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ABSTRACT

We investigate the relationship between GDP per capita, trade costs, demand, and income inequality between 1996 and 2011. Specifically we apply the aggregate AIDS-based gravity model as developed in Fajgelbaum and Khandelwal (2016) to a panel of 40 countries to generate a new measure of market potential. We then relate this measure of market potential to country level GDP per capita finding a significant positive relationship which performs better than CES-based measures of market potential. The AIDS model allows for non-homotheticicities in demand and the possibility that nations produce goods with higher or lower income elasticities so that income inequality and GDP per capita matter for the direction of trade. CES-based market potential measures are typically only a function of overall income and trade costs, but in AIDS relative incomes and average incomes matter. We also go beyond this partial equilibrium relationship and explore the welfare effects of a unilateral decline in international trade costs. A 10% decline in import prices induces an average rise in welfare of 2% for importing countries. This effect is larger for smaller countries and depends in an interesting way on the income elasticity of demand for source and destination products.

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1. Introduction

Three significant macro-trends in the global economy over the past three decades are

- Falling trade costs
- Changes in economic geography associated with East Asia making large gains
- Increased income inequality within countries and a narrowing of the cross-country distribution of income.

The first two of these have been the object of myriad studies in the new economic geography literature. In this view, market access determines jointly the location of economic activity and incomes. Such a view has been fairly successful in explaining the cross-country variation in income (Redding and Venables, 2004; Head and Mayer, 2011; Jacks and Novy, 2011). "Market potential", a trade cost-adjusted measure of demand for a nation's output, is consistently found to be a positive and significant determinant of GDP per capita and location of activity.

How do within country income inequality and per capita incomes fit into the picture? Previous research on market potential assumes both of these variables away. The standard Dixit-Stiglitz-Norman formulation of preferences, widely used in the trade and geography literature, imposes a representative consumer and homothetic preferences; income inequality and per capita incomes are irrelevant; only the overall size of markets matters. In a recent exploration, Fajgelbaum and Khandelwal (2016) lay a foundation for exploring what happens when this assumption is relaxed. Starting from the Almost Ideal Demand System (AIDS), an expenditure system with a long-tradition (Deaton and Muellbauer, 1980), Fajgelbaum and Khandelwal (2016) derive a gravity equation of trade that allows for non-homotheticities in consumer demand. Since the gravity model is really an equilibrium expression for demand for a nation's output, this is the building block for assessing what the new economic geography calls *market potential*.

In this paper we follow the derivation of Fajgelbaum and Khandelwal (FK hereafter) for a one-sector gravity model allowing for non-homotheticities in demand in the AID system.[1] With this

[1] Without non-homotheticities, the gravity equation from the flexible demand system would be the homothetic translog gravity equation studied by Feenstra and Weinstein (2010) or Novy (2012).

gravity equation and a simple Ricardian assumption on the supply side, we are able to derive an expression for *market potential* in this demand system. We gather data for a panel of 40 countries for the years 1996, 2001, 2006 and 2011 and estimate a single sector version of the non-homothetic gravity equation with aggregate bilateral trade data. Consistent with the literature (e.g., Hallak, 2010; Hallak and Schott, 2011, and Feenstra and Romalis, 2014), we find strong and intuitive evidence that richer countries generally export higher income elastic goods. At the same time, we provide some limited evidence on the dynamics of these income elasticities. There is significant stability in these elasticities although China in particular may have seen a rise since 2006.

Next we proceed to relate market potential to the level and change in income per capita at the country level. Market potential consists of two components as in the homothetic setup. One term is related to a nation's trade costs. The second, and more novel term, involves the interaction between the supply side (i.e., a nation's average income elasticity) and world demand. Instead of one non-linear term featuring these two main components, non-homothetic market potential is additively separable in destination demand and trade costs. Moreover, world demand for a source country depends not on the sum of total incomes but on incomes per capita and the within country distributions of income as well. This last term raises the possibility that growth abroad does not necessarily translate into higher income at home. Market potential is positively related to foreign market incomes but only when a country has a positive income elasticity. We aim to quantify the magnitude of these non-homothetic forces. In this regard we are also able to compare the non-homothetic measure of market potential to a homothetic (CES-based) measure in terms of goodness of fit in the wage equation relationship. We find that the non-homothetic market potential measure explains a larger share of the cross-sectional variation in GDP per capita and in better predicts the level of GDP per capita in a cross-section. Both models prove similar in terms of predicting medium horizon changes in GDP per capita.

Finally we explore a welfare calculation building on the main welfare results in FK. We study a decline in iceberg trade costs for each country in isolation (i.e., a unilateral liberalization) highlighting the impact of non-homotheticities on welfare. A 10% decline in trade costs in a counterfactual raises welfare on average by about 2%. Quantitatively, non-homotheticities in the single sector model explain only a small fraction of aggregate welfare gains. Qualitatively, the impact of non-homotheticities is to raise the welfare impact when a country has a high income elasticity. Moreover, the effect on welfare is inversely related to the expenditure share weighted average of estimated foreign income elasticities.

Our paper is inspired in part by the theoretical growth literature (Matsuyama, 2002) as well as from contributions in empirical and theoretical trade (Matsuyama, 2000; Fieler, 2011; Markusen, 2013). The focus of these papers was generally to describe the conditions for demand-led modern economic growth when the income distribution mattered, or to provide an exploration of the product range exported, imported and consumed at various levels of income per capita.[2] FK provide an elegant and innovative solution to the welfare gains from trade when average incomes and the income distribution matter. A trade view is crucial in this regard since trade shares in expenditure often range between 20% and 30%.

The market potential approach is broader in the sense that it explores the relationship between the world income distribution (i.e., equilibrium income per capita) and the economic geography of demand. In a more ambitious framework of economic growth that accounts for the within country income distribution, the two variables would be strongly related and jointly determined (Matsuyama, 2002). Our paper supplies a first pass in assessing how important these relationships might be, bearing in mind their relevance due to the dramatic convergence process and unprecedented rises in within country income inequality in the past several decades. As far as we are aware, there is no quantitative empirical exploration of the relationship between market potential and the level of GDP per capita in the context of a non-homothetic demand system. Our paper also builds on and is motivated by the success of the earlier literature relating market potential to GDP per capita. Fujita, Krugman and Venables (1999) provided an elegant theoretical link between factor payments (i.e., wages) and market potential in the context of a homothetic demand system. Of course, the tradition in economic geography dates as far back as Harris (1954). Redding and Venables (2005), in the same framework as Fujita, Krugman and Venables, examined the wage equation empirically and found market potential to be an economically significant determinant of the cross country variation in income. Recent research by Head and Mayer (2011) and Jacks and Novy (2016), amongst many others, again working in the homothetic framework, supports the idea that market potential is a key determinant of cross-country incomes over the long run.

