MOVEABLE FEASTS:
A NEW APPROACH TO ENDOGENIZING TASTES

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Abstract

We provide a new empirical approach to endogenizing tastes in consumer demand. We argue that tastes can be understood as the result of utility maximizing behavior in the past, whose properties can be used to partially endogenize tastes. As the old maximization problem depends critically on relative prices, we use old relative prices to endogenize tastes, overcoming many of the empirical criticisms of the taste formation literature while at the same time being consistent with a broad class of existing theoretical approaches to taste and preference formation. To test the empirical implications of our approach, we estimate the demand for food using unique household consumption and price data from the nineteenth century. We use contemporaneous relative prices and old relative prices from the home countries of immigrants measured fifteen years prior to our consumption survey. We first establish that the old relative prices are uncorrelated with the contemporaneous relative prices. We then find that older relative prices have a large and significant effect on the demand for food. On average, a one standard deviation in the old relative price changes the current food budgetshare by .2 standard deviations. We also provide suggestive evidence of persistence—the effect of old relative prices on demand persists more than 40 years later. We conclude by noting how our empirical strategy can be used to parameterize changes in tastes in both microeconomic and macroeconomic contexts.

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"Economists take statements of preferences as 'primitives.' That is, statements such as 'Mary prefers punk rock to country-and-western music' are taken as *meaningful*, as statements that require *no explanation*. The question 'Why does Mary prefer punk to country and western?' – interesting and important as it may be – is not treated in ordinary economic science."

-Eaton and Eaton [1998 p. 40; emphasis in original]

Neoclassical economic theory traditionally takes "tastes" as given and beyond the scope of economic analysis. Depending on the situation, this has been both a saving grace and Achilles heel for economists. It is a saving grace when we cannot explain differences in behavior between groups with prices, income, or wealth; an Achilles heel because everything not explained by prices, income, or wealth can be attributed to tastes. One drawback of this approach is that we lack general techniques which allow us to analyze taste formation and changes in tastes over time. Economists have long recognized this weakness, but many of the most prominent theoretical approaches appeal to special cases: analyzing long term trends in consumption, theories of addiction, the formation of habits, political preferences, or brand loyalty [Pollak 1970, Becker and Stigler 1977, Becker and Murphy 1988, Pollak and Wales 1992, Becker 1992, Alesina and Fuchs-Schudein 2007, Alesina and Giuliano 2009, Bronnenberg, Dube and Gentzkow 2010]. At the same time, economists have recently attempted to identify the mechanisms behind endogenous preferences [Postlewaite 1998, Tabellini 2008, Fernandez, Fogli and Olivetti 2004, Fernandez and Fogli 2006, Benjamin, Choi and Strickland 2009] and the welfare implications of taste differences [Atkin 2009].

Tastes must come from somewhere, and economic theory has never truly assumed that they should be wholly orthogonal to economic analysis. Attempting to overcome the weaknesses of previous theoretical approaches, research into preference formation has accelerated, giving us a number of new frameworks. These include cased based decisions [Gilboa and Schmeidler 1995, 1996, 1997, 2001], reference-dependent preferences [Koszegi and Rabin 2006, 2007, 2009], and consumption commitments [Chetty and Szeidl 2007, 2009]. These alternative models yield different predictions than traditional demand theory [Gul and Pesendorfer 2006, Mazar, Koszegi, and Ariely 2009], but can be generalized to cover a wide variety of cases. Despite their differences, each of these approaches share one common characteristic: they view preferences as a dynamic that is formed partially by economic factors. While theoretically important, the open question is how to bring this insight into the standard empirical apparatus in a general, tractable way.

We attempt to endogenize tastes empirically using a simple metric based on microeconomic principles. Our primary insight is that models of preference formation predict, to varying degrees, that present behavior will be a function of constraints faced in the past in addition to current constraints. The extension to traditional demand theory is straightforward—to the extent that old relative prices are key to old consumption maximization, old relative prices will predict current consumption. While it is certainly the case that differences in demand could be due to innate differences, we argue that the degree to which the old relative prices explain differences in current demand is a partial endogenization of tastes. Our general approach allows consumer affinity to form in a variety of ways—intrinsic differences in ability to consume (as in lactose intolerance), differences in resource endowments that lead to affinities and/or aversions to certain goods, endogenous production that depends on certain goods that are relatively inexpensive when first employed, or cultural signifiers of success and good fortune—without assuming that preferences are stable over time and/or identical for each consumer. Our approach to taste formation is not a critique of the neoclassical or contemporary approaches, but rather an attempt to extend the predictive and empirical power of those approaches to the questions of where preferences come from, how they change, and *measuring* those effects, which has been a long standing research agenda [Pollak 1970, Becker and Stigler 1977, Becker 1992, Postlewaite 1998, Chetty and Szeidl 2009, Mazar, Koszegi and Ariely 2009].

Our basic idea is intuitive—items that are cheap in the past will be consumed, and these goods will be consumed in the future to the extent that consumer's form an affinity for these goods. Goods not preferred in the past are not consumed at any price. Alternatively, high relative prices for a good may leave it desirable but outside of the budget constraint. If the budget constraint shifts out in the future, high relative prices in the past may be correlated with increased consumption today. While it would seem that sorting out these cases would be difficult, this intuition leads to a further prediction: *the current income elasticity should be positively correlated with the effect of the old relative price on demand*. Items that have large and positive income elasticities today (luxuries) should be items that were expensive but highly desirable in the past. Items that have low income elasticities (normal goods) will be items that were cheap in the past and consumed, partly, for that reason. Items that have large negative income elasticities (inferior goods) would be items consumers had no desire for in either past or present. That is, the old relative prices tells us *why*: why luxury goods are luxuries (as these items were desired in the past but outside of the budget set), why normal goods are normal (since they were cheap in the past they become staples whose budgetshares decrease with income), and why inferior goods are inferior (since these items were either expensive or cheap in the past but not desired at any price). In this way, our approach endogenizes tastes because it provides an economic rationale for the consumer demand patterns we see today.

Our primary empirical task, then, is to see if old relative prices affect current consumption independent of current prices. The data problems of such an exercise are not trivial. Prices exhibit a high degree of serial correlation, making it difficult to parse out the effects of old relative prices versus present relative prices. We turn to history to overcome this difficulty, analyzing the effect of current and old relative prices on demand using unique data on immigrants from the late nineteenth century. Immigrant households are particularly useful because of the large migratory flows in the late nineteenth and early twentieth centuries and the lack of globalization and biological innovations in food production at that time [Olmstead and Rhode 2008].[1] To strengthen our case we provide historical evidence that prices in the past largely reflected local resource endowments.

We concentrate on food demand since food consumption should be particularly sensitive to current prices and insensitive to older prices. This is most likely to be true for households who have high demand for food, and again history strengthens our approach. Previous work has shown that food demand was particularly high in the past [Logan 2006], and that historical households had greater calorie demand than the poorest households in developing countries today [Logan 2009].[2] Similarly, the mechanisms identified in the existing literature largely apply to durable, long-horizon or –lived decisions such as childbearing or political ideology, where prices are difficult to quantify. Food is certainly in the most generalizable class of goods. The fact that we use food also makes a traditional story of inter-temporal substitution or durable, "salient" goods unlikely [Simonshon 2006, Simonshon and Lowenstein 2006], especially over long time periods.

[1] Using immigrants to test consumption contemporaneous responses to changes in prices and income has a long tradition in economics [Staehle 1934, Haines 1989].

[2] Logan [2006] notes that households in the late nineteenth century had demand elasticities for food above 0.8.

Indeed, Becker [1996] has argued that the usual theoretical strategy of assuming that the main determinants of preferences are biological needs "may not be a bad approach for the very poorest countries, where families spend over half their income on food and another quarter on shelter" [p. 3]. Even the more recent approaches to taste formation take a dim view on finding effects for items such as food. In reference dependent preferences, the usual approach is to assume that agents cease to have reference dependent preferences once they face a large shock such as moving to a completely different environment [Koszegi and Rabin 2006, 2009, Chetty and Szeidl 2009]. In case based decisions the "cumulative utility" of previous decisions may be highly uncertain, such that a consumer will be unable to use previous decisions as a guide in the presence of such a shock [Gilboa and Schmeidler 1995, 1996, 1997, 2001]. As such, analyzing the empirical implications of our model for food demand in the past acts as a powerful test of our empirical approach to tastes and taste formation.

We use a late nineteenth century household survey of more than 3,000 immigrant households and retail prices that were collected at the time of the survey, in 1888. Our old relative prices are retail prices from the immigrants' home countries measured more than 15 years earlier. Both sets of prices were recorded by the same statistical agency, for the same goods and used the same methodology for measuring prices. Most importantly, these relative prices are appropriate for testing our model—the old and new relative prices are poorly correlated with one another, no correlation is above 0.1.

We find that the old relative prices are strong predictors of current food consumption. The demand for food among these immigrants was a function of relative prices that they faced in their country of origin more than 15 years prior. On average, a one standard deviation in the old relative prices changes the budgetshare for that food item by 0.2 standard deviations—a sizable effect. As predicted, we also find a strong correlation between the current income elasticity and the old relative price elasticity (from 0.65 to 0.80). We also provide evidence that the effects of old relative prices on demand for food persist for a surprisingly long time: using a consumption survey from 1917, we show that the old relative prices continue to exert a strong influence on demand more than 40 years later and, although substantially weaker, the correlation of the current income elasticity and old relative price elasticity remains positive. At a minimum, our results suggest that demand estimates could be biased by excluding this dimension of preferences from the specification. While our old relative prices are uncorrelated with the current prices, serial correlation in prices could lead to under or overestimates of demand responsiveness and biased estimates of welfare effects and behavioral responses. Parsing out the effects of old relative price changes could lead us to decompose tastes into economic and non-economic (innate) primitives. We view the potential of this decomposition as a promising development that could lead to improved welfare estimates and measuring preference change over time, both of which have a large number of implications.

I. The Intuition of Endogenized Tastes

Knowing more about preferences could potentially add more restrictions to the usual theoretical apparatus and increase its interpretive power. If people have a taste for *A* and not for *B*, and that preference relation is related to some economic variables of interest, then we have moved beyond the traditional assumption that tastes are given because we conjecture that they can be (partially) explained by some economic variables and therefore endogenized. The open question is to what degree these economic variables matter. In what follows we take the advice of Becker and Stigler [1977], who argued that researchers should look for "subtle forms that prices and incomes take in explaining differences among men and periods" rather than leave those differences up to primitives beyond economic explanation [p. 76]. Our goal is to see if tastes can be modeled (at least somewhat) as the outcome of previous optimizing behavior, which is similar to the insight provided by reference-dependent preferences, consumption commitments, and case-based decisions. If so, then we have found one route to empirically endogenizing tastes.

Our key insight that current demand should be conditioned on previous demand is certainly not new. The assumption of demand independence has not only been a matter of convenience but also practicality. It can be very difficult to empirically estimate such relationships and demand systems. As Becker has argued, however, this assumption can divert our attention away from important topics:

> "The assumption of independence [that choices today are not directly dependent on choices in the past] is not 'nonsense', for it usefully simplifies many problems that are not crucially affected by dependences over time. But the assumption has discouraged economists from grappling with other issues of considerable significance—including addictions, work habits, preference formation, why children support their elderly parents, preference solutions to the problem of future commitments, and the evolution and stability of institutions. " [Becker 1992, p. 327]

Becker is also critical of the instinct to explain anomalous results as "differences in preferences" when the traditional theory gives few tools to analyze why preferences would change. Our approach here is to discover if something as intuitive and well-studied as food demand also crucially depends on critical components of the demand system in the past. If so, the range of issues that require detailed focus on the time dimension would expand significantly.

We take as a starting point the idea the preferences can be understood as, partially, the product of rational choices. Differences in prices in the past may lead otherwise similar groups to choose different consumption bundles in the present. This idea is similar to the Becker-Stigler notion of consumption capital, but more flexible. Differences could be due to endowments, technology use, adaptation, or other primitives such as culture or genetics. The key is that these "tastes" develop and are maintained over a long period of time and are reinforced by the environment itself. For example, low levels of mobility and technological change throughout human history will cause people to face the same maximization problem in the same environment over and over again, giving rise to responses that are consistent with models of habits, reference dependence, or case based decisions.

