) \quad (42)$$

Note that  $\alpha_t$  and  $\kappa_t$  depend on the steady state values, which reflect market prices, available income and wealth. The sign of  $\beta_t$  and  $\phi_t$  (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  $\Delta n_t$  only depends on  $\beta_t$ , we can proxy life under socialism with  $N_0^W$ . For the sign of  $\Delta f_t$ , instead, there is no one-to-one relation because in principle  $F_0^E - F_0^W$  could have any sign. The difference  $\Delta f_t$  is positive if  $\phi_t (F_0^E - F_0^W) > 0$ . 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  $\text{sign}(F_0^E - F_0^W) = \text{sign}(f_0^E - f_0^W)$ . Hence  $\text{sign}(\Delta f_t) = \text{sign}(U_{fF}) \text{sign}(\Delta f_0)$ . Since we have empirical information on both consumption of familiar food at the time of the reunification  $\Delta f_0$ , and consumption of familiar food in a subsequent period  $\Delta f_t$ , we can infer the properties of reinforcement or satiation of past consumption experience with familiar food on current preferences. Using (37) and (38) we can compute changes in consumption:

$$\Delta n_{ts} = n_t - n_s = \alpha_{ts} + \beta_{ts} N_0 \quad (43)$$

$$\Delta f_{ts} = f_t - f_s = \kappa_{ts} + \phi_{ts} F_0 \quad (44)$$

where

$$\alpha_{ts} = \alpha_t - \alpha_s = -(\delta + \lambda_n)(e^{\lambda_n t} - e^{\lambda_n s}) N_{ss} > 0 \Leftrightarrow U_{nN} < 0$$

$$\beta_{ts} = \beta_t - \beta_s = (\delta + \lambda_n)(e^{\lambda_n t} - e^{\lambda_n s}) > 0 \Leftrightarrow U_{nN} < 0$$

$$\kappa_{ts} = \kappa_t - \kappa_s = -(\delta + \lambda_f)(e^{\lambda_f t} - e^{\lambda_f s}) F_{ss} > 0 \Leftrightarrow U_{fF} < 0$$

$$\phi_{ts} = \phi_t - \phi_s = (\delta + \lambda_f)(e^{\lambda_f t} - e^{\lambda_f s}) > 0 \Leftrightarrow U_{fF} < 0$$

Similarly to what we have found above,  $\beta_{ts}$  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  $\phi_{ts}$  and  $U_{fF}$ .

## Appendix D: Identification

This section discusses in more detail the different assumption necessary to interpret the estimated coefficients of the model in equation 20 as “causal.” After having adjusted the sample with a set of 15 socio-demographic, educational, and work-related variables, the coefficient  $\beta$  identifies differences between East and West Germans in terms of (A) consumption levels in 1991 and changes in consumption between 1988 and 1991, (B) body weight measures in 1991 and changes in body weight between 1988 and 1991, and (C) diet-related objective health measures in 1991.  $\psi$  informs us about the consumption and health dynamics between 1991 and 1998.

Since we use three cross-sectional data sets from 1991/1992, 1997/1998, and 2005 a strictly causal interpretation of  $\beta$  and  $\psi$  requires several assumptions. However, almost all assumptions are standard and well-established in the literature that uses 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; Rainer and Siedler, 2013; Brosig-Koch et al., 2011; Heineck and Süßmuth, 2013; Bursztyn, 2012; Burchardi and Hassan, 2013; Friehe and Mechtel, 2014).

One first assumption states that the division of Germany and the erection of the Berlin Wall were unexpected and quasi-random events that divided an otherwise united, and thus similar, population. In one part of divided Germany, the GDR—a socialist regime, established a centrally-planned economy with limited food variety. In the other part of divided Germany, the FRG—a western capitalist economy, offered a large variety of Western food products. The Berlin Wall divided the GDR and the FRG from 1961 until 1989 for 28 years. During that time, it was basically impossible to migrate to West Germany. The fall of the Wall on November 9, 1989 was as unexpected as its construction (see Section 3.1).

Second, after the fall of the Wall, from 1989 to 2004, it is estimated that 3.4 million mostly young and well-educated East Germans migrated to West Germany (Hunt, 2009). Although our oldest dataset was in the field shortly after the reunification, in 1991/1992, we cannot capture East Germans who migrated to West Germany between 1989 and 1991/1992, since the 1991/1992 questionnaire only refers to the *current* residency of the respondents. In the first year after the reunification, it is estimated that 400,000 East Germans migrated to West Germany (Hunt, 2009). This migration introduces measurement error that is likely to downward bias the estimates obtained with the 1991/1992 dataset (Wagner and Ziebarth, 2015). However, in the second and third dataset employed, we can clearly identify people who were socialized in the GDR, e.g., lived there before 1989.