The remainder of the paper is organized as following. Section 2 outlines the theoretical framework based on the model developed by FK; here we show a simple derivation of the wage

[2] Related empirical work establishing links between incomes per capita, the income distribution and the volume of bilateral trade includes Choi, Hummels, and Xiang (2009), Eppinger and Felbermayr (2015), and Mitra and Trindade (2005).

equation relating factor payments to market potential within the FK framework; Section 3 presents our empirical findings; we replicate the gravity regressions from FK and use these estimates to build measures of market potential. We go on to relate the cross-national income distribution between 1996 and 2011 to our measure of market potential. Section 3.5 provides a comparison to the homothetic version of market potential. Section 4 discusses a trade liberalization scenario and the impact on welfare for a quantitative comparison to results in Section 3. Section 5 concludes.

2. Model

2.1 Gravity

We follow the international trade setup in FK (2016) which is based on an Almost Ideal Demand System (AIDS) expenditure system. The AIDS system is an approximation of many different demand systems that satisfy key economic properties. AIDS features non-homothetic preferences and product-specific income elasticities. AIDS allows for flexible patterns of substitution and the aggregate equilibrium expenditure relationship is a function not only of relative prices but also average expenditure (i.e., per capita income) *and* the distribution of expenditure (i.e., within country income inequality in our setup).

The world consists of a finite number of D destinations $(1,\ldots,D)$ with index d and the same set of source or exporting countries $(1,\ldots,S)$ indexed by s. We impose an Armington assumption so that each country produces one product.[3] As in FK, each variety's demand has its own income elasticity such that demand for backpacks from China might decrease with income while demand for backpacks from Denmark could increase with income.

Suppliers in source country s produce their good under perfect competition at price p_s. Labor is the only factor of production and each country has a productivity level Z_s. With perfect competition and constant returns to scale, the prevailing wage, adjusted for the national-level of productivity is $w_s = p_s Z_s$. Heterogeneity across households within country s is due to differing endowments of units

[3] FK build their model up from the broad sector level and then aggregate up at the country level. The income elasticity we estimate is the scaled average income elasticity at the country level. Results below are not significantly different when using the sectoral approach.

of labor, z_h, so that household *h* receives an income $x_h = w_s z_h$. Country *s* then has an average income $\overline{x}_s = w_s \overline{z}_s$. The income dispersion in country *s* is characterized by a Theil index Σ_s.

There are international and domestic trade costs such that in order to receive one unit of a product in country *d* $\tau_{sd} \geq 1$ units must be shipped. We assume throughout that domestic trade costs equal one. With this assumption, the price per-unit paid in destination *d* for the product with origin *s* is $p_{sd} = \tau_{sd} p_s$.

Working with the expenditure share in country *d* for the value of imports from origin *s* it is possible to formulate a gravity equation of bilateral trade. After imposing some assumptions on the (semi) elasticities of substitution between products (γ) to simplify the algebra (see expression (21) in FK), the share in total expenditure Y_d of exports in a given sector from country *s* to country *d*, X_{sd}, in country *d* is given by

$$\frac{X_{sd}}{Y_d} = \alpha_{sd} - \gamma \ln\left(\frac{\tau_{sd} p_s}{\overline{\tau}_d \, \overline{p}}\right) + \beta_s \left[\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right] \tag{1}$$

where the product of $\overline{\tau}_d = \exp\left(\frac{1}{D}\sum_{d=1}^{D} \ln(\tau_{sd})\right)$ and $\overline{p} = \exp\left(\frac{1}{D}\sum_{d=1}^{D} \ln(p_d)\right)$ allows for multilateral resistance to matter for bilateral trade flows.

The last term in (1) features the exporter specific income elasticity of its product, β_s, which determines the partial effect on the expenditure share of a rise in "adjusted real income" (the sum of real average income of the importing country $\frac{\overline{x}_d}{a(\mathbf{p}_d)}$ and the Theil index). The latter component of adjusted real income is a measure of inequality. Note that $a(\mathbf{p}_d)$ is a homothetic price index as defined in FK. We also call attention to the fact that $\sum_{s=1}^{S} \beta_s = 0$. We impose FK's assumption that the preference parameters α_{sd}^j, for sector *j*, consist of an exporter fixed effect α_s, a sector fixed effect and a zero mean, finite variance disturbance at the sector, importer level, $\alpha_{sd}^j = \alpha_s(\alpha^j + v_d^j)$. The restriction that $\sum_{s=1}^{S} \alpha_s = 1$ is also imposed. After aggregating across sectors and imposing market clearing (the sum of world sales equals supplier income) the bilateral gravity relationship is given by

$$\frac{X_{sd}}{Y_{dt}} = \frac{Y_s}{Y_W} - \gamma T_{sd} + \beta_s \Omega_d \tag{2}$$

where world income $Y_W = \sum_{s=1}^{S} Y_s$. We also have

$$T_{sd} = \ln\left(\frac{\tau_{sd}}{\bar{\bar{\tau}}_d}\right) - \left[\sum_d \frac{Y_d}{Y_W} \ln\left(\frac{\tau_{sd}}{\bar{\bar{\tau}}_d}\right)\right]$$

$$\Omega_d = \left[\ln\left(\frac{\bar{x}_{dt}}{a(\mathbf{p}_{dt})}\right) + \Sigma_{dt}\right] - \left[\sum_d \frac{Y_d}{Y_W}\left(\ln\left(\frac{\bar{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right)\right].$$

which show that bilateral factors matter relative to 'mulitlateral' forces in the spirit of Anderson and van Wincoop (2003).

The property of the demand system that all income elasticities sum to 0 implies some exporters will have negative income elasticities while others will have positive income elasticities. Countries with negative income elasticities have inferior goods and will see declining expenditure shares in the destination as the destination country becomes richer or income becomes more unequally distributed. Exports from a low income, inferior good producing country would decline as its partner country (or countries) developed. The reason why the income elasticity has the same impact on trade for changes in inequality as for changes in average income is because of aggregation. Inequality turns out to be associated with a higher level of income in the "representative" budget (Deaton and Muellbauer, 1980) in this demand system.

2.2 Market Potential and the Wage Equation

The gravity equation also depends in a simple way on supply forces. This allows us to find a relationship between nominal per capita income (i.e., payments to immobile factors of production or wages in this case) and international demand. The motivation for what has come to be called the "wage equation" comes from traditional models in the new economic geography in the vein of Fujita, Krugman, and Venables (1999). These models, based on homothetic demand, produce a tight equilibrium relationship between payments to the factors of production and "market potential" referred to as a "wage equation". In these models, market potential is a function of the economic size of destination markets, proxied by total income, each destination's income being weighted by its distance (i.e., trade costs) to the source country. In such a model, with constant marginal costs and a representative household, countries have higher prices and wages when demand is high for its output. This occurs when foreign (and domestic) total income is higher and the destinations are more proximate.[4] Similar logic applies in the non-homothetic demand system albeit with a different functional form. We derive an equilibrium "wage equation" in this demand system. The equation relates income per capita (payments to factors of production) to terms involving foreign demand and trade costs that are very similar in spirit to the market potential term in standard homothetic models. However, unlike in a homothetic model, non-homothetic demand implies that the impact of foreign demand depends on the trade partners' income elasticities. In addition, foreign demand is related positively to per capita income and income inequality rather than total income in the homothetic/CES setup.