Our goal also differs from that of Becker and Stigler [1977] in that we do not assume a long lived, stable preference relation, precisely because these have been difficult to estimate empirically. Crucial to their model was the idea that consumers purchase commodities and only indirectly consume market goods, so the price and income changes reflected both market and non-market changes. Similarly, our technique does not look at changes in consumption over time, only the demand at present as a function of the old maximization problem – the former relative prices. Our conceptual framework is a traditional "snap-shot" of a consumer's choice with the added idea that their tastes are themselves functions of economic variables faced in the distant past.

As we noted earlier, nearly all models of preference formation assume that behaviors are reference, case, or time dependent. The reasons for this dependence vary, but the end result is that present behavior is a function of past behavior and choices. We focus on that key similarity in our empirical approach, although we note that future research should delve deeper into empirical methods which would lead to distinct empirical predictions. We leave the technical details of our model, which takes a production function approach encouraged by Becker and

Stigler, to the next section. That section may be skipped without loss of continuity. Since the key insight does not require such derivations, we concentrate on the intuition below.

As an illustrative example, consider the preference for spices. Spices come from the endowment—one either lives in a place with a large endowment of spices or does not. Consider two types of consumers from two different parts of the world, those with a large spice endowment (*S*), and those without (*N*). Parts of the world that are not well endowed with spices will have high relative prices for spices. This would imply that recipes for *N*, to the extent that they form from the food environment, will use few spices while recipes for *S* consumers will contain more spices. *N* consumers would come to form an affinity with foods that lack spice, and will not have strong preferences for (nor much experience with) spice in their diets. *S* consumers, on the other hand, will eat foods that are relatively spicy and form an attachment to them, partially because they are abundant.

Now consider a situation where an *N* consumer moves to a new environment with a different endowment of spices, and therefore a different relative price of spices. Traditional demand theory would predict that the consumer would fully update their basket to reflect the new relative price structure. We assert that the original environment will govern, partially, the adjustment (or *lack* of adjustment) to the new relative prices. Thinking in terms of annual expenditures and a comparison of *S* and *N* consumption decisions, we consider three cases:

<u>Case 1:</u> Relative to *S* consumers, *N* will consume less spicy food because it was more expensive in the past, on average. This case is for normal goods, and is the most intuitive. We would predict that the old relative price of spices would have a negative effect on current consumption—the more expensive the good in the past the less that would be consumed in the present. In the current demand, we would expect spices to have a relatively low income elasticity for *N* households in keeping with it being a normal good for which they have little experience. In this way, the negative old price effect partially endogenizes the normality of this good—their consumption today is somewhat responsive to the now-lower price of the good.

<u>Case 2:</u> If *N* consumers had no demand for spices in the past, the higher relative price of spices would have been a further disincentive to consume them. This is the case for inferior goods. For goods that the consumer did not desire at any price, the old relative prices will have a strong and negative effect on demand, much larger than the effect in Case 1. Similarly, to the extent that the consumer still has no desire for the good in the new environment, the current income elasticity will be large and negative as well, larger than the effect in Case 1.[3] Such a situation could arise because of externalities involved in fully adjusting to the new prices. For example, to partake in spicy foods *N* households would have to change existing recipes, learn new cooking techniques, and generally alter the production process. There could also be biological processes at play—simply digesting spicy food may be more difficult for those without much experience. In this way, the large and negative old price effect partially endogenizes the inferiority of this good—the large negative effect implies that the consumer had little desire for this good at any price, which is confirmed by the large and negative current income elasticity.

Case 3: If *N* consumers desired spices it could be the case that the high relative price of spices in the past caused it to be above the marginal rate of substitution and therefore consumed in very low quantities (if at all). We note that some goods that fall into this category may be desired for what they represent—items that signal wealth and prosperity are likely to be desired but expensive. If in the new environment the relative price of spices declined significantly, the effect of the old relative price of spices may in fact be positive to the extent that high prices for this desired good could lead to increased consumption of that good once the budget constraint shifts out—the definition of a luxury item. We stress that intertemporal substitution could explain this result over very short periods of time, but not the extended time period we consider (15 years) for an item such as food. The key here is that, between households, the luxurious item's consumption is increased most for those who could least afford it in the past (*N* relative to *S* in this example), exactly those consumers who faced the higher relative prices of the good, *ceteris paribus*. Put another way, the households most denied the good in the past will increase their consumption the most. Similarly, we would expect that the income elasticity of these goods would be the least negative or even positive, owning to the items luxury status. In this sense, we see that the high relative price in the past partially explains the items current luxury status today for the consumer, partially endogenizing the effect.

Our three cases lead to an additional empirical implication: the current income elasticity and the effect of the old relative prices should be positively correlated with one another. The

[3] While estimating a simple demand system would seem to imply that the effects should be zero, this would be artificially due to the censoring of the data. Indeed, the development of the Tobit model [Tobin 1958] was designed to uncover the demand parameters for goods when their recorded expenditures were truncated, especially for households with low income.

income elasticity and old price effects should be large and negative for inferior goods, small and negative for normal goods, and perhaps positive for luxury goods, giving us a positive correlation between the two overall. This is intuitive—if the income elasticity tells us which goods are inferior, normal, and luxurious and the relative prices rationalize those distinctions, the two should be strongly related to one another. We view this implication as an additional check which we can bring to the data to test our empirical approach to taste formation.

We stress that our approach is, at best, a partial endogenization. There is certainly likely to be an innate component of preferences beyond the reach of theory. Our main contribution here is to think, intuitively, about the ways that former or conditioning economic parameters shape the preferences that people have. Our approach takes account of the fact that differences in these older relative prices will have effects on current demand that we usually contribute to tastes but which should properly be attributed to these predetermined economic variables. For example, consumers may have different innate preferences, but if the relative prices that they faced in the past were different as well part of the consumption differences would be due to the differences in these former relative prices and not innate differences.

II. A Production Function Model of Tastes

Below, we sketch out simple models which yield the key prediction that the effect of old relative prices on demand may be either positive or negative. Rather than construct a model consistent with a variant of the taste formation literature, we use a simple production-function approach as argued by Becker and Stigler [1977] to show that the effect of old relative prices on demand can be either positive or negative.

a. Induced Innovation

We can begin to think about taste formation within the context of an induced innovation model of a household production process. Suppose a household combines consumption items, q_i, in a CES production process to produce utility as follows:

$U=(\sum_i(A_iq_i)^{\rho})^{1/\rho}$

where A_i is the augmentation coefficient of q_i and ρ is related to the elasticity of substitution $\sigma= 1/(1-\rho)$ and lies in the range $-\infty<\rho<1$.

The augmentation coefficient, A_i, captures how effectively input q_i generates utility.

$\partial U/\partial A_i = A_i^{\rho-1} q_i^{\rho} (\sum_i(A_iq_i)^{\rho})^{(1-\rho)/\rho}= q_i ((A_iq_i)^{\rho}/\sum_i(A_iq_i)^{\rho})^{(\rho-1)/\rho} >0.$

We can think of the A_i as recipes associated with the different inputs. Just as increasing an input lead to diminishing marginal utility, so does increasing the augmentation coefficients:

$\partial^2U/\partial^2A_i = ((1-\rho)A_i^{\rho-2}q_i^{\rho}(\sum_i(A_iq_i)^{\rho})^{(1-\rho)/\rho})(-1+(A_i q_i)^{\rho}/\sum_i(A_iq_i)^{\rho})\leq 0$

because each of the terms in the first parenthesis is positive and $1\geq(A_iq_i)^{\rho}/\sum_i(A_iq_i)^{\rho}$.

In an induced innovation model, the household can trade-off investing (learning) to increase the augmentation coefficients of different inputs. There exists different ways of formulating the trade-offs. A simple approach is to specify a positive cost of increasing A_i.

For the moment, let us focus on the static household optimization problem holding A_i constant. At prices P_i, the optimum ratio of q_j to q_k is:

$q_j/q_k=(P_j/P_k)^{1/(\rho-1)}(A_j/A_k)^{\rho/(1-\rho)}$.

Given $\rho<1$, $\partial(q_j/q_k)/\partial(P_j/P_k)<0$. The relative input quantities move inversely with the relative prices. But how the input ratio varies with the augmentation coefficients is more complicated. That is, $\partial(q_j/q_k)/\partial A_j/A_k)$ depends on the sign of ρ (and thus on the elasticity of substitution, σ).

If $0<\rho<1$, $\partial(q_j/q_k)/\partial(A_j/A_k)>0$.

That is, when ρ is positive, the elasticity of substitution is high; an increase in the augmentation coefficient of one input leads the household to *use* more of that input.

If $\rho<0$, $\partial(q_j/q_k)/\partial(A_j/A_k)<0$.

That is, when ρ is negative, the elasticity of substitution is low; an increase in the augmentation coefficient of one input leads the household to *save* that input. It is also informative to examine the relationships for budget shares. Let $S_j=P_jq_j/\sum_i(A_iq_i)$. Then, at prices P_i, the optimum combination yields $S_j/S_k=P_jq_j/P_kq_k=(P_j/P_k)^{\rho/(\rho-1)}(A_j/A_k)^{\rho/(1-\rho)}$.

The relationship between budget shares and the augmentation ratio depends on the sign of ρ. But so does the relationship between budget shares and the price ratio. And they move in exactly opposite ways.

If $0<\rho<1$, $\partial(S_j/S_k)/\partial(P_j/P_k)<0$ and $\partial(S_j/S_k)/\partial(A_j/A_k)>0$.

If $\rho<0$, $\partial(S_j/S_k)/\partial(P_j/P_k)>0$ and $\partial(S_j/S_k)/\partial(A_j/A_k)<0$.

For what follows, it will be useful to consider the dual formulation. If M is total consumption expenditure, the indirect utility function at prices, P_i, is:

$V=M(\sum_i(A_i/P_i)^{\rho/(1-\rho)})^{(1-\rho)/\rho}$.

$\partial V/\partial A_i = M P_i^{-\rho/(1-\rho)}A_i^{(2\rho-1)/(1-\rho)}(\sum_i(A_i/P_i)^{\rho/(1-\rho)})^{(1-2\rho)/\rho}>0$.

$\partial^2V/\partial^2A_i=M(2\rho-1)(1-\rho)^{-1}P_i^{-\rho/(1-\rho)}A_i^{(3\rho-2)/(1-\rho)}(\sum_i(A_i/P_i)^{\rho/(1-\rho)})^{(1-2\rho)/\rho}$

$*(1-(A_i/P_i)^{\rho/(1-\rho)}/\sum_i(A_i/P_i)^{\rho/(1-\rho)})$

Because $1>(A_i/P_i)^{\rho/(1-\rho)}/\sum_i(A_i/P_i)^{\rho/(1-\rho)},$

$\partial^2V/\partial^2A_i<0$ if $\rho<1/2$ and $\partial^2V/\partial^2A_i>0$ if $1/2<\rho<1$.

If $1/2<\rho<1$ or equivalently $\sigma<2$, the SOC condition will not be satisfied. Investing in augmenting the input with the highest (A_i/P_i) will yield the highest payoff.

Now consider an inter-temporal utility maximization problem where it is possible to devote some of the income, Y, to increase A_i. A motivating example would be to buy additional recipes to utilize the specific input q_i better. At time t, the current stock will be $A_{t,i}$ and it can be increased $\Delta A_{t,i}$ via an investment process involving instantaneous costs:

$C(\sum_i \Delta A_{t,i})$ where $C'>0$ and $C''>0$.

Denote $c=C'(0)>0$. The assumption that the investment costs are positive and convex captures the idea that changes to the augmentation coefficients will occur only gradually.

The household can choose to divide its income, Y_t, between current consumption, M_t, and investing $C(\sum_i \Delta A_{t,i})$ to increase the augmentation coefficients permanently. That is, its budget constraint is:

$Y_t=M_t-C(\sum_i \Delta A_{t,i})$.