Actually, the third dataset from 2005 is rich enough to disentangle long-term weight effects of an eastern socialization from East-West migration: Fifteen years after the fall of the Wall, it allows us to compare the BMIs of (i) East Germans living in West Germany with (ii) East Germans living in East Germany and (iii) West Germans who stayed in West Germany. While the two datasets from 1998 and 2005 allow us to study long-term effects of eastern socialization, they do not allow us to unambiguously trace changes in food consumption and diet-related health back to one single impact factor.

This is because the third necessary assumption for a *narrow* causal interpretation of the treatment “switch from life under socialism to capitalism” is that unobserved developments after the reunification in East Germany did not lead to changes in the dependent variables. Obviously, this is a bigger concern the larger the time gap between the fall of the Wall and the survey. For example, the unemployment rate in East Germany has been consistently about twice as large as West Germany (Sinn, 2002; Uhlig, 2006; Burda, 2006). While many of the food consumption categories represent low budget staple foods that are unlikely to be strongly confounded by unemployment, researchers have shown that unemployment affects health (Sullivan and von Wachter, 2009; Browning and Heinesen, 2012; Marcus, 2013). However, note that we adjust differences in the outcome variables with a rich set of socioeconomic controls, among them several (un)employment and educational measures as well as household income measures (see Tables B1 and B1 in the Appendix). In addition, even 10 or 15 years after the reunification, one could still interpret differences in consumption patterns and health between East and West Germans as an overall reduced form “intention-to-treat” effect that incorporates changes in unemployment or environmental conditions since these changes were all exogenously triggered by life under socialism and the reunification. However, this latter effect would then represent the combined overall impact of “life under socialism plus all post-reunification adaptation processes to capitalism” on food consumption and health. Note that we can empirically test whether these potential confounding factors are likely to severely confound our main message of the change in diet among East Germans due to novelty consumption. For example, we show below that unemployed and blue collar workers were *not* the ones who predominantly changed their diet and gained weight in East Germany after the reunification—the effect was mainly driven by white collar workers and the better off.

Finally, the core empirical analysis (and the model) cannot include thousands of specific measures of food quality and prices but incorporates changes in these two factors in a reduced-form manner by the variable  $EastGerman_i$ . It is obvious that food availability dramatically increased

overnight in the GDR. However, food quality and thousands of relative food prices also changed. One cannot comprehensively model the very complex simultaneous changes in quality, prices, and availability. However, one can interpret the observed change in consumption of selected food categories as an overall reduced form effect that normalizes the quality, price and availability change in the course of the reunification. This approach mirrors and links to our theoretical model in which we condensate all these economic development-related changes into one single specific price variable.

In the empirical model, to shut down as many potential confounding channels as possible, 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. We provide information on pre and post-reunification prices and consumption in Section 3.2. It is reasonable to assume that the quality of familiar food did not change significantly after the reunification. In addition, for most staple familiar food price effects are unlikely to play a major confounding role due to arguably inelastic demand (Hsieh et al., 2009). To anticipate the empirical results, except for boiled potatoes, the consumption pattern for all types of familiar are found to be extremely stable over time.

To sum up, the coefficient  $\beta$  measures differences in food consumption patterns, body mass, and objective diet-related health between East and West Germans right after the reunification. When the dependent variable elicits *changes* in consumption and body weight in 1991 (cf. Table B1),  $\beta$  can be interpreted as a DiD estimator that yields the short-term effect of a sharp exogenous economic development shock on consumption. It assesses the change in consumption for East Germans minus the change for West Germans over time. When employing the pooled 1991 and 1998 data, the interaction term  $\psi$  can also be thought of as a DiD model assessing the long-term effect of a sharp exogenous economic development shock on consumption. This longer-term adjustment is theoretically illustrated in Figure 1 and 2.

To the extent that the identification assumptions hold, the identified differences can be traced back to life under socialism vs. capitalism. One can interpret the exposure effect broadly and view all post-reunification events that also affected food consumption and diet-related health as the long-term effect of the division and subsequent reunification. Thus, the German example allows us to study the immediate and long-term effects of economic development—in the form an abrupt change from a communist to a capitalist economy—on food consumption and diet-related health measures. However, to be on the safe side, we interpret the long-term findings as strongly suggestive, instead of

strictly causal, and we primarily intend to show that the empirical facts are in line and rationalizable with our model predictions and theory of novelty consumption.