To derive the wage equation, we use the expression for nominal wages $w_s = p_s Z_s$ to substitute for p_s in equation (1) and the fact that the sum of sales across all destinations, $\sum_d x_{sd}$, must equal total income Y_s.[5] Using equation (1), the following relationship between "adjusted wages", $\gamma \ln(w_s) + \frac{Y_s}{Y_W}$, in country *s*, trade costs and supply and demand forces is given by

$$\gamma \ln(w_s) + \frac{Y_s}{Y_W} = \ln(Z_s) + \sum_d \frac{Y_d}{Y_W} \alpha_{sd} + \left[\sum_d \frac{Y_d}{Y_W}\left[\beta_s\left(\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right) - \gamma \ln\left(\frac{\tau_{sd}}{\overline{\tau}_d\, \overline{p}}\right)\right]\right].^{6} \quad (3)$$

It is clear by inspection of (3) that wages are positively related to a difference between destination income and trade cost terms very similar in spirit to a market potential measure derived from a homothetic model of demand. In this regard, the expression for market potential for country *s* in the AIDS framework, $MP_{s,NH}$, is given by

$$MP_{s,NH} \equiv \sum_d \frac{Y_d}{Y_W}\left[\beta_s\left(\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right) - \gamma \ln\left(\frac{\tau_{sd}}{\overline{\tau}_d\, \overline{p}}\right)\right]$$

[4] Proper allowance for general equilibrium forces is allowed via the exponentiated CES price index.
[5] Note that the gravity equation which determines x_{sd} is a function of income of the source country via the supply price term. Trade deficits and surpluses do not in principle matter when real expenditure is used in the market potential term since local income in country *s* is in the model and what we study empirically. However, to achieve global balance between income and expenditure, shift terms can be included. In practice these effects are likely to be small and unimportant here.
[6] See appendix B for a short derivation.

The first term in brackets is the modified demand shifter, a weighted average of destination incomes per capita and destination income inequality $\left[\sum_d \frac{Y_d}{Y_W} \beta_s \left(\ln\left(\frac{\bar{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right)\right]$. Note that the income elasticity of the home country *s* matters here. The second term is a weighted average of bilateral trade costs relative to average or "multilateral" trade costs in the destination country $-\gamma\left[\sum_d \frac{Y_d}{Y_W} \ln\left(\frac{\tau_{sd}}{\bar{\tau}_d\,\bar{p}}\right)\right]$.

The wage equation is useful for studying changes in source country nominal wages given a change in the export opportunities of an exporter. Were we to estimate this equation using the data, we should not think of the partial effect of market potential on wages as a general equilibrium effect but rather a partial equilibrium effect. The wage equation does not account for the general equilibrium effects on prices and incomes of exogenous changes in technology or trade costs but rather estimates the equilibrium relationship defined by this particular model. As used and under standard assumptions, the wage equation can also be used to understand better the forces that shape variation in the global distribution of (nominal) incomes and possibly even which model best describes the process of international trade. Higher market potential due to changes in trade costs or destination market adjusted incomes requires nominal payments to factors to be higher in order to satisfy the general equilibrium conditions of the international trade model. Generally speaking, the wage equation relation is not too useful in isolation for studying the general equilibrium impact of a change in market potential unless such a change is relatively small. It can be useful in verifying the properties of the model, for comparing different explanations for trade and global income distributions and so forth. We explore a welfare calculation below which highlights the gains from trade better than the wage equation.

Nevertheless, wages are related in an interesting and novel way to destination demand shifters compared to other standard homothetic models such as a CES or homothetic translog model. Income per capita is always increasing in market potential when market potential is defined as the entire term in brackets in (3). However, income in country *s* is not always increasing in destination market incomes but instead *declines* when $\beta_s < 0$. While richer and more unequal destination markets are associated with higher adjusted wages for high income elasticity suppliers, foreign market incomes have *the opposite relationship* when $\beta_s < 0$. This result stems from the Engel curves implicit in the demand system. If a country *s* supplies low income elasticity goods, then foreign growth may indeed shift demand away from that source country This dynamic highlights an open-economy demand channel for economic growth which is a feature in the literature (e.g., Matsuyama, 2000).

3. Empirical Results

We proceed by estimating the non-homothetic gravity equation to show that this relationship provides a good fit for the bilateral export data, to establish that our baseline estimations are in line with FK's estimations and to provide estimates of the income elasticities and trade cost parameters. We then use these parameter estimates to obtain an estimate of market potential. The market potential term is the key explanatory variable in estimating (3). We then provide some robustness checks and a simple comparison between how well the non-homothetic market potential measure and a CES-based measure of market potential predict GDP per capita.

3.1 Data

Our data consist of a balanced panel of 40 countries for the benchmark years 1996, 2001, 2006, and 2011. For bilateral trade data we use the 2013 release of the WIOD (Timmer et. al. 2015). This version of WIOD records gross flows across 35 sectors and between 40 countries. We aggregate final and intermediate use together. For trade cost proxies like distance, language and shared border we rely on data from CEPII (Mayer and Zignago, 2011). We use the Penn World Tables to quality adjust prices (Feenstra and Romalis, 2014). For nominal GDP we used data from the World Bank World Development Indicators. Real GDP per capita is from the Penn World Tables. Gini coefficients are obtained from the Standardized World Income Inequality Database version 5.0.[7] We average trade data with a three year average of trade values centered on the indicated sample years. The exception, due to data availability is 2011 when we use data from 2009, 2010 and 2011. More recent data from WIOD are available from 2012 onwards, but the sectors are not easily matched across samples.

3.2 Gravity

Table 1 shows results of estimating the following gravity equation (4), which is based on equation (1), for each year in our sample as well as two pooled panel models with respectively country-pair random effects and country pair fixed effects:

[7] Refer to Solt (2014) for detailed information on the database.

$$\frac{X_{sdt}}{Y_{dt}} - \frac{Y_{st}}{Y_{Wt}} = -\gamma_t T_{sdt} + \beta_{st}\Omega_d + \eta_{sdt}.^{8} \tag{4}$$

Throughout what follows, we impose the following functional form for trade costs $\tau_{sd} = dist_{sd}^{\rho} b^{\delta_{1sd}} \lambda^{\delta_{2sd}} \tilde{\eta}_{sd}$ where $dist_{sd}$ is the bilateral distance between countries, δ_{1sd} is an indicator equal to 1 when two countries do not share a border, δ_{2sd} equals 1 when two countries do not share a common language, *b* measures the tariff equivalent of the trade cost when two countries do not share a border, λ measures the tariff equivalent of trade costs when two countries do not share a border and η_{sdt} is a random, unobservable component at the country-pair level. We include domestic trade flows in all regressions.