For fixed prices, P_{0i}, the household's maximization problem is

$L=\sum_{t=0}(1/(1+r))^t M_t(\sum_i(A_{t,i}/P_{0i})^{\rho/(1-\rho)})^{(1-\rho)/\rho}$

subject to:

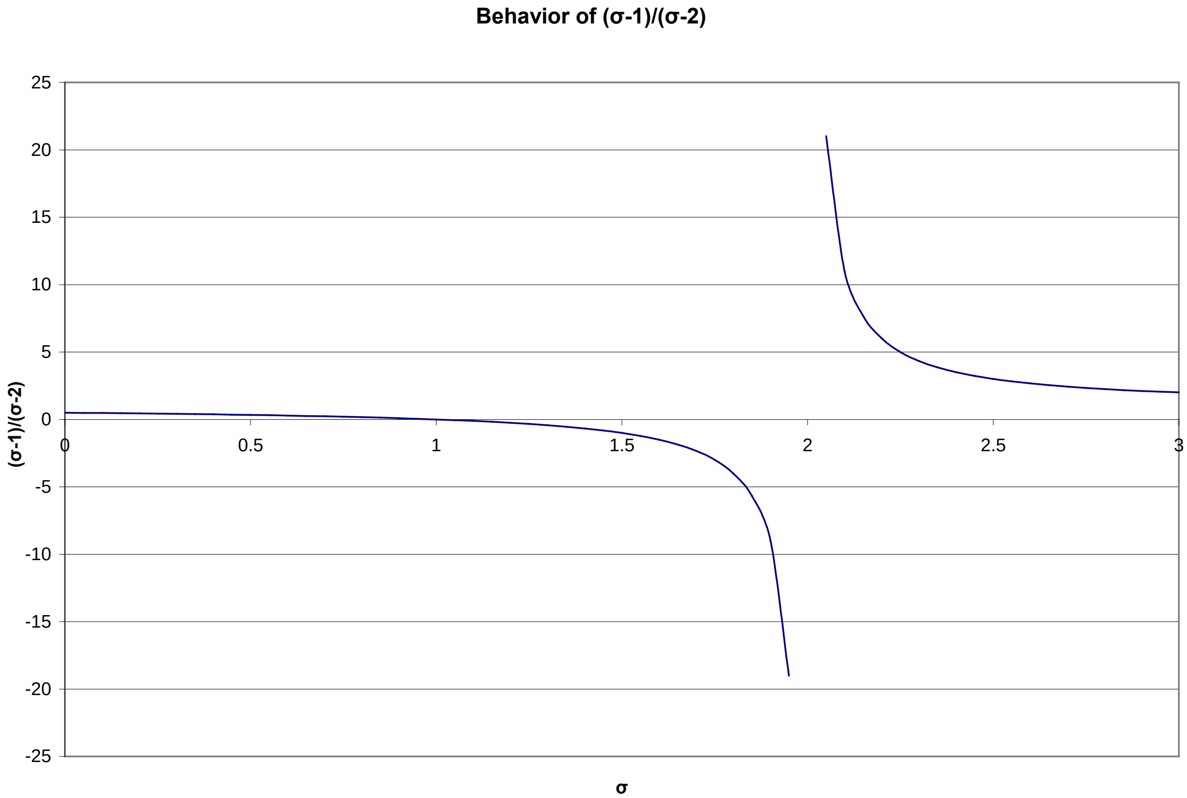
$Y_t=M_t-C(\sum_i \Delta A_{t,i})$ and $A_{t+1,i}=A_{t,i}+\Delta A_{t,i}$.

In this formulation, if $\rho<1/2$, the optimal investment in ΔA_i will involve setting:

$\partial V/\partial A_{t,j}=\partial V/\partial A_{t,k}$.

This implies along any steady state path for $\rho<1/2$:

$A_{t,j}/A_{t,k}=(P_{0,j}/P_{0,k})^{\rho/(2\rho-1)}=(P_{0,j}/P_{0,k})^{(\sigma-1)/(\sigma-2)}$.



The exponent $(\sigma-1)/(\sigma-2)$ is positive if $\sigma<1$, implying a higher relative price leads to a higher augmentation ratio. It becomes negative, implying a higher relative price leads to a lower augmentation ratio, if $1<\sigma<2$. (For $\sigma>2$, the SOC of the problem is not satisfied.) The change in behavior at $\sigma=1$ (i.e. the Cobb-Douglas case where it is not possible to distinguish between augmentation coefficients) is expected and well-understood. The singularity at $\sigma=2$ is more surprising. But note that other studies allowing investment in augmentation coefficients (such as Acemoglu 2004) also find $\sigma=2$ is a critical value for unusual behavior. The intuition for the difficulties is that if $\sigma>2$, the relative quantities change more than proportionally to the relative rates of augmentation. The present model admits a range of behavior in the effect of relative prices on relative augmentation coefficients.

Let us now apply our approach to the case of an immigrant moving from sending economy with prices, $P_{S,i}$ to a receiving economy with prices, $P_{R,i}$. If $P_{S,i}$ reflect long-standing relative scarcities in the sending countries, it is reasonable that the consumer/immigrant will have invested over the long-run in augmentation coefficients to adjust to relative prices, $P_{S,j}/P_{S,k}$. Thus, the consumer/immigrant initial demand function in the receiving country will be: $q_j/q_k=(P_{R,j}/P_{R,k})^{-\sigma}(P_{S,j}/P_{S,k})^{(\sigma-1)(\sigma-1)/(\sigma-2)}$.

The relative shares will be:

$S_j/S_k=(P_{R,j}/P_{R,k})^{1-\sigma}(P_{S,j}/P_{S,k})^{(\sigma-1)(\sigma-1)/(\sigma-2)}$.

That is, both relative demand and shares will be functions of both the current, receiving country prices and the old, sending country prices. So long as $\sigma<2$, the dynamic process is well-behaved and the model predicts *higher relative prices in the old country will lead to lower consumption in the receiving country.*

b. Learning by Doing

As an alternative to modeling the consumer as being able to consciously choosing to increase in Ai, one may consider a process of learning by doing. In this habit-formation variant, Ai may costlessly increase with qi. In a rational addiction version of this model, the consumer is aware to this relationship and takes the future effects into account in making their current choices. As in the form:

$\Delta A_{t,i}. = L(q_{t,i})$ where $L'>0$.

(In a rational addiction version of this model, the consumer is aware to this relationship and takes the future effects into account in making their current choices.) On the steady-state path with prices, P_0,

$A_{t,j}/A_{t,k} = q_{t,j}/q_{t,k}$, which implies $A_{t,j}/A_{t,k} = (P_{0,j}/ P_{0,k})^{1/(2\rho-1)} = (P_{0,j}/ P_{0,k})^{\sigma/(\sigma-2)}$.

This differs from the induced innovation case because the exponent is $\sigma/(\sigma-2)$ rather than $(\sigma-1)/(\sigma-2)$ as before. As in the induced innovation case, for $\sigma>2$, the learning-by-doing model generates unusual behavior. We will suppress its consideration for the moment.

If a consumer/immigrant with preferences defined above moves from a sending county with prices, P_S, to a receiving country with prices, P_R, the initial demand function will be:

$q_j/q_k=(P_{R,j}/P_{R,k})^{-\sigma}(P_{S,j}/P_{S,k})^{\sigma(\sigma-1)/(\sigma-2)}$.

The relative shares will be:

$S_j/S_k=(P_{R,j}/P_{R,k})^{1-\sigma}(P_{S,j}/P_{S,k})^{\sigma(\sigma-1)/(\sigma-2)}$.

The learning-by-doing model admits the possibility of either a positive or negative relationship between past relative prices and current consumption.

A difficulty with the learning-by-doing case is that it can be difficult to predict the sign of the effect of old prices. The learning-by-doing approach allow for the previous prices to have positive or negative effects, and it is easy to imagine situations where a consumer who was previously denied a particular action due to the budget constraint may actually partake in that action in the present.

III. The Power of Tastes

In this section we briefly document the failure of prices and income to explain a significant portion of the variation in consumer demand and present evidence to show that historical food prices reflected local environments. First, we estimate a standard demand system and find that prices, income, and household demographics explain roughly 40% of the variation in demand. When we add nationality to the specification, which is usually considered a control for differences in tastes between groups, we find that nationality alone explains approximately 40% of the differences in demand. We explain just as much of the variation in demand with economic measures as with measures that are proxies for preferences. Second, we show that food prices in the past are closely aligned with our view of exogenous differences in resource environments. We highlight the large literature in agricultural history which shows that until very recently, food prices largely reflected local conditions, key to our assumption that prices reflect stable environments in which tastes form.

a. Evidence from the British Board of Trade

To consider the magnitude of the empirical implications of the traditional approach, we use evidence from the British Board of Trade (BBT), which conducted a study of the consumption of American wage-earning families of various nationalities by income class in industrial cities February 1909. [4] We use this independent historical data to foreshadow our use of historical data on immigrants to the United States in the late nineteenth century. [5]

One reason for choosing the BBT study as independent evidence is that, like many studies at the time, the BBT study was explicitly concerned with differences in consumption

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[4] The cities included New York City, NY; Boston, MA; Brockton, MA; Fall River, MA; Lawrence, MA; Lowell, LA; Providence, RI; Baltimore, MD; Newark, NJ; Paterson, NJ; Philadelphia, PA; Cincinnati, OH; Cleveland, OH; Detroit, MI; Louisville, KY; Muncie, IN; Pittsburgh, PA; Chicago, IL; Duluth, MN; Milwaukee, WI; Minneapolis-St. Paul, MN; St. Louis, MO; Atlanta, GA; Augusta, GA; Birmingham, AL; Memphis, TN; New Orleans, LA; and Savannah, GA. Each of these locations was on or to the east of the Mississippi river.

[5] Great Britain, Board of Trade, *Cost of living in American towns. Report of an enquiry by the Board of Trade into working class rents, housing and retail prices, together with the rates of wages in certain occupations in the principal industrial towns of the United States of America.* With an introductory memorandum and a comparison of conditions in the United States and the United Kingdom, London, Pub. by H.M. Stationery off., printed by Darling and son, limited, 191, p. xxxix.

between ethnic and racial groups.[6] Researchers continue to find large consumption differences by race and ethnicity that cannot be explained by prices and income today [Charles, Hurst and Roussanov 2009]. But in a very important way they show the persistence of neoclassical economic thought—these studies take preferences as given.

The BBT study collected budget data for 7,616 families classified into seven "nationalities" based on the declaration of the husband.[7] A breakdown of the sample by nationality is reported in Table 1.[8] The BBT study reported expenditures for nationality-by-income categories, not for individual families. For each nationality, the tables are subdivided into 8 weekly families' income categories. Associated information includes size of household and total expenditures. The tables show expenditures and quantity purchased of about 40 food items. By dividing expenditures by quantities, one can derive implicit prices (which represent an average across the cities in the sample). By combining the averages by income we can estimate a traditional demand system for food groups. We use this data because its aggregated nature allows us to look at the role of income versus nationality in explaining differences in group consumption patterns while minimizing idiosyncratic differences in consumption.

We regress the expenditure share for these foods items on prices, income and family size. This is shown in Panel A of Table 2. Prices and income do explain some of the variation in demand for these food items. When we add nationality to the regressions in Panel B of Table 2, the fit of the regressions improves dramatically, however. The R-squares go from below 0.3 on average to above 0.8 on average once nationality is included. In the traditional interpretation of demand, the addition of nationality (or race) are controls that proxy for preferences. But from this simple example we see that we prices and income do not explain the vast majority of

[6] Early studies of consumer behavior are rife with ethnic stereotypes about consumption. Italians were undernourished because they favored "an excess of fuel in the forms of wheat flour, pork, lard, and second-rate vegetables," and Italian "cooking is indefensibly uneconomical… too much fuel and too little protein" [Streightoff 1911, p. 94]. Another observer noted "the Italians' well known dependence on macaroni and dried beans" [Chapin 1909, p. 124]. Unlike Italians, Slavs were malnourished because they had high marginal propensities to save, and valued a saved dollar over a full stomach [Byington 1910]. The list covers almost every ethnic group-- Russians and Austrian Jews consumed more meat than other ethnic groups, Germans and the Irish spent the most on alcohol [Chapin 1909].

[7] In the terminology of the study, these "nationalities" were: (1) American-British families (included (British) American, Irish, English, Scottish, Welsh, and Canadian) who were subdivided between Northern, Southern US, and Southern US "broken" families; (2) German (including Dutch, Belgian, and Swiss); (3) Scandinavian (including Swedes, Norwegians, and Danes); (4) Southern European (Italians, Greeks, Spaniards, and Portuguese as well as a "few French and Syrians"); (5) Slavonic and "allied" peoples (Bohemians, Croats, Hungarians, Galicians, Poles, Lithuanians, Russians, Roumanians, and Serbs); (6) Jewish (from all countries but chiefly Russia); (7) Negroes (African Americans), who were subdivided between Northern and Southern US.