Table 1 shows that distance is negatively and significantly associated with bilateral trade shares, while not sharing a common language and not sharing a border are associated with higher trade costs and lower trade shares. We also note that the point estimates on our trade costs are remarkably stable across time both in terms of their magnitude and their statistical significant in the separate cross-sections. In the pooled panel models, the coefficient on distance is estimated at one half to one quarter of the size it attains in the cross-sectional models of columns (1) through (4).The penalty for not sharing a language is decreased in magnitude by about 30% using pooled data. On the other hand, the tariff equivalent of not sharing a border increases.

The gravity regressions in Table 1 also provide estimates of country-level income elasticities as in FK which we do not directly report. Evidently in columns (1)-(4) identification of these income elasticities is from cross-sectional variation in demand. Columns (5) and (6) use time series and cross-sectional variation. Figures 1A-1D plot the univariate regression line for the regression of the logarithm of GDP per capita on our estimates of β_{st}. Our results are strongly consistent with those of FK's. Both their data and our replication show a strong positive relationship between GDP per capita and β_{st}.

[8] Since the distance proxy is time-varying in this framework, pair fixed effects do not preclude estimation of the relevant trade cost parameters on the distance term. The error term involves other terms from the mulitlateral trade costs function as in FK footnote 28.

In several sets of un-reported gravity regressions we are able to find some quantitative changes in the estimated βs. In particular we weighted the gravity regressions by population of the destination. Here the fit between β and GDP per capita is positive but much tighter. We also allowed for the square of the adjusted income term Ω_d along the lines of Banks, Blundell and Lewbel (1997). We calculated the marginal effect of Ω_d at each destination's level of adjusted aggregate income $\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d$. In this specification the relationship between per capita GDP of the exporter and the income elasticity is negative but not statistically significant. Using importer fixed effects in order to use within-importer time variation also generates a positive relationship, but the point estimate on real per capita GDP is not significant.

In general a strong positive relationship emerges between the log of income per capita and the estimated βs with some notable counter-intuitive outliers like Austria, Belgium, Germany and France (visible in Figure 1D).These countries estimated βs also behave more in line with the expectation that richer countries have higher income elasticities in the panel gravity regression (columns (5) and (6)) becoming positive or larger. It should be noted that our estimates of country-level total market potential are sensitive to the sign of the income elasticity. Indeed, using the cross-sectional gravity estimates, we find that German and French market potentials are on the decline over time. Using the gravity panel estimates show rising or stable market potentials. In any case, because the relative rankings are ostensibly not too dis-similar from specification-to-specification so that our wage regressions are stable—as we will show below.[9]

For two large and important countries in the developing world, we observe interesting results. The point estimate for China, $\hat{\beta}_{China}$, increased and became positive between 1996 and 2011 moving from -.005 (s.e. = 0.025; 95% C.I. -0.055 to 0.044) to 0.01 (s.e. = .02 ; 95% C.I. -0.03 to .05). For India, the opposite happened. The point estimate for India, $\hat{\beta}_{India}$, started negative and became more negative falling from -.028 (s.e. = 0.03 ; 95% C.I. -0.09 to 0.03) to -0.05 (s.e. 0.04; 95% C.I. -0.13 to 0.04) over the same 15 year period. Again, these estimates have interesting implications for how the

[9] One possibility is that much of international trade occurs in intermediates and not in final products. It may be possible that exports of these products tend to produce estimates of lower income elasticities since many of these countries offshore assembly and export intermediate goods to low income countries. Competition for such products is lower in these destinations than in the leading countries leading to rising (unconditional) trade shares with low-income countries. We replicated FKs sectoral gravity regressions and found similar patterns to those described above in the one sector model across nearly all sectors and in three aggregate sectors (food, manufacturing, and services). Since our wage regressions are robust to the various specifications of gravity we do not pursue this issue further.

domestic component of market potential changes, but they do not necessarily have a great impact on relative market potential measures.

3.3 Wage Equation

We now turn to estimating the wage equation in (3). Our estimating equation is implemented as follows:

$$\ln(w_{st}) + \frac{Y_{st}}{Y_W} = \phi_0 + \phi_1 \left[\sum_d \frac{Y_{dt}}{Y_W}\left[\hat{\beta}_{st}\left(\ln\left(\frac{\overline{x}_{dt}}{a(\mathbf{p}_{dt})}\right) + \Sigma_{dt}\right) - \hat{\gamma}_{st}\ln\left(\frac{\hat{\tau}_{sdt}}{\overline{\tau}_d\ \overline{p}}\right)\right]\right] + \epsilon_{st} \tag{5}$$

where $\ln(\hat{\tau}_{sdt}) = \left(\hat{\rho}(\ln d_{sd}) + \hat{b}\delta_{1sdt} + \hat{\lambda}\delta_{2sdt}\right)$. Additionally, $\hat{\beta}_{st}$ indicates the estimated income elasticities from the four cross sectional estimates in Table 1 columns (1)-(4). Alternatively we employ the estimates from the panel gravity model and drop the time subscripts on these coefficients. Both variables are "generated" regressors and are time varying but come from cross-sectional estimations. Given that these regressors are "generated" we bootstrapped the standard errors in un-reported results and results are strictly qualitatively the same as our reported results. We use nominal GDP per capita for w_{st} and then real GDP per capita in our robustness checks.

As equation (3) shows, it is potentially advantageous to estimate this relationship using panel data so as to be able to use country fixed effects to proxy long-run cross-country differences in the productivity parameter. We control for population size throughout to deal with differences in relative factor endowments. We assume the product preference shocks are constant across exporters and across time. If these factors are time-varying and correlated with either the trade cost term or the world income shifter then our estimates may remain biased. We assume these variables are uncorrelated.

Table 2 shows our results first in year-by-year cross-sectional regressions and then for two variations of a panel data approach. All regressions are weighted by population or average population in the panel fixed effects model. The wage equation shows a positive and statistically significant relationship in all specifications. In the cross sections, each one standard deviation rise in market potential (roughly equal to 0.05) is associated with a one half standard deviation rise in the dependent variable. In columns (5) and (6) which include random effects or country fixed effects these values are reduced to about one-fifth or one-third of a standard deviation respectively. The r-squareds are high in both the cross sections and in the panel fixed effects model at roughly 0.9.

The positive relationship holds in long-run changes as well. Figure 2A shows the conditional added variable plot for long-changes in the dependent variable between 1996 and 2011 and the long change in market potential. We use the values of market potential from the cross-sectional gravity regressions to create the differences. A strong, positive and statistically significant association between changes in income and market potential is visible. As we mentioned above, there is some difference in the estimated betas over time and depending on the gravity model estimated. In particular, the sign of the income elasticity can change between specifications. In Figure 2B we use the income elasticities from the panel gravity model. In terms of explaining cross-country variation in adjusted wages, the effect of this inconsistency is not qualitatively consequential.

While the relationship in Table 2 bears resemblance to the standard positive relationship seen in the literature (Redding and Venables, 2004; Head and Mayer, 2011; Jacks and Novy, 2016) there is a significant difference in our results due to the non-homotheticities captured in the theoretical model. While trade cost reductions always raise market potential and are associated with a rise in incomes as long as $\phi_1 > 0$, for countries with negative income elasticities, higher income in their trading partners shifts demand away from domestic products and as a consequence this could lead to lower adjusted wages.

Changes in market potential are obviously related to time-variation in the country-level point estimates of the income elasticities. According to our cross sectional estimates, the income component of market potential for the USA peaked in 2001 and has fallen by one half between 2006 and 2011 while for Japan it has monotonically declined by as much as 30% between 1996 and 2011. In the major countries of the developing world in our sample, trends are the exact opposite. China has seen a relentless rise in its destination income component — due partially to the rise in the income elasticity of its exports. On the other hand, for India this part of market potential has stayed relatively flat in accordance with its near-constant (and negative) income elasticity of exports.

As for the trade costs term, the evolution of this term depends heavily on the location of economic activity since our three proxies for trade costs are time invariant. As factory-Asia has expanded and China's global income has risen meteorically, trade weighted trade costs fallen for countries in Asia. In several countries, the trade cost component increased, implying higher international trade costs. This is true for the USA, Canada, France, and Germany. Despite Japan's proximity to China, its falling world income share has led to a fall in its economic proximity. Korea, China, India, and Indonesia posted increases in their measured proximity. Amongst this group, China witnessed the largest increases.

3.4 Robustness and Alternative Specifications

In Tables 3 through 5 we explore several different robustness checks. In Table 3 we substitute real GDP per capita for nominal GDP per capita as the dependent variable. Results here are qualitatively similar to those in Table 2. Table 4 separates out domestic and foreign market potential. When both components of market potential enter the regression simultaneously, both are significant and positive in most specifications. The exceptions are in 2011 and in the random effects panel when the point estimate on foreign market potential is reduced in size and is statistically insignificant. In un-reported regressions, we drop domestic market potential, a variable likely to suffer from endogeneity or simultaneity bias. In these regressions, the coefficient on foreign market potential is always significant and of the same magnitude as in Table 2 even in the random effects specification.

3.5 Comparison of CES and AIDS/Non-Homothetic Market Potential

We provide one benchmark comparison for the non-Homothetic market potential measure by making a comparison to market potential generated from a constant elasticity/constant markup (CES) homothetic demand system. The latter was first systematically estimated from gravity models based on the homothetic CES setup in Fujita, Krugman and Venables (1999) by Redding and Venables (2004). Jacks and Novy (2016) provide a new and elegant derivation of market potential in a CES-homothetic model based on observable trade and income data and a plausible functional form for trade costs. They have kindly shared their data with us for the years and countries in which our sample overlaps. Using our notation for subscripts and letting σ be the elasticity of substitution across varieties of products, their measure is given as:

$$MP_s^{CES} = \frac{Y_s Y_W}{(\tau_{ss}^{\sigma-1} X_{ss} Y_W)^{\frac{1}{2}}}.$$

Figures 4 and 5 show scatter plots and a regression line for a simple univariate relationship between the logarithm of GDP per capita and both $MP_{s,NH}$and MP^{CES} in 2006 the latest year for which we have an overlapping sample available.

$MP_{s,NH}$ dominates MP^{CES} based on simple measures of regression goodness of fit and statistical significance. Both measures of market potential are statistically significant. The t-statistic for $MP_{s,NH}$ is 3.5 while that for MP^{CES} is 2.60. The R-squared and RMSE for $MP_{s,NH}$ are 0.43 and 0.97 while for MP^{CES}they are 0.12 and 1.18. While the CES model grants Belgium the title of largest market potential, the non-homothetic model suggests that the USA has the largest market potential which we believe is overwhelmingly consistent with intuition about relative market sizes and what we know about the trade costs facing small economies. Both models rank China near the median level of market potential. A rank correlation test fails to reject the hypothesis that the two measures are significantly different however.

Figures 5 and 6 show how model-based predictions of GDP per capita vary between the CES and the NH models. The predicted values for the logarithm of GDP per capita are plotted versus the actual levels with a 45-degree line. The predictions from the non-homothetic model lie significantly closer to the 45-degree-line and therefore provide better predictive power in levels. This result seems to obtain because at the lower end of the world income distribution the CES model predicts much higher market potential than the levels of GDP per capita warrant (e.g., China, Indonesia and India) while Australia and Canada have much lower market potential in the CES-based measure than these large and poor developing countries. This feature is likely because the CES model fails to take into account the importance of GDP per capita and the income distribution. The non-homothetic model penalizes (correctly as far as intuition is concerned) large countries like Indonesia, India, Brazil and to an extent China for their low levels of income per capita.

A caveat is due however when we investigate the dynamics of GDP per capita versus changes in market potential. Here, both models seem roughly equivalent. In Figures 7A-7C we plot the actual changes in the logarithm of GDP per capita between 1996 and 2006 against changes in both the CES and the NH measures of total market potential. Without Belgium in the CES model, both models have nearly the same RMSE (0.24) and R-squared values (0.45).[10] The regression of predicted changes in income on actual changes in income using the CES model has an R-squared double that of the NH model (0.42 vs. 0.2) while the RMSE is about equivalent. The coefficient in the CES model is larger and closer to 1 (0.45, s.e. 0.10, 95% C.I. 0.23 to 0.68) versus that or the NH model (0.23, s.e. 0.07, 95% C.I. 0.08 to 0.37). . Figures 8A-8C show the predicted values of the logarithm of GDP per capita from these regressions versus the actual values. In sum, the CES model, when excluding the anomalous case of Belgium does about equally well in predicting medium horizon changes in incomes as the NH model.

4 Welfare Calculation under Lower International Trade costs: an Illustrative example

Using the techniques established in FK to investigate welfare changes in the AIDS context (especially equations (32)-(36)), we study the welfare implications of a 10% decline in distance related trade costs for each importing country. The magnitude of this decline is near the fall in the average of bilateral trade costs between 1970 and 2000 reported by Jacks, Meissner and Novy (2013). The objective here is three fold. First we want to investigate the relative magnitude of the homothetic and the non-homothetic contributions to welfare changes. Second we want to compare the welfare changes to the reduced form regression results from section 3.2. Finally, we are able to illustrate a relationship between international trade costs and both the average income elasticity a country faces from its international trade partners and its own income elasticity.