[8] For further studies in a similar vein see Staehle [1934].

variation in demand between ethnic groups. On average, ethnicity explains more than half of the variation in food demand.[9] Even more, nationality as a proxy for tastes does not easily lend itself to economic interpretation—nationality tells us very little about *why* there would be substantial differences in tastes between groups, especially after controlling for prices and income.

b. The Case for Using Historical Food Prices

A key insight in our approach is that old relative prices are related to the environments in which tastes form. We also implicitly argue that tastes and the environment are relatively slow to change. As such, it is important that the prices we look at reflect those resource environments and not something else. There is broad agreement among agricultural historians that agricultural production was relatively stagnant until recently. As Johnson [1997] notes, the development of agriculture as a scientific field began only in the middle of the 19th century and the resulting increases in agricultural productivity are recent as well. Before the advances of modern agricultural science most increases in output were achieved through the cultivation of more land or the greater intensity of cultivation, such as shorter fallow periods [Boserup 1965]. Some agricultural historians have claimed that medieval-level agricultural practices and yields persisted into the 18th and 19th centuries for staple crops [Karakacili 2004, Gimpel 1977], although new crops such as potatoes were added during the 16th and 17th centuries in the West [Nunn and Qian 2009]. While much has been made of labor savings in agriculture which led to the development of more and larger cities, there was little increased productivity of the land itself. Output per land unit only began to improve at the very end of the 19th century [Johnson 1997], and for the majority of crops not until the 20th century [Olmstead and Rhode 2008]. The general history of agricultural developments has long noted that yields per unit of land were relatively stable throughout the world [Federico 2005]. This distinction is important in that land productivity is the key for a stable resource environment, while fewer labor inputs were needed to harvest crops, the land gave the same crop size.

The changes in technology and the diffusion of technology in agriculture which led to large increases in output per unit of land are decidedly a 20th century phenomena, and the

[9] When we regress the budget share on nationality alone the R-squares range from 0.34 to 0.92, with an average R-squared of 0.61.

individual histories of wheat, corn, and other crops bear this out.[10] This production extended to non-food agricultural products, including tobacco and cotton, whose increased land productivity is also well documented [Olmstead and Rhode 2008, Federico 2005]. The innovations led to crops that were resistant to drought, pesticides, rusts, rot and other environmental hazards, increasing land productivity dramatically. For example, wheat production per acre, stagnant from the early 19th century to the 1930s, doubled between 1940 and 1960. Corn productivity increased nearly three-fold from 1935 to 1970, whereas it had also been stagnant since at least the early 19th century.

The increase in land productivity had positive spillovers to the animal sector, which was also undergoing biological innovations in animal husbandry and feeding. Large increases in the quantity and quality of cows, cattle, hogs, sheep, and chicken were a direct result (as were the increases in beef, pork, and chicken available to consumers). For example, the number of cows per bull grew from a steady-state of 2.5 per bull in the nineteenth century to more than 4 per bull during the mid-twentieth century; milk yield per dairy cow increased nearly 25% between 1890 and 1920; the number of hogs on farms increased nearly 20% between 1880 and 1920 [Olmstead and Rhode 2008]. This positive feedback loop has been properly regarded as a stunning achievement of modern science.

The diffusion of these new technologies altered agriculture in fundamental ways throughout the world [Griliches 1960, Farrell 1977]. Olmstead and Rhode [2008] note that these innovations were duplicated by those on the technological frontier—knowledge of innovations spread quickly to other developed nations. Similarly, Frederico [2005] documents the rapid increase in agricultural trade in the early 20th century—the growth of trade in agricultural goods outpaced the growth of trade in nonagricultural goods until 1950. This explosion of technological, biological, and economic change has altered the food environment, so much so that many of the foods eaten today are not consumed in their country of origin and diets and prices reflect not local environments, but global food production and distribution. Combining this with restrictive trade policies and government subsidization of agricultural production, it is difficult to argue that food prices today primarily reflect resource as opposed to the combination of environment, technological sophistication in agriculture, trade, and subsidies. Since a key

[10] See Olmstead and Rhode [2008] and Federico [2005] for the particular literatures on each crop.

idea is that these tastes form as a function of the resource environment and that the environment is relatively stable over time, we view historical prices for food as a better indicator.[11]

IV. Data

a. Consumption Data

We use the "Cost of Living of Industrial Workers in the United States and Europe 1888-1890" survey published by the United States Department of Labor. The study was conducted under the direction of Carroll D. Wright, then the U.S. Commissioner of Labor. When Wright was appointed the U.S. Commissioner of Labor in 1885 one of his goals was to conduct the first national expenditure survey. The findings of the 1888CEX, as well as studies of the costs of production, would inform the Congressional debate on the McKinley Tariff and were used for cost of living indices [Stapleford 2009]. This historical coincidence leaves us with a household survey that is broad in its scope, large in size, rich in detail, and allows us to test the predictions of our model.

The 1888CEX data set contains a sample of 8,544 families working in iron, steel, coal, textile, and glass industries in both Western Europe and the United States. Nearly 80% of the sample, 6,809 households, is from the United States. For the American households surveyed, enumerators from the Department of Labor were sent to firms in the nine selected industries and collected information on the costs of production and the standard of living of the workers in the firms surveyed for costs of production. As Haines [1979, 1989] notes, how the household sample was chosen remains unclear. The report notes that it attempted to obtain information on a representative number of employees at each firm surveyed, although it is not known in what ways the employees were deemed to be representative. These selected households were surveyed about their annual expenditures on various items, and the annual income of the household head was obtained from the employer. Despite these potentially limiting features, Haines [1979] notes that, in comparison to the age distributions of the household head for each industry in the Census of 1890 that "the broad similarities were more striking than the differences, and the case for the representativeness of the survey is strengthened [by the comparison]" (pp. 294-295).

[11] We provide suggestive evidence for this assertion when we discuss the price data.

Modell [1978] posits that Wright used a quota system to obtain his representative sample in the 1888CEX, meaning that Wright wanted the household survey to reflect the size of the various firms where the workers were employed. This would mean that families headed by a worker employed in a large industrial firm would be more prevalent in the 1888CEX than families whose heads were employed by small industrial firms.[12] Modell further notes that the usual banes of household surveys, age-heaping and dollar-heaping are not prevalent in the 188CEX. In inspecting the budgets he finds that budgets are "careful documents, filled out with sufficient care to give one confidence in the outline they reveal" (p.208).

The data set contains detailed annual expenditure information for both food and non-food items and annual income information for all members of the household (father, mother, and children). Annual rent from boarders is also included in the data. In addition, the data also contains demographic information on the household's age and sex composition, as well as a detailed enumeration of the husband's occupation and nationality if not from the United States. These households form the sample that we use in the following empirical work.

Table 3 shows the summary statistics for our household survey, both for the entire American sample and for the households who have a nativity other than the United States. There are relatively few differences between the native and immigrant subsamples. For example, immigrant household heads (and their wives) are four years older than native household heads, immigrants have .5 more persons in their household, and immigrant children provide more income to the household. Overall, however, there are more similarities between natives and immigrants on most measures.

b. Price Data

We use the report by the United States Senate Committee on Finance, entitled "Retail Prices and Wages: A Report by Mr. Aldrich" [1892] to estimate the contemporaneous relative prices of food items. The Aldrich report lists the retail quantity prices of various foods for a sample of stores in each state from June, 1889 to September, 1891.[13] For each state we take the annual average price of each food item from June, 1889 to May, 1890. For the former relative prices, we use the report "Labor in Europe and America: A Special Report on the Rates of

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[12] This would mean that Wright's definition of representative would mean that the sample was weighted to reflect the firms that were surveyed.

[13] Indeed, more states are included in this report, and price estimates for all states surveyed in the Aldrich Report are available from the authors. In the rare instance in which a good's price was not available for a specific state, we took the simple average of the two nearest states' prices. See Logan [2006] and Stapleford [2009] for further details.

Wages, The Cost of Subsistence, and the Condition of the Working Classes in Great Britain, France, Belgium, Germany, and Other Countries of Europe," which was published in 1875 by Edward Young, Chief of the US Bureau of Statistics. The report list the retail prices of subsistence items from England, Ireland, Scotland, Wales, France, Belgium, Bohemia, Austria, Switzerland, Italy, Sweden, Denmark, Russia, and Canada. The general methodology for obtaining these relative prices is the same as those in the Aldrich Report—actual retail prices in stores in particular cities, which are listed in the report. Table 4 lists the food items for which we have retail prices in the past and present, listing the specific name of the food item and the years the prices were collected in each country. Table 4 also shows the geographic distribution of the immigrant sample of the 1888CEX. Other than food items, the only one other item that was consistently listed in both the Aldrich and Young reports was the price of a pair of "men's heavy boots." As such, all relative prices that we calculate are relative to the price of "men's heavy boots" in that specific location and year.

We use the prices from the Young and Aldrich reports for several reasons. First, both reports used the same methodology of obtaining prices and use the same categories of goods. Second, the prices reported in both studies are retail prices, allowing us to overcome the objections of using wholesale prices, which may differ from retail prices systematically by country. Third, we avoid the use of prices published in local newspapers as those items are likely to be sale items and may not reflect the average price for that good. It is also difficult to obtain consistent advertised prices for all of the countries and goods that use in this study.

V. Empirical Strategy

We use a standard Almost Ideal Demand System (AIDS) to estimate the effects of old and new relative prices on demand. In the AIDS the Engel curve is a function of income, prices, and other controls such that

(1)
$$w = \alpha + \beta \ln\left(\frac{x_i}{n_i}\right) + \delta P_{OLD_i} + \lambda P_{NEW_i} + \Theta Z_i + \varepsilon_i$$

where w is the budget share, P are the relative prices, and Z is a vector of controls for household size, composition, and occupation. Since the prices themselves are not well correlated with one another this regression will capture the effect of old relative prices on current demand. Since the regularity conditions of the traditional demand system have been independently verified by

Haines [1989] and Costa [2001] for the 1888CEX, we focus on the effects of the old relative prices on demand.[14]

VI. Empirical Results

a. The Correlation of Old and New Relative Prices

Key for our empirical strategy is the lack of a correlation of the old and current relative prices—colinearity between the two make it difficult to identify the effects of either. Panel A of Table 5 shows the correlations of the old and new relative prices. As the Panel shows, the current and former relative prices are not well correlated with one another. In only one instance is the correlation greater than 0.10, and no correlation is above 0.15. Of the thirteen food items for which we have relative price comparisons, eight have a negative correlation between the old and new relative prices, although these correlations are not strong either. When we regress the old relative prices on the new to see how strongly the new relative prices predict the old the relationship is slight.[15] The overall fit from the models is quite poor, and the point estimates show that increases in the new relative prices are met just as often with decreases in the relative prices as with increases. Beyond this, the size of the coefficients suggests a weak economic relationship between the old and new relative prices.

We also report the relative standard errors (the standard error of the old price divided by the standard error of the new price) in Panel A. Earlier, we argued that prices should reflect local environments, and that this would be more likely to hold for historical prices. While there are certainly environmental differences within the United States, intranational trade (for the US, interstate trade) is much more feasible than its international counterpart, both then and now. Indeed, the prices that we use should certainly reflect the scope of intranational food trade. While there should still be price remaining variability reflecting local environments in the US, overall price variability should be lower within the US than between European countries. This is in keeping with our criterion that prices reflect the environment, which for practical purposes we define as international borders as they existed at the time. The relative standard errors suggest much greater variability in the European food prices than in the state food prices in the United

[14] Note that since we use the budget share as the dependent variable the price effects need not be negative for the demand curve to be downward sloping, although they must be less than unity.
[15] See the appendix for the results.

States. In every instance, the European prices exhibit more variability than the American prices, usually several orders of magnitude more.