FK derive the equivalent variation welfare change in the context of their AIDS model which we follow exactly. The key relationships are given here, but we refer the reader to the full derivation in FK (2016). We study a 10% decline in trade costs related to distance between international trade partners. We investigate only the aggregate welfare effects of a trade shock in a single sector version of FK. We do not calculate the within country distributional effects studied by FK. As in FK we

[10] As per theory, we include the world share of expenditure on the right had side when in the AIDS/NH model. Leaving Belgium out of the sample benefits the CES approach since the CES model creates an outlier out of Belgium by giving it the largest rise in market potential of all countries.

normalize the importer's wage to 1. Paired with the simple supply side assumption, domestic prices and nominal wages do not change in this experiment. The trade cost shock affects welfare through relative price changes and also by affecting real aggregate income, $y_d = \ln\left(\frac{\bar{x}_d}{a(\mathbf{p}_d)}\right)$. To calculate welfare we rely on the following relationships. First the change in expenditure shares follow

$$\hat{p}_{sd} - \hat{p}_{dd} = \hat{p}_{sd} = -\frac{dS_{sd} - dS_{ss}}{\gamma} + \frac{1}{\gamma}(\beta_s - \beta_d)dy_d$$

where the first equality is due to the normalization and the supply side assumption and we have $\hat{p}_{sd} = d\ln(p_{sd})$.[11] The total welfare gains are composed of changes related to the homothetic (*H*) contribution and to the non-homothetic contribution (*N*) as follows

$$\widehat{W}_d = \widehat{W}_{H,d} + \widehat{W}_{N,d}$$

With

$$\widehat{W}_{H,d} = \sum_{s=1}^{S} \frac{1}{\gamma} S_{sd}(dS_{sd} - dS_{ss})$$

$$\widehat{W}_{N,d} = \sum_{s=1}^{S} \frac{1}{\gamma} S_{sd}(\beta_d - \beta_s)dy_d$$

Simplifying expression (36) in FK for dy_d yields

$$dy_d = \sum_{s=1}^{S} (S_{sd} - \beta_s y_d)\hat{p}_{sd}$$

Together these expressions provide a full characterization of the marginal impact on welfare of incremental changes in trade costs. We numerically integrate this system solving for the aggregate welfare change for each of the 40 countries in our sample. Table 5 shows the overall gains and the homothetic and non-homothetic contributions in log points (x 100). The average (median) overall welfare gain is 2.0 (1.9) with a standard deviation of 1.0. Most of the welfare gains are accounted for by the homothetic component with an average contribution of the homothetic share of 99.6% (minimum = 95.7%, maximum = 1.03%, std. deviation = 1.3).

[11] We recover γ by assuming ρ = 0.177 as in FK.

Interestingly the homothetic component over-accounts for welfare changes in 15 out of 40 countries all of which have negative point estimates for their income elasticities and negative expenditure weighted differences between estimated destination and estimated source income elasticities defined as $\sum_{s=1}^{S} S_{sd}(\beta_d - \beta_s)$. China is an exception with a positive estimated income elasticity of 0.008 and overall welfare gains of 0.8271 ($\widehat{W}_{H,China} = 0.828, \widehat{W}_{N,China} = -0.00095$). China's negative weighted differences in income elasticities explains this fact. The countries with the largest decline in welfare due to non-homotheticities include Belgium, Canada, India and Mexico all of which have some of the smallest own income elasticities and all of which have negative weighted income elasticity differences. It should be recalled that in our baseline estimation for 2006 Germany and France also have negative income elasticities and see similar albeit smaller (in absolute value) effects related to this. The relationship between weighted differences in the income elasticities and the non-homothetic welfare component is plotted in Figure 9.

The somewhat non-intuitive result here is that the equivalent variation change in welfare would fall if importer income elasticity is negative and would rise in the case a foreign good was an inferior good. This is a natural consequence of the definition of the equivalent variation and the particular experiment we study. In this case, the fall in the relative price of products sourced from inferior-good producing nations increases the amount of income needed to be indifferent between consumption at the old prices and the new prices because these goods are not preferred. Oppositely, if a country's own income elasticity is negative then the welfare increase is smaller. The relative price increase arising from the liberalization which drives consumers away from these inferior goods (i.e., the expenditure effect) requires lower compensation.

5 Conclusions

We have investigated the relationship between trade costs, the location of economic activity and global income inequality over the last two decades. We apply the AIDS system as developed in Fajgelbaum and Khandelwal (2016). This model allows for non-homotheticities in demand. The conceptual advantage to this approach is that it allows for the possibility that nations produce different types of goods that might be inferior or luxury goods. The approach also allows income inequality and GDP per capita to matter for the direction of trade.

We apply the AIDS/gravity approach to a panel of countries and find gravity regression results ultra-consistent. Non-homothetic gravity provides plausible and highly stable relationships between directional expenditure shares and common proxies for trade costs. We also leverage the gravity relationship in the AIDS model to derive a measure of market potential. Market potential relies on two terms: a trade cost term and a demand shifter. The latter encompasses an interesting interaction between the level of demand and the structure of domestic production. The most novel finding conceptually is that greater foreign demand does not necessarily promote higher sales and wages. The standard positive effect of foreign income on source incomes occurs only when a country's income elasticity of exports is positive. On the other hand, for a country with a negative income elasticity assume consumers' incomes per capita rise. In this case local income would fall since the products would lose market share. The negative effect could be offset if inequality were reduced at the same time. Multiple other combinations of this effect are possible and merit further exploration.

Finally we explore one welfare calculation in a counterfactual in order to see how the reduced form equilibrium wage equation regressions compare to a structural welfare calculation. Here we find that welfare impacts are heterogeneous when we use the model-based approach. However, our average effect of a rise in one-half of a standard deviation or 0.5 log points from the regressions in Table 2 is comparable to the average welfare change using model-based counterfactuals. In principle one could also explore the welfare implications of a change in foreign incomes which will shed light on how much countries are handicapped by exporting inferior goods.

Our bottom line is that greater access to foreign consumers via lower trade costs and higher spending power remain significant determinants of the world income distribution. Nevertheless, the benefits seem to be conditional on the supply side as much as the demand side. Understanding how the income elasticities of nations have evolved over time also merits further research. We are currently experimenting with longer-run historical data to see if a similar approach can be taken. A constraint is that income inequality measures are scarce in the past. Yet it may be possible to estimate non-homothetic gravity without this variable and still obtain reasonable point estimates.

Appendix A: Data

Bilateral Trade Data: WIOD world trade data http://www.wiod.org/home

Income Inequality: The Standardized World Income Inequality Database (SWIID) version 5.0.

Trade Cost Proxies: CEPII http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp

- Distance population weighted bilateral distances between cities
- Common border: 1 if two countries share a common land border 0 otherwise
- Shared language: 1 if two countries share an official language 0 otherwise.

Nominal GDP in US Dollars: World Bank, *World Development Indicators*

Real GDP: Penn World Tables

Quality Adjusted Prices: Data underlying Feenstra and Romalis (2014). We adjust expenditures using these data as do FK.

Population: Penn World Tables or World Bank *World Development Indicators*.

Appendix B: Derivation of the Wage Equation

Equation (1) can be written as

$$\frac{X_{sd}}{Y_d} = \alpha_{sd} - \gamma \ln\left(\frac{\tau_{sd}}{\overline{\overline{\tau}}_d\ \overline{\overline{p}}}\right) - \gamma \ln\left(\frac{w_s}{Z_s}\right) + \beta_s \left[\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right]$$

using $p_s = \frac{w_s}{Z_s}$.

Market clearing together with $\sum_d Y_d = Y_W$ yield

$$Y_s = \sum_d X_{sd} = \sum_d Y_d \alpha_{sd} - \gamma \sum_d \ln\left(\frac{\tau_{sd}}{\overline{\overline{\tau}}_d\ \overline{\overline{p}}}\right) Y_d - Y_W\, \gamma \ln\left(\frac{w_s}{Z_s}\right) + \beta_s \sum_d Y_d \left[\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right].$$

Rearranging and dividing through by Y_W, we find

$$\gamma \ln(w_s) + \frac{Y_s}{Y_W} = \ln(Z_s) + \sum_d \frac{Y_d}{Y_W} \alpha_{sd} + \left[\sum_d \frac{Y_d}{Y_W}\left[\beta_s \left(\ln\left(\frac{\overline{x}_d}{a(\mathbf{p}_d)}\right) + \Sigma_d\right) - \gamma \ln\left(\frac{\tau_{sd}}{\overline{\overline{\tau}}_d\ \overline{\overline{p}}}\right)\right]\right]$$

which provides an expression relating what we call "adjusted wages" to market potential ($MP_{s,NH}$) in large brackets. Adjusted wages equals factor payments (w_s) scaled by γ plus a country's share in world income.

If we further assume productivity is a constant plus a country specific, mean zero, error term ($Z_s = Z + \epsilon_s$) and $\alpha_{sd} = \alpha_s + \nu_d$ with $\sum_s \alpha_s = 1$ and $\sum_s \nu_s = 0$ we arrive at expression equivalent to equation (5). Our baseline assumption for the productivity parameter using panel data is that $Z_{st} = Z_s + \epsilon_{st}$ where Z_s is an unobservable proxied by a country fixed effect and ϵ_{st} is a mean zero finite variance error term.

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Table 1 Non-Homothetic Gravity Model, 1996-2011

	(1) 1996	(2) 2001	(3) 2006	(4) 2011	(5) Pooled	(6) Pooled
Distance	-0.04***	-0.04***	-0.04***	-0.04***	-0.01***	-0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
No Common Language	-0.20***	-0.18***	-0.18***	-0.19***	-0.15***	-0.16***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
No Common Border	-0.12***	-0.12***	-0.12***	-0.12***	-0.26***	-0.21***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Observations	1,600	1,600	1,600	1,600	1,600	1,600
Dyad fixed effects	---	---	---	---	yes	no
R-squared	0.521	0.518	0.504	0.508	0.686	0.477

Notes: Table reports OLS regression of equation (4). The dependent variable is the expenditure share for country *d* on imports from country *s* less an adjustment for the world income share of *s* as per the theoretical model discussed in the text. Estimation is by OLS. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2 GDP per capita vs Market Potential, 1996-2011

	(1) 1996	(2) 2001	(3) 2006	(4) 2011	(5) Panel	(6) Panel
MP	11.61***	9.91***	10.82***	9.94***	3.74***	7.71***
	(0.86)	(0.72)	(0.79)	(1.12)	(1.24)	(1.25)
ln (population)	-0.67***	-0.63***	-0.66***	-0.59***	-0.25***	-0.33
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.74)
Observations	40	40	40	40	160	160
R-squared	0.906	0.904	0.913	0.868	0.345	0.932
Number of countries	40	40	40	40	40	40
Year fixed effects	---	---	---	---	Yes	Yes
Country fixed effects	---	---	---	---	No	Yes

Notes: The dependent variable is the logarithm of GDP per capita in US dollars plus an adjustment for the level of the share of the country in world income. See text for an explanation. All regressions (except that in column 5) are weighted by the within country sample average population size. Estimation is by OLS. Robust standard errors in parentheses, clustered at the country level in columns 5 and 6. *** p<0.01, ** p<0.05, * p<0.1

Table 3 Real GDP per capita vs. Market Potential, 1996-2011

	(1) 1996	(2) 2001	(3) 2006	(4) 2011	(5) Panel	(6) Panel
MP	8.24***	6.65***	7.87***	7.08***	2.13***	5.36***
	(0.32)	(0.34)	(0.73)	(1.24)	(0.76)	(1.28)
ln (population)	-0.48***	-0.48***	-0.42***	-0.38***	-0.19***	-0.24
	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.74)
Observations	40	40	40	40	160	160
R-squared	0.935	0.920	0.915	0.844	0.339	0.931
Number of countries	40	40	40	40	40	40
Year fixed effects	---	---	---	---	Yes	Yes
Country fixed effects	---	---	---	---	No	Yes

Notes: The dependent variable is the logarithm of real GDP per capita in US dollars plus an adjustment for the level of the share of the country in world income. See text for an explanation. All regressions are weighted by the within country sample average population size. Estimation is by OLS. Robust standard errors in parentheses, clustered at the country level in columns 5 and 6. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4 Foreign and Domestic Market Potential vs. GDP per capita, 1996-2011

	(1) 1996	(2) 2001	(3) 2006	(4) 2011	(5) Panel	(6) Panel
Domestic MP	10.32***	7.59***	11.96***	17.95***	7.92**	8.38***
	(1.74)	(1.35)	(1.35)	(3.73)	(3.22)	(2.93)
Foreign MP	6.54***	5.87***	5.48***	1.26	0.34	2.63*
	(1.49)	(1.39)	(1.41)	(2.59)	(0.50)	(1.41)
ln (population)	-0.51***	-0.49***	-0.46***	-0.54***	-0.23***	-0.25
	(0.04)	(0.04)	(0.05)	(0.08)	(0.06)	(0.71)
Observations	40	40	40	40	160	160
R-squared	0.936	0.921	0.924	0.882	0.378	0.937
Number of countries	40	40	40	40	40	40
Year fixed effects	---	---	---	---	Yes	Yes
Country fixed effects	---	---	---	---	No	Yes