In Panel B of Table 5 we report the correlation matrix for the old relative prices. Our conjecture would be that since the prices are coming from Europe they should be fairly well correlated with one another, or at least better correlated than with the American prices fifteen years later. The Panel shows this to be the case. Overall, the prices of food items within Europe are fairly well correlated, but the individual prices between food groups are not as well correlated. For example, eggs are generally negatively correlated with the prices of other food items. Also the correlation of meats such as pork and beef with items such as fish and tea is quite low. Overall, the correlation matrix shows heterogeneity in the cross-correlations of the prices which is useful for our empirical strategy.

One drawback is that prices are derived from geography. We cannot use geographic controls in our estimates of demand because they are perfectly correlated with prices. This holds, however, for any demand estimates that use prices since market prices apply to locations. Prices should be functions of the local environment, and goods that must be imported should be relatively more expensive and therefore have higher relative prices than others. In some ways, the derivation from geography works to our disadvantage—we are supposing a relationship with old relative prices that is much more sensitive than dichotomous indicators for location, and therefore it is less likely that we will find significant effects of old relative prices on demand. Geography captures some of the taste formation because it is a proxy for the environment in which these taste are formed. But the key is that these prices can vary for locations that are close or far from one another. For example, while two areas may be similarly endowed with one food item, they may be very different for another. Relative prices will reflect this difference, while dichotomous indicators for location will not.

b. Empirical Estimates of Endogenized Tastes

Table 6 shows the results of the regression of the food item's budget share on the old and new relative prices. As the results show, the effect of old relative prices on current demand is statistically significant for nine of the thirteen foods for which we can estimate demand. In the majority of instances where the old relative price has a statistically significant impact on current consumption, the effect is negative, suggesting that high relative prices in the past lead to lower consumption in the present. For sugar, a one standard deviation increase in the old relative price would decrease the sugarshare by 0.28 standard deviations, a sizable effect. For pork, the effect is 0.27 standard deviations, also a sizeable effect. We obtain smaller, but similar effects for coffee (0.084 standard deviations), milk (0.16), and potatoes (0.029). Also of note is that fact that the income elasticities for these foods is generally low and negative, ranging from -0.015 for sugar to -0.006 for milk.

The old relative prices of eggs and beef, however, are strongly correlated with increased current consumption. For beef, a one standard deviation increase in the old relative price would increase the beefshare by 0.26 standard deviations, once again a sizable effect. For eggs, the effect is 0.09 standard deviations. Old relative prices for rice and tea have marginally significant positive effects on current consumption with much larger effects on budgetshares (7.59 and 15.04 standard deviations, respectively). Interestingly, the income elasticities for these goods are generally less negative than those of the goods with negative old price effects (and for beef the income elasticity is positive), ranging from -0.005 for tea to 0.003 for beef. The effect of the old relative prices on intermediate foods, such as butter and lard, is not significant. Overall, Table 6 shows that the old relative prices of food have a large and significant effect on current food consumption.

Interestingly, the four foods that we identify with positive old relative price effects have each been documented to be relatively scarce and/or luxurious in European food history [Kiple and Ornelas 2000, Albala 2003, Albala 2006, Rebora 2001]. In particular, large amounts of beef were reserved for special occasions such as celebrations or community events, although this varied by location in Europe. For example, beef was less luxurious in Northern Europe than in Southern Europe. Historically, beef and dairy cattle were interchangeable, but this implies that using a dairy cow for beef would negatively impact the milk supply.[16] Eggs, while plentiful, were used in relatively copious amounts for baking. Also, there were many fewer chickens and fewer eggs per chicken in the past. Also, since eggs were used in so many dishes and since they spoiled easily before the days of refrigeration, their supply was tight relative to their demand, and the same applies to beef, which could also spoil easily. Rice and tea were particularly luxurious as they were largely imported food items that could not be produced in large quantities

[16] The opposite is true today. For example, in the United States today less than 20% of the beef supply comes from slaughtered dairy cattle. Also note that milk would not spoil as readily as beef since the amount of milk drawn from a heifer can be controlled. It is also the case that cows gave substantially less milk in the past, necessitating more cows per unit of milk. For example, milk production nearly doubled in the second half of the 20th century in the United States while the number of dairy cows declined.

domestically in Europe. In short, the history of food in Europe is consistent with our findings that beef, eggs, rice, and tea were luxury food items.

As additional suggestive evidence, we calculated the ratio of food prices relative to potato prices (both old and new) to see where the largest price changes were. That is, the changes in the price of a food item relative to potatoes gives us some clues about the relative price changes within food itself. If our ideas about luxury food items are correct than the relative prices of luxury foods should have decreased dramatically. We find that old beef prices were 85% more expensive in Europe, on average, and that tea was twice as expensive. Overall, the four food items where we find positive old price effects were nearly 70% more expensive in Europe than in the United States, while all the other food items were less than 40% more expensive in Europe, on average.

Earlier, we posited that our method of endogenizing tastes led to an empirical prediction: that the correlation of the old relative price elasticity and the income elasticity should be positive. As we argued earlier, goods that were expensive in the past and therefore not enjoyed, or goods that were cheap but not desirable, would both have negative old relative price effects and large negative current income elasticities. On the other hand, goods that were expensive in the past but desired would have positive old relative price effects and less negative (and perhaps positive) income elasticities. The correlation of the income elasticity and old relative price effects is positive in Table 6 across all of the goods (r=0.65), which we take as suggestive evidence consistent with our approach.

c. Tastes versus Geography

As mentioned earlier, a key empirical problem for our approach is the fact that the prices are driven by geography. This leaves us open to the argument that our approach is simply supplanting geographic indicators with prices, which does not increase the economic interpretation since the two are collinear. Similarly, the statistical significance of our results could be driven by the failure to account for the natural clustering of the data by either immigrant group or current state of residence. We address both issues below.

While it is true that we cannot add both the old prices and the country of origin to the demand system, we provide suggestive evidence that our results do capture a portion of the variation in demand that is usually attributed to national origin alone.[17] This is a key for our approach—if the prices captured all of the variation that would be explained by geography it would be doubtful to consider our technique a partial endogenization of tastes since the geographic explanation does not have economic content. We produce suggestive evidence by regressing the residuals for the demand system estimated in equation (1) on indicators for nativity. We estimate

$$(2) \qquad \varepsilon_{ij} = \alpha + \sum_{j}^{J-1} \beta_j S_{ij} + \upsilon_i$$

If our price measure is simply a proxy for country indicators then the residual regression would find no remaining geographic variation to be explained by the residuals—the residuals from the demand system estimated by equation (1) would be the same as those estimated by a demand system with geographic indicators. On the other hand, if there is remaining geographic variation that is not explained by the relative prices then the old relative prices are not a simple proxy for geography. This reduces to a test of whether the country indicators for the residual regression are statistically significant.

We report the t-statistics from the regressions in Table 7, since the coefficient estimates themselves are of little interest. The table shows that there is a significant amount of geographic variation to be explained after controlling for the relative prices, and, more importantly, this remaining variation varies by food group and by country. We take the results of Table 7 as suggestive evidence that our price measures captures features of demand that are distinct from geography itself. The reverse, however, is not true. When we estimate a demand system using the geographic indicators and regress those residuals on the old relative prices they have no effect—this is what we would expect since the geographic indicators "soak up" all of the variation in old relative prices and their own independent effects.

The statistical significance of our results could be driven by the assumption that there is no correlation among immigrants from the same country, from residents of the same state, or from immigrants from the same country who are located in the same state. That is, the standard errors reported earlier assume an independence that is not consistent with the potential clustering in the data. We check the sensitivity of our results to clustering in Table 8. We estimate

[17] When we compared the r-squares of the regressions in Table 6 with regressions in which we drop the old relative prices and add nationality indicators, the tests reveal that our regressions with old relative prices have just as much explanatory power.

clustered standard errors at the nativity, state of residence, and nativity-state of residence levels. Our multi-level clustering follows the methodology of Cameron, Gelbach, and Miller [2008], who extend the standard cluster-robust variance estimator to allow for multi-way clustering. In nearly every specification the results remain statistically significant regardless of the level of clustering we use. We take this as suggestive evidence that our results are not sensitive to the arbitrary correlation both within immigrant groups and within current state of residence.

VII. Robustness and Extensions

We check the robustness of our approach in two ways. First, we estimate an alternative specification of the demand system by looking at the share of the food budget rather than the total budget. Second, we move our analysis forward in time, and use the 1917 Consumer Expenditure Survey (1917CEX) to see if the relative prices in the Young Report continue to have explanatory power for immigrants. In both instances we find that our central results hold. We then seek to parse out the effects of the old relative prices by determining how much of the explanatory power of nativity indicators is actually explained by the old relative prices. We adopt two methods, motivated by MaCurdy's [1981] use of fixed effects in empirical labor supply models. First, we estimate a traditional demand system (using only contemporaneous prices, income and nativity indicators) and regress the fitted budget shares on the old relative prices to see if the old relative prices predict differences in consumption net of the nativity effect itself. Second, we estimate the traditional demand system and regress the country fixed effects on the old relative prices. This is done to estimate the degree to which the country fixed effects are related to the old relative prices. Overall, both strategies show that the old relative prices exert an effect on current consumption, both net of the traditional demand system and as correlates of the country fixed effects.

a. Robustness

Table 9 shows the results from our second approach, where we regress the food items share of the food budget on the same set of covariates. This, we believe, gets closer to the key insight of our model since foods share of the budget could be crowded out by other needs such as shelter and heating. This specification allows us to look at food directly. The table shows that the result holds when looking at the share of the food budget devoted to these items. For sugar, a one standard deviation increase in the old relative price would decrease sugars' share of the food budget by 0.41 standard deviations, once again a sizable effect. For pork, the effect is 0.24

standard deviations of pork's share of the food budget, also a sizeable effect. We obtain smaller, but similar effects for coffee (0.11 standard deviations), milk (0.18), and potatoes (0.032). For beef, a one standard deviation increase in the old relative price would increase beef's share of the food budget by 0.39 standard deviations. For eggs, the effect is 0.09 standard deviations. In general, the effects are larger when looking at the food budget itself, which we would expect. These larger effects also hold for the correlation of the income elasticity with the old relative price effects, which grows to 0.85 in Table 9.

As a second check of our results, we move our analysis forward in time, using the 1917 Consumer Expenditure Survey. Like the 1888CEX, the 1917CEX contains information on nativity. Unfortunately, the nativity data is recorded for only a fraction of the households, and there are fewer than 400 households whose nativity can be matched to the countries in the Young Report. Even so, we estimate the demand system for these households with both the contemporaneous and old relative prices.[18] The results are given in Table 10. Panel A confirms that the old relative prices are uncorrelated with contemporaneous (1917) prices, just as in the 1888CEX. In Panel B we report the demand estimates. As the results show, the old relative prices continue to have an effect on current demand, even with old relative prices that are now more than forty years old. For coffee, milk, cheese, sugar, butter, and pork the old relative prices continue to have an influence on demand. Except for cheese, in all cases the old relative prices have a negative effect on demand for food. In general, these 1917 results confirm the 1888CEX results. While much weaker than in Tables 6 or 9, the correlation of the income elasticity with the old relative price effect is still positive (r=0.04).

b. Extensions – Parsing out Effects

Thus far, we have considered the effect of old prices on demand, and earlier made the case that our technique of using old relative prices was weaker than the standard approach of using nativity in demand systems. In Table 7 we showed that there was still significant variation in demand by nativity even after controlling for the old relative prices. We now move in the reverse direction—parsing out how much of the nativity fixed effect is actually due to the old relative prices. In other words, the interesting decomposition is to see how much the old prices can explain the country of origin effect that we usually take as fixed. We view this as the first

[18] Although there are regional price indices for food available, we exploit greater variation in food prices by using the food prices by state derived from all of the households in the 1917CEX (N=12,817).

step in parsing out the effects of our endogenous taste measure into components that are subject to economic analysis.

We take two approaches to the issue, both of which are inspired by MaCurdy [1981]. First, we estimate a traditional demand system and use standard controls for nativity from country *j* rather than old relative prices.

$$(3) \qquad w_{ij} = \varsigma + \beta \ln\left(\frac{x_i}{n_i}\right) + \gamma_j \Psi_j + \lambda P_{NEW_i} + \Theta Z_i + \nu_{ij}$$

We then take the fitted estimates of the budget share and regress them on the old relative prices to see if they predict the budget share even with controls for country of origin.

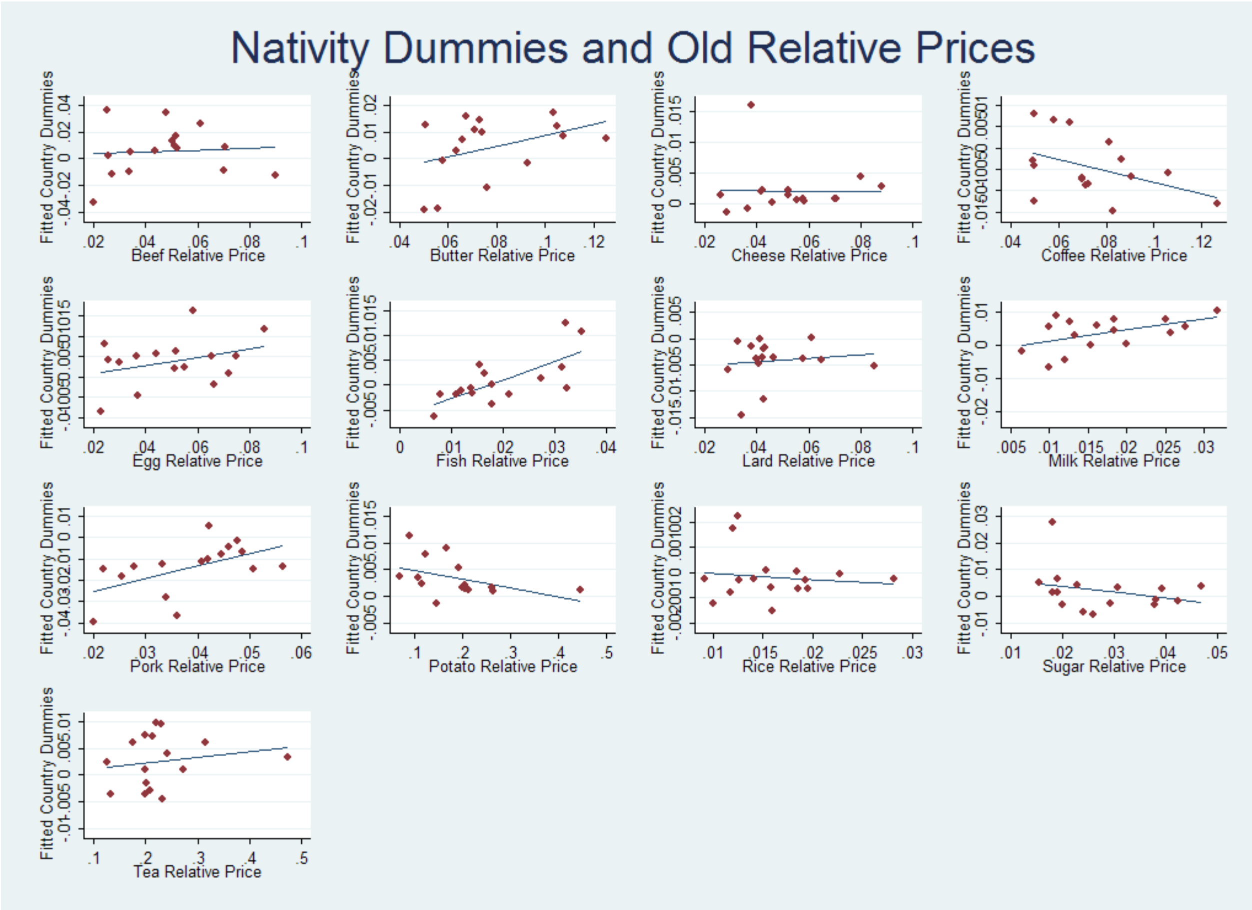
$$(4) \qquad \hat{w}_{ij} = a + \eta P_{OLDi} + \zeta_i$$

This is an attempt to see whether, between households and countries, the variation in the old relative prices has predictive power on current consumption even after the nativity fixed effect has been included. Table 11 shows the results. We find that the between country variation in old relative prices exerts an independent effect on the predicted consumption. Indeed, the results in terms of sign are the same as those in Table 6. For most goods, higher relative prices are met with lower levels of consumption. For eggs, rice, beef, and tea, however, higher relative prices are positively correlated with the predicted consumption. In general, where the old relative price had an effect on demand in our specification in (1) we find that the old relative prices are related to predicted demand in Table 11.

As a second technique, we regress the fitted country effects from estimates of (3) on the old relative prices.

$$(5) \qquad \hat{\gamma}_j = \tau + \xi_j P_{OLDj} + \vartheta_j$$

Since the number of observations from this second technique is small due to the limited number of countries of origin we graph the results below. As with the first technique, we find that the old relative prices are related to the country fitted dummy estimates from the traditional demand system in (3). Slopes of the fitted lines are suggestive, but due to the small number of countries involved are not robust. Overall, however, we do see a general relationship between the country fixed effects and the old elative prices. We stress that these results are preliminary and that more development of the model of endogenized tastes is necessary before the parsing that we have advocated can be used to derive meaningful estimates of the parameter that we are most interested in. The results do suggest, however, that our method could be used to decompose the fixed effect of country of origin into a component that would contain our endogenous taste measure.



VIII. Conclusion

Rather than thinking of tastes as primitives, we modeled tastes as a function of a path dependent production process where old prices cause households to adapt to certain types of production that are slow to change. This slow adaptation implies that tastes are a function of older relative prices as well as current relative prices. In contrast to traditional models of intertemporal substitution, we applied our model to consumption goods for which old relative prices, particularly those in the distant past, should have little effect on demand. We empirically tested our model with unique consumption data from the nineteenth century, which allowed us to produce old and new relative prices that were uncorrelated with one another and measured fifteen years apart. Consistent with our predictions, we found that old relative prices for food were strong predictors of current food consumption for a number of food groups.

We believe that our approach to tastes could be incorporated into both micro and macroeconomic contexts. For microeconomists, our results suggest that estimates of price sensitivity would need to be augmented by the fact that old relative prices exert an independent effect on demand. Rather than asking how consumption would change for a given change in price, we may want to ask how consumption would change for a given change in old and current prices. Mazar, Koszegi, and Ariely [2009] show that demand systems may be misspecified since they assume that preferences are stable. For macroeconomists, our results suggest that in addition to price stickiness, there may also be a degree of household demand stickiness that should find its way into micro-founded macroeconomics models. Atkin [2009] shows that the failure to account for tastes biases the welfare calculations of trade, where he takes tastes as the unexplained differences in consumption patterns. We believe that our approach could extend and strengthen such trade arguments by providing an empirical approach to counterfactual welfare calculations. While much more research is needed on how to fully incorporate and interpret the results we find, we provide strong evidence that a portion of preferences can be endogenized in the traditional neoclassical framework.

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Table 1
Classification of Budgets by Nationalities in British Board of Trade Study

	Number of Budgets	Percentage of Total
American-British		
Northern	3215	42.2
Southern	580	7.6
Southern-Broken Families	46	0.6
German	906	11.9
Scandinavian	335	4.4
Southern European	599	7.9
Slavonic	598	7.9
Jewish	758	10.0
American Negro		
Northern	303	4.0
Southern	276	3.6
Total	7616	100.0

Source: British Board of Trade Study, "Cost of Living in the United States" p. 40

Table 2
Traditional Demand Estimates from British Board of Trade Study

Panel A	*Dependent Variable: Food Item's Share of Total Expenditure*						
	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Imputed Price	-0.01598	-0.0187	0.0103	0.0286***	0.0290*	-0.0500***	-0.0391***
	[0.0099]	[0.0186]	[0.0084]	[0.0036]	[0.0158]	[0.0072]	[0.0051]
Log Income	0.00357	-0.0199*	-0.0022	-0.0056	-0.0006	-0.0029	-0.0035
	[0.0039]	[0.0105]	[0.0060]	[0.0036]	[0.0035]	[0.0049]	[0.0029]
Observations	70	70	70	70	70	70	70
R-squared	0.36	0.10	0.19	0.51	0.35	0.45	0.62
	Butter	Pork	Beef	Lard	Tea	Fish	
Imputed Price	-0.0076	-0.0728***	0.0747*	0.0203	0.0122*	-0.0093	
	[0.0412]	[0.0187]	[0.0432]	[0.0130]	[0.0064]	[0.0114]	
Log Income	0.0334***	0.0159*	-0.0003	-0.0003	0.0028	-0.0065	
	[0.0107]	[0.0090]	[0.0169]	[0.0071]	[0.0029]	[0.0066]	
Observations	70	63	70	70	70	69	
R-squared	0.15	0.31	0.05	0.29	0.11	0.05	

Panel B	*Dependent Variable: Food Item's Share of Total Expenditure*						
	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Imputed Price	-0.0078	0.030***	-0.0039	0.011	0.0307***	0.004	-0.0091
	[0.0078]	[0.0076]	[0.0055]	[0.0077]	[0.0103]	[0.0078]	[0.0066]
Log Income	-0.0055*	-0.0018	-0.0012	0.0005	-0.0116***	-0.0077**	-0.0088***
	[0.0029]	[0.0054]	[0.0048]	[0.0034]	[0.0029]	[0.0035]	[0.0027]
Nationality	X	X	X	X	X	X	X
Observations	70	70	70	70	70	70	70
R-squared	0.85	0.90	0.78	0.81	0.81	0.88	0.86
	Butter	Pork	Beef	Lard	Tea	Fish	
Imputed Price	0.0133	0.0234	0.0193	0.0048	0.0247***	0.0041	
	[0.0191]	[0.0183]	[0.0449]	[0.0093]	[0.0055]	[0.0060]	
Log Income	-0.0013	-0.0017	-0.0149	-0.0080**	-0.0002	0.0003	
	[0.0057]	[0.0073]	[0.0159]	[0.0034]	[0.0024]	[0.0035]	
Nationality	X	X	X	X	X	X	
Observations	70	63	70	70	70	69	
R-squared	0.89	0.83	0.61	0.93	0.73	0.86	

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests]. Note: Regressions include household size. Imputed prices are constructed by dividing expenditure by quantity. Ethnicities are American-British, German, Jewish, Negro, Scandinavian, Slavonic, and Southern European. American-British and Negro are recorded seperately for Northern/Souther location in US.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.

Table 3
Summary Statistics for 1888CEX

Entire Sample (N=6,809)

Variable	*Mean*	*Std. Dev*	*Min*	*Max*
Per Capita Expenditure	134.9	68.6	27.14	750
Per Capita Income	151.1	91.3	15.71	1500
Husband Age	38.1	12.3	0.0	84.0
Wife Age	35.4	11.4	0.0	88.0
Household Size	5.2	2.3	1.0	22.0
Husband Income	517.6	307.6	0	4500
Wife Income	12.8	54.3	0	800
Children's Income	104.7	214.8	0	1795
Total Income	683.3	335.0	84	4500
Food Expenditure	269.4	114.8	38.42	1300

Sample Native to United States (N=3,735)

Variable	*Mean*	*Std. Dev*	*Min*	*Max*
Per Capita Expenditure	134.8	71.8	27.14	748
Per Capita Income	150.9	93.8	15.71	1500
Husband Age	36.2	12.0	0	78
Wife Age	33.8	10.6	0	78
Household Size	4.9	2.1	1	22
Husband Income	521.2	313.2	0	4500
Wife Income	12.2	53.2	0	800
Children's Income	71.9	160.7	0	1406
Total Income	646.6	318.3	84	4500
Food Expenditure	243.9	95.8	38.42	1300

Sample Not Native to United States (N=3,074)

Variable	*Mean*	*Std. Dev*	*Min*	*Max*
Per Capita Expenditure	135.1	64.6	30.95	750
Per Capita Income	151.2	88.1	29.42	1052
Husband Age	40.3	12.2	0	84
Wife Age	37.3	12.0	0	88
Household Size	5.5	2.4	2	22
Husband Income	513.2	300.7	0	3000
Wife Income	13.5	55.7	0	606
Children's Income	144.6	260.6	0	1795
Total Income	727.8	349.2	120	3192
Food Expenditure	300.3	127.6	81	1040

Note: Income and expenditure are annual amounts.
Authors' Calculations based on 1888CEX.

Table 4
Home Nations in the 1888CEX and Historical Price Data

Country	Number of Households	Years Prices Collected
French Canada	239	1873
Canada	107	1872, 1873, 1874
England	650	1872, 1874
Ireland	947	1873, 1874
Scotland	147	1872, 1873, 1874
Wales	144	1872
France	80	1874
Belgium	12	1872, 1874
Switzerland	11	1872, 1873
Germany	667	1872, 1873, 1874
Austria	12	1872
Bohemia	14	1873
Italy	13	1873
Russia	1	1872
Sweden	23	1873
Denmark	7	1872
Total Sample	3074	

Note: Number of Households is number of households with the given country of origin in the 1888CEX. Years prices collected list the year of any price report for the country in Young (1875).

Table 5

Panel A: Food Items Descriptions and Old/New Relative Price Correlations

Food Item	Specific Matched Description	Old/New Price: Correlation	Standard Error
Coffee	Coffee, Rio Roasted, Per Lb.	-0.039	1.466
Milk	Milk, Per Quart	0.084	2.872
Eggs	Eggs, Per Dozen	0.104	1.869
Cheese	Cheese, Per Lb.	0.066	2.73
Sugar	Sugar, Good Brown, Per Lb.	-0.085	4.064
Potato	Potatoes, Per Bushel	0.047	1.897
Rice	Rice, Per Lb.	-0.049	1.977
Butter	Butter, Per Lb.	-0.290	3.525
Pork	Pork, Fresh, Per Lb.	-0.072	3.528
Beef	Beef, Roasting Pieces, Per Lb.	-0.012	2.686
Lard	Lard, Per Lb.	-0.077	5.434
Tea	Tea, Oolong Black, Per Lb.	0.021	4.125
Fish	Dry Codfish, Per Lb.	-0.053	1.861

Panel B: The Correlation Matrix for Old Relative Prices

	Coffee	Milk	Eggs	Cheese	Sugar	Potato	Rice	Butter	Pork	Beef	Lard	Tea
Coffee	1											
Milk	0.6959	1										
Eggs	-0.1915	-0.4763	1									
Cheese	0.6278	0.502	-0.4785	1								
Sugar	0.5757	0.0829	0.1031	0.0524	1							
Potato	0.2912	0.7707	-0.3013	0.0933	-0.0116	1						
Rice	0.7539	0.3382	-0.2572	0.3325	0.8658	0.1799	1					
Butter	0.6376	0.5189	-0.455	0.5455	0.562	0.4952	0.8151	1				
Pork	0.4075	0.5405	-0.6419	0.6416	0.0869	0.5369	0.4005	0.7734	1			
Beef	0.5003	0.6219	-0.5821	0.7564	-0.0972	0.4944	0.2823	0.6482	0.8577	1		
Lard	0.6172	0.4427	-0.3639	0.3858	0.6803	0.4583	0.8728	0.9598	0.6788	0.502	1	
Tea	0.528	0.1126	0.2517	0.3525	0.2865	-0.3267	0.2144	-0.0469	-0.1098	0.0421	0.0311	1
Fish	0.4171	-0.0026	0.1148	0.0525	0.8762	0.0921	0.7795	0.6664	0.3299	0.0454	0.7878	0.1455

Note: Food item descriptions match between the Aldrich Report (1892) and Young Report (1875). All food relative prices are recorded as relative to the price of men's heavy boots in each respective country/state and year. Standard error is the standard error of the old relative price divided by the standardc error of the new relative price.

Table 6
Demand for Food as a Function of Old and New Relative Prices

Dependent Variable: Food Item's Share of Total Expenditure

	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0395***	-0.179***	0.0501***	-0.0109	-0.305***	-0.0092***	0.0138*
	[0.015]	[0.051]	[0.015]	[0.013]	[0.031]	[0.0022]	[0.0082]
New Relative Price	-0.0402***	-0.0137	0.0279***	0.00075	0.0844***	0.0052***	-0.0031
	[0.0049]	[0.030]	[0.0087]	[0.0065]	[0.023]	[0.0011]	[0.0054]
Log of Per Cap. Exp.	-0.0104***	-0.0062***	-0.0028***	-0.0008**	-0.0150***	-0.0075***	-0.001***
	[0.00083]	[0.0011]	[0.00095]	[0.00032]	[0.00095]	[0.00072]	[0.00015]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0.17	0.19	0.21	0.04	0.21	0.17	0.03

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	-0.00481	-0.188***	0.184***	-0.00595	0.0124*	-0.022
	[0.027]	[0.062]	[0.068]	[0.014]	[0.0072]	[0.022]
New Relative Price	0.0268*	-0.041	0.151***	-0.0210*	0.0207***	0.0101
	[0.014]	[0.035]	[0.041]	[0.012]	[0.0040]	[0.0081]
Log of Per Cap. Exp.	-0.0152***	-0.0111***	0.00288	-0.0035***	-0.0051***	-0.0003
	[0.0018]	[0.0016]	[0.0026]	[0.00052]	[0.00077]	[0.00055]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0.09	0.08	0.21	0.08	0.14	0.11

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the Aldrich report and are relative to the price of men's heavy boots as given by the state the household resides in in the 1888CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.
Regressions include log of household size, share of household in five year age sex categories, and the industry that employs the household head.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.

Table 7
Residual Regression T-Statistics by Food Item

Country	Coffee	Milk	Eggs	Cheese	Sugar	Potato	Rice	Butter	Pork	Beef	Lard	Tea	Fish
Canada	***[1.978]***	[0.947]	***[-2.479]***	[1.362]	***[4.196]***	[-1.122]	***[-2.064]***	***[3.150]***	***[4.013]***	***[4.566]***	[1.531]	***[-2.463]***	[0.590]
England	***[6.231]***	[0.238]	***[-5.377]***	***[3.206]***	***[1.759]***	***[-4.398]***	***[-2.701]***	***[4.058]***	[-1.024]	***[3.865]***	***[-4.847]***	[1.196]	***[-2.889]***
Ireland	***[4.904]***	[1.126]	***[-6.437]***	[0.780]	***[2.562]***	***[-5.117]***	***[-2.417]***	***[5.078]***	[-1.028]	***[6.728]***	***[-5.740]***	***[3.911]***	[-0.147]
Scotland	[1.554]	[1.317]	***[-4.512]***	***[2.483]***	[0.445]	***[-2.058]***	***[-1.918]***	***[1.811]***	[-1.008]	***[5.406]***	***[-3.194]***	[0.104]	***[-3.037]***
Wales	[0.409]	[-1.606]	***[-3.935]***	***[1.764]***	[-0.343]	***[-2.815]***	[-1.165]	***[5.207]***	[-0.750]	***[5.906]***	***[-3.844]***	[-0.851]	***[-6.127]***
France	***[5.038]***	[-0.0246]	***[-2.387]***	[0.0554]	[0.384]	***[-2.053]***	***[-2.845]***	[0.453]	[1.452]	***[3.391]***	[0.314]	***[-4.363]***	[-0.573]
Belgium	***[2.136]***	***[-2.029]***	***[-4.666]***	[-0.864]	[1.586]	[-0.277]	***[-3.038]***	[-0.187]	[0.894]	***[3.965]***	***[-1.779]***	[-0.660]	***[-2.102]***
Switzerland	***[1.832]***	[0.546]	[-0.660]	***[1.885]***	***[-1.883]***	[-1.474]	[0.849]	***[-3.607]***	***[-6.350]***	***[2.052]***	[-0.504]	***[-5.319]***	***[-4.433]***
Germany	***[13.36]***	[1.600]	***[-6.350]***	***[3.715]***	[0.401]	***[-4.632]***	***[-2.095]***	***[2.781]***	[-0.0292]	***[5.253]***	***[-5.054]***	***[-6.201]***	***[-2.845]***
Austria	***[3.110]***	[-0.424]	***[-13.33]***	[0.422]	[-1.594]	[0.840]	[0.829]	[-0.387]	[-1.375]	***[3.410]***	[-0.848]	***[-2.381]***	***[-9.709]***
Bohemia	*[1.091]*	***[-2.233]***	***[-2.157]***	[0.518]	***[-2.085]***	[1.471]	***[-6.468]***	***[-3.323]***	***[-2.205]***	[-0.319]	***[-6.222]***	***[-4.120]***	***[-5.499]***
Italy	[1.092]	***[1.982]***	***[-2.890]***	[1.325]	***[2.206]***	***[-2.301]***	***[-4.938]***	[0.391]	***[-2.335]***	[-0.326]	***[-3.113]***	[-1.278]	***[2.785]***
Russia	***[5.083]***	***[-6.821]***	***[-6.224]***	***[18.56]***	***[23.19]***	***[-9.353]***	***[-4.960]***	***[-24.38]***	***[-9.731]***	***[-9.241]***	***[-23.33]***	***[-4.528]***	***[13.20]***
Sweden	***[3.044]***	[0.584]	***[-2.425]***	***[-2.013]***	[-0.945]	***[-1.651]***	***[-4.113]***	[0.903]	***[-2.614]***	***[2.131]***	***[-3.118]***	***[-1.868]***	***[-3.430]***
Denmark	***[2.794]***	[-1.516]	***[-3.376]***	***[-2.087]***	[-0.400]	***[-2.205]***	[-0.833]	[-0.498]	***[-3.427]***	[1.007]	[-0.223]	[-0.672]	[-1.471]
Observations	3074	3074	3074	3074	3074	3074	3074	3074	3074	3074	3074	3074	3074
R-squared	0.075	0.009	0.022	0.034	0.016	0.018	0.013	0.023	0.036	0.030	0.034	0.091	0.039

Note: Results reported are the t-statistics of the regression of the residuals from the demand system with old relative prices on country indicators (French Canada is the omitted country). T-statistics are from robust standard errors, bold numbers are for p<0.1 [two tailed tests].

Table 8
Demand for Food as a Function of Old and New Relative Prices, Clustered Standard Errors

	Dependent Variable: Food Item's Share of Total Expenditure						
	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0395	-0.179	0.0501	-0.0109	-0.305	-0.0092	0.0138
Robust Standard Errors	**[0.015]*** **	**[0.051]*** **	**[0.015]*** **	[0.013]	**[0.031]*** **	**[0.0022]*** **	**[0.0082]* **
State Clusters	[0.0262]	**[0.0604]*** **	**[0.0283]* **	[0.0159]	**[0.0418]*** **	**[0.0023]*** **	[0.0183]
Nativity Clusters	[0.0395]	**[0.0613]** **	**[0.0132]*** **	[0.0201]	**[0.0703]*** **	**[0.0040]** **	**[0.00725]* **
State-Nativity Clusters	**[0.0205]* **	**[0.0547]*** **	**[0.0124]*** **	[0.0189]	**[0.0584]*** **	**[0.0036]*** **	[0.0103]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0.17	0.19	0.21	0.04	0.21	0.17	0.03

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	-0.00481	-0.188	0.184	-0.00595	0.0124	-0.022
Robust Standard Errors	[0.027]	**[0.062]*** **	**[0.068]*** **	[0.014]	**[0.0072]* **	[0.022]
State Clusters	[0.0378]	**[0.101]* **	**[0.103]* **	[0.0339]	**[0.0106]* **	[0.0382]
Nativity Clusters	[0.0499]	**[0.106]* **	**[0.099]* **	[0.0331]	[0.0231]	[0.0631]
State-Nativity Clusters	[0.0143]	**[0.016]*** **	**[0.037]*** **	[0.0249]	[0.0210]	[0.0232]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0.09	0.08	0.21	0.08	0.14	0.11

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report.
Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.
Regressions include log of household size, share of household in five year age sex categories, and the industry that employs the household head.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.

Table 9
Demand for Food as a Function of Old and New Relative Prices

	Dependent Variable: Food Item's Share of Total Food Expenditure						
	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0806**	-0.287***	0.0711**	-0.017	-0.671***	-0.0150***	0.0256
	[0.033]	[0.11]	[0.032]	[0.028]	[0.063]	[0.0046]	[0.017]
New Relative Price	-0.0944***	-0.11	0.0360*	0.00528	0.132***	0.0087***	-0.00529
	[0.011]	[0.067]	[0.019]	[0.014]	[0.051]	[0.0026]	[0.011]
Log of Per Cap. Exp.	-0.0138***	0.00118	0.00262	0.0002	-0.0147***	-0.0079***	-0.0009***
	[0.0019]	[0.0023]	[0.0021]	[0.00072]	[0.0021]	[0.0015]	[0.00031]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0.16	0.18	0.18	0.04	0.12	0.1	0.03

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	0.0276	-0.248**	0.423***	-0.0131	0.018	-0.0237
	[0.056]	[0.11]	[0.14]	[0.029]	[0.014]	[0.047]
New Relative Price	0.03	-0.174**	0.184**	-0.0570**	0.0429***	-0.000343
	[0.029]	[0.080]	[0.092]	[0.026]	[0.0086]	[0.018]
Log of Per Cap. Exp.	-0.0039	-0.0166***	0.0271***	-0.00199*	-0.00412**	0.00351***
	[0.0037]	[0.0034]	[0.0058]	[0.0011]	[0.0016]	[0.0012]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0.05	0.07	0.22	0.06	0.13	0.12

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the Aldrich report and are relative to the price of men's heavy boots as given by the state the household resides in in the 1888CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.
Regressions include log of household size, share of household in five year age sex categories, and the industry that employs the household head.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.

Table 10

Panel A: The Correlation of Old and New Relative Prices, 1917 CEX

	Coffee	Milk	Eggs	Cheese	Sugar	Potato	Rice
Correlation	-0.3277	-0.0792	0.00663	0.341	-0.0257	-0.1632	-0.0346

	Butter	Pork	Beef	Lard	Tea	Fish
Correlation	-0.2075	0.0708	-0.1464	0.0502	-0.0721	-0.2112

Panel B: Demand for Food as a Function of Old and New Relative Prices, 1917 CEX

Dependent Variable: Food Item's Share of Total Food Expenditure

	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0808***	-0.470**	-0.0453	0.0957***	-0.0480*	-0.00613	-0.0301
	[0.0159]	[0.195]	[0.0336]	[0.0142]	[0.0262]	[0.00574]	[0.0265]
New Relative Price	0.00017	0.0024***	0.0052***	0.0114***	-0.00004	-0.000004	0.0004***
	[0.0001]	[0.0007]	[0.0009]	[0.002]	[0.00002]	[0.00008]	[0.0001]
Log of Per Cap. Exp.	-0.00271**	-0.0162***	-0.00212	-0.00136	-0.00501***	-0.0098***	-0.00193***
	[0.0013]	[0.006]	[0.0026]	[0.00095]	[0.001]	[0.002]	[0.0006]
Observations	327	304	363	363	363	356	322
R-squared	0.106	0.076	0.094	0.285	0.067	0.065	0.063

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	-0.116***	-0.367**	0.000359	-0.00132	-0.00294	-0.0119
	[0.0365]	[0.145]	[0.0320]	[0.0261]	[0.00217]	[0.00761]
New Relative Price	0.0008***	-0.0004	0.0047***	0.0025***	0.0027**	0.0011**
	[0.0002]	[0.0006]	[0.0017]	[0.0008]	[0.0014]	[0.0005]
Log of Per Cap. Exp.	-0.0023	0.0155**	0.0013	-0.0038*	-0.0013	0.0002
	[0.004]	[0.006]	[0.003]	[0.002]	[0.0009]	[0.0003]
Observations	361	363	363	363	363	363
R-squared	0.069	0.038	0.024	0.037	0.02	0.026

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the 1917CEX and are relative to the price of men's heavy rubber boots by the state the household resides in in the 1917CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1917CEX.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.

Table 11
Fitted Budget Shares as a Function of Old Relative Prices

Dependent Variable: Fitted Value of Budget Share from Regression with Nativity Dummies

	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0640***	-0.0676***	0.0830***	-0.0143***	-0.358***	-0.0131***	0.00868***
	[0.00837]	[0.0217]	[0.00531]	[0.00415]	[0.0132]	[0.000737]	[0.00218]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0.015	0.003	0.051	0.009	0.236	0.082	0.005

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	-0.0376***	-0.349***	0.0972***	-0.00700	0.0230***	-0.0402***
	[0.00674]	[0.0252]	[0.0307]	[0.00545]	[0.00375]	[0.00981]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0.012	0.050	0.004	0.001	0.014	0.006

Robust standard errors in brackets *** $p<0.01$, ** $p<0.05$, * $p<0.1$ [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the Aldrich report and are relative to the price of men's heavy boots as given by the state the household resides in in the 1888CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.
Regressions include log of household size, share of household in five year age sex categories, and the industry that employs the household head.

Appendix Table 1
Nationality Coefficients from BBT Demand Regressions

Commodity		British-American South	British-American South-Broken	African-American North	African-American South	German	Jewish	Scandavian	Slavonic	Southern European	Constant
Rice											
	Coeff.	0.74	0.99	0.29	1.06	0.21	0.37	0.08	0.50	0.33	0.27
	St. Err	0.13	0.13	0.10	0.13	0.09	0.11	0.09	0.10	0.12	0.59
Potatoes											
	Coeff.	-0.55	-0.59	-0.42	-0.91	-0.05	-0.39	-0.22	-0.02	-0.65	1.49
	St. Err	0.09	0.11	0.08	0.11	0.07	0.08	0.08	0.08	0.09	0.38
Beef											
	Coeff.	-0.13	-0.24	-0.49	-0.26	-0.05	0.29	-0.16	-0.24	-0.46	1.03
	St. Err	0.10	0.12	0.12	0.13	0.10	0.11	0.10	0.14	0.12	0.96
Pork (fresh and salt)											
	Coeff.	0.16	0.41	-0.03	0.36	0.20	NA	0.08	0.38	-0.78	0.38
	St. Err	0.14	0.17	0.16	0.16	0.14		0.15	0.16	0.17	1.84
Bacon, Ham, & Brawn											
	Coeff.	0.50	0.50	0.55	0.39	-0.29	NA	-0.36	-0.22	-0.97	-0.32
	St. Err	0.14	0.19	0.14	0.17	0.12		0.12	0.14	0.14	1.27
Veal											
	Coeff.	-1.12	-0.41	-0.53	-1.29	0.47	0.35	0.03	0.32	0.44	1.22
	St. Err	0.22	0.31	0.26	0.24	0.21	0.25	0.23	0.25	0.27	1.92
Sausage											
	Coeff.	0.26	-0.49	0.52	0.63	0.41	-0.27	0.00	1.04	0.08	-0.64
	St. Err	0.17	0.22	0.20	0.19	0.17	0.23	0.18	0.19	0.25	1.29
Fish											
	Coeff.	-0.05	0.20	0.73	0.53	-0.31	0.71	0.08	-0.01	0.37	0.25
	St. Err	0.10	0.13	0.11	0.10	0.09	0.11	0.10	0.11	0.12	0.65
Lard											
	Coeff.	0.67	0.65	0.42	0.63	0.01	-1.51	-0.27	0.11	0.13	-0.24
	St. Err	0.09	0.12	0.09	0.09	0.08	0.14	0.08	0.09	0.10	0.74
Butter											
	Coeff.	-0.23	-0.08	-0.41	-0.54	-0.18	-0.20	0.17	-0.72	-1.05	0.10
	St. Err	0.10	0.13	0.12	0.11	0.10	0.12	0.11	0.11	0.12	1.55

Appendix Table 1 (Continued)
Nationality Coefficients from BBT Demand Regressions

Commodity		British-American South	South-Broken	African-American North	South	German	Jewish	Scandavian	Slavonic	Southern European	Constant
Cheese											
	Coeff.	0.31	0.57	-0.47	0.27	0.28	0.49	0.28	0.20	0.82	-1.56
	St. Err	0.12	0.14	0.13	0.12	0.11	0.20	0.12	0.16	0.22	1.03
Milk											
	Coeff.	-0.67	-0.77	-0.78	-1.05	0.09	0.48	0.43	0.23	0.21	0.77
	St. Err	0.11	0.13	0.12	0.11	0.10	0.12	0.11	0.12	0.13	0.66
Eggs											
	Coeff.	-0.39	-0.24	-0.58	-0.63	-0.11	0.12	-0.01	-0.15	-0.19	1.23
	St. Err	0.07	0.09	0.08	0.08	0.07	0.08	0.08	0.08	0.09	0.38
Tea											
	Coeff.	-0.80	-0.78	-0.30	-0.59	-0.70	-0.48	-1.16	-0.57	-1.20	-3.72
	St. Err	0.15	0.21	0.17	0.16	0.14	0.16	0.15	0.18	0.18	1.57
Coffee											
	Coeff.	0.14	0.41	-0.41	-0.10	0.28	-0.17	0.31	0.12	-0.08	1.76
	St. Err	0.06	0.07	0.07	0.06	0.06	0.07	0.07	0.08	0.07	0.69
Sugar											
	Coeff.	0.03	0.11	-0.06	0.03	-0.25	-0.12	0.10	-0.18	-0.38	0.66
	St. Err	0.05	0.06	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.35

Source: BBT data. Omitted category is British-American North
NA= no quanitity reported.

Appendix Table 2
Relative Price Regressions

Dependent Variable: Old Relative Price

	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
New Relative Price	-0.0111**	0.0501***	0.0475***	0.0278***	-0.0651***	0.0230***	-0.0216***
	[0.0052]	[0.011]	[0.0082]	[0.0075]	[0.014]	[0.0087]	[0.0079]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0	0.01	0.01	0	0.01	0	0

	Butter	Pork	Beef	Lard	Tea	Fish
New Relative Price	-0.015	-0.0391***	-0.00647	-0.0613***	0.0112	-0.0209***
	[0.0093]	[0.0097]	[0.0097]	[0.014]	[0.0098]	[0.0071]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0	0.01	0	0.01	0	0

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the Aldrich report and are relative to the price of men's heavy boots as given by the state the household resides in in the 1888CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.

Appendix Table 3
Demand for Food as a Function of Old and New Relative Prices, IV Estimates

	Dependent Variable: Food Item's Share of Total Expenditure						
	Coffee	Milk	Eggs	Cheese	Sugar	Potatoes	Rice
Old Relative Price	-0.0394**	-0.175***	0.0499***	-0.0109	-0.310***	-0.00887***	0.0127
	[0.0164]	[0.0518]	[0.0152]	[0.0108]	[0.0293]	[0.00216]	[0.00897]
New Relative Price	-0.0407***	-0.0104	0.0281***	0.000470	0.0883***	0.00558***	-0.00277
	[0.00500]	[0.0315]	[0.00797]	[0.00471]	[0.0237]	[0.00110]	[0.00407]
Log of Per Cap. Exp.	-0.0086***	-0.0077***	-0.00494***	-0.00055	-0.0167***	-0.0096***	-0.00082***
	[0.00096]	[0.0013]	[0.0012]	[0.00046]	[0.0012]	[0.00084]	[0.00019]
Observations	3074	3074	3074	3074	3074	3074	3074
R-squared	0.164	0.189	0.204	0.041	0.207	0.170	0.034

	Butter	Pork	Beef	Lard	Tea	Fish
Old Relative Price	-0.00652	-0.184***	0.210***	-0.00657	0.0127*	-0.0239
	[0.0268]	[0.0573]	[0.0695]	[0.0136]	[0.00696]	[0.0221]
New Relative Price	0.0286**	-0.0379	0.157***	-0.0205*	0.0226***	0.0106
	[0.0140]	[0.0318]	[0.0426]	[0.0110]	[0.00400]	[0.00870]
Log of Per Cap. Exp.	-0.018***	-0.015***	-0.018***	-0.0039***	-0.0084***	-0.0009
	[0.0022]	[0.0021]	[0.0036]	[0.00065]	[0.00099]	[0.0007]
Observations	3074	3074	3074	3074	3074	3074
R-squared	0.093	0.078	0.195	0.084	0.140	0.113

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 [two tailed tests].

Note: Old relative prices are calculated from the Young Report (1875) and are relative to the price of a pair of men's heavy boots as given in the same country in the Young Report. New relative prices are calculated from the Aldrich report and are relative to the price of men's heavy boots as given by the state the household resides in in the 1888CEX. Old relative prices are calculated for households based on the nativity of the household head as recorded in the 1888CEX.
In each regression the log of per capita income is used as an instrument for expenditure.
Regressions include log of household size, share of household in five year age sex categories, and the industry that employs the household head.
Note that for downward sloping demand price effects must be less than 1, but not necessarily less than 0.