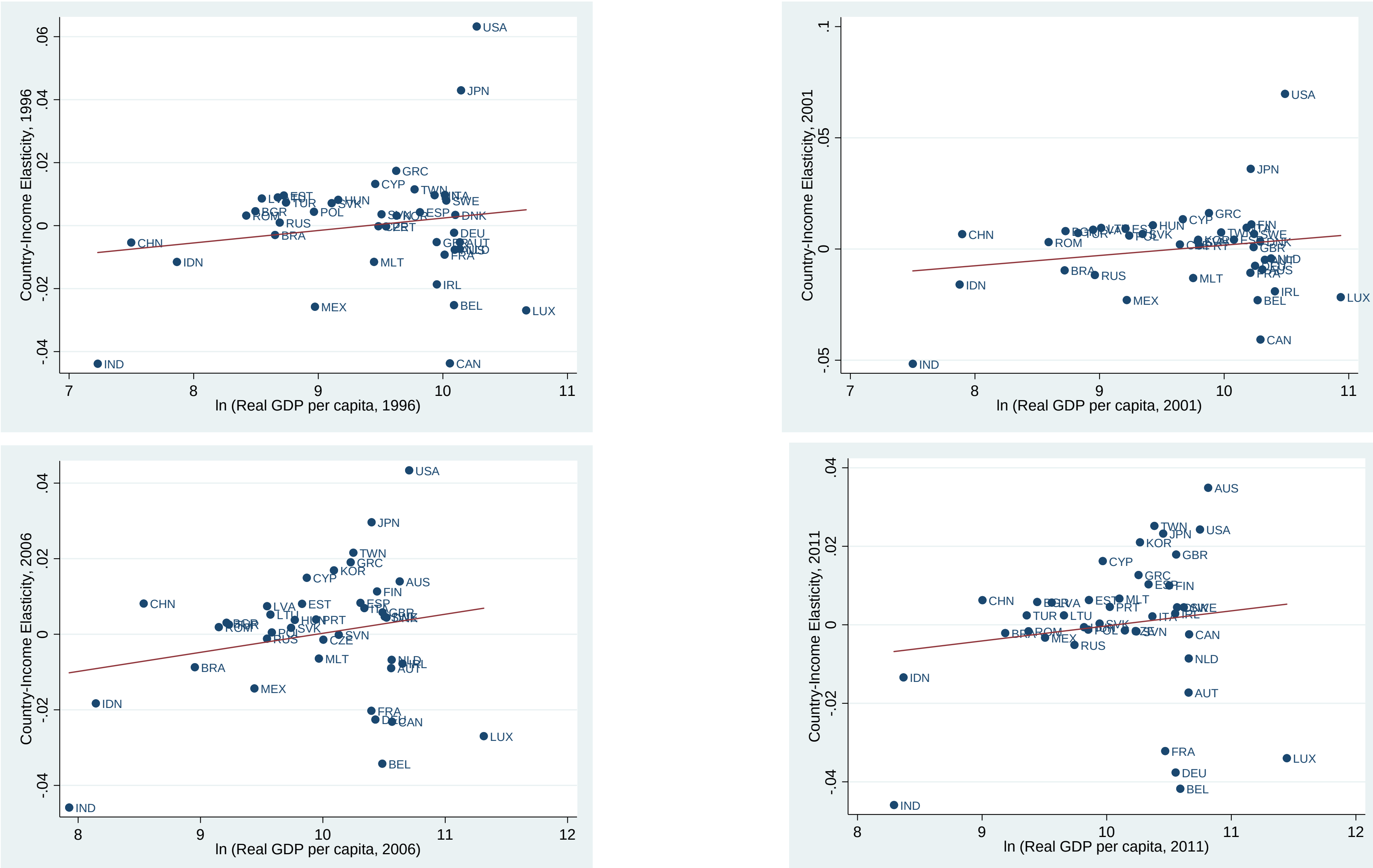
Notes: The dependent variable is the logarithm of real GDP per capita in US dollars plus an adjustment for the level of the share of the country in world income. See text for an explanation. All regressions are weighted by the within country sample average population size. Estimation is by OLS. Robust standard errors in parentheses, clustered at the country level in columns 5 and 6. *** p<0.01, ** p<0.05, * p<0.1

Table 5 Aggregate Welfare Gains from a 10 percent decline in International Trade Costs

ISO Country	Welfare Gain	Homothetic Component	Non-Homothetic Component	ISO country	Welfare Gain	Homothetic Component	Non-Homothetic Component
BRA	0.54	0.54	0.00	POL	1.90	1.90	0.01
JPN	0.57	0.56	0.01	ROM	2.03	2.02	0.01
IND	0.72	0.73	-0.01	SWE	2.04	2.03	0.01
USA	0.72	0.69	0.03	TWN	2.14	2.13	0.01
CHN	0.83	0.83	0.00	NLD	2.27	2.27	0.00
IDN	0.90	0.91	-0.01	CYP	2.30	2.27	0.03
AUS	0.90	0.90	0.00	DNK	2.30	2.29	0.01
RUS	1.03	1.03	0.00	LVA	2.35	2.33	0.02
TUR	1.09	1.09	0.00	AUT	2.40	2.40	0.00
ITA	1.17	1.16	0.01	BGR	2.57	2.56	0.01
KOR	1.25	1.25	0.00	CZE	2.68	2.67	0.01
FRA	1.28	1.28	-0.01	EST	2.80	2.78	0.03
GBR	1.31	1.30	0.01	LTU	2.84	2.82	0.02
ESP	1.36	1.35	0.01	SVN	2.86	2.84	0.02
MEX	1.53	1.56	-0.03	BEL	2.91	2.96	-0.06
GRC	1.66	1.63	0.03	SVK	3.12	3.10	0.02
CAN	1.72	1.75	-0.03	HUN	3.23	3.19	0.04
PRT	1.79	1.78	0.01	IRL	3.29	3.36	-0.07
DEU	1.81	1.83	-0.02	MLT	3.52	3.56	-0.04
FIN	1.85	1.83	0.02	LUX	5.02	5.19	-0.18

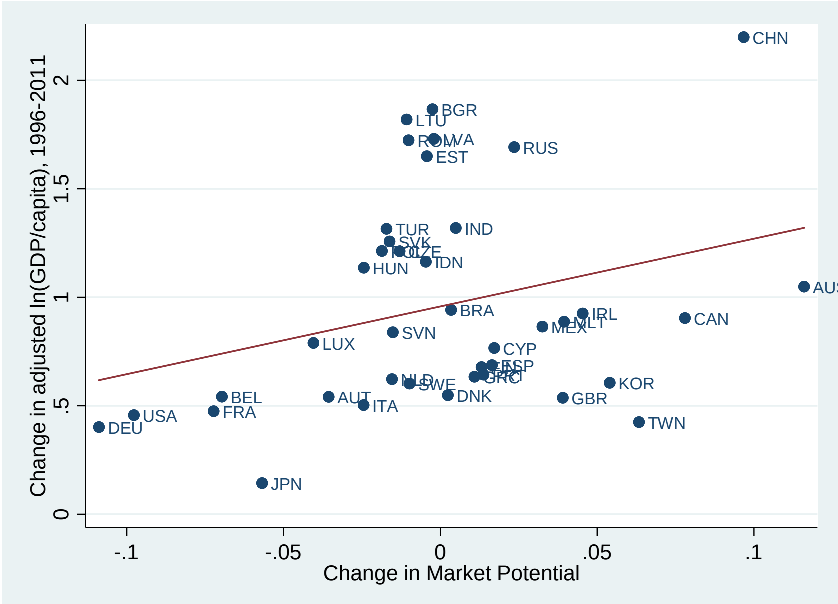
Notes: Table reports the equivalent variation in log points (x 100) for a 10 percent decline in prices of all imports. See Section 3.4 for calculations.

Figure 1A-1D Country-Specific Income Elasticities vs. logarithm of Real GDP per capita, 1996-2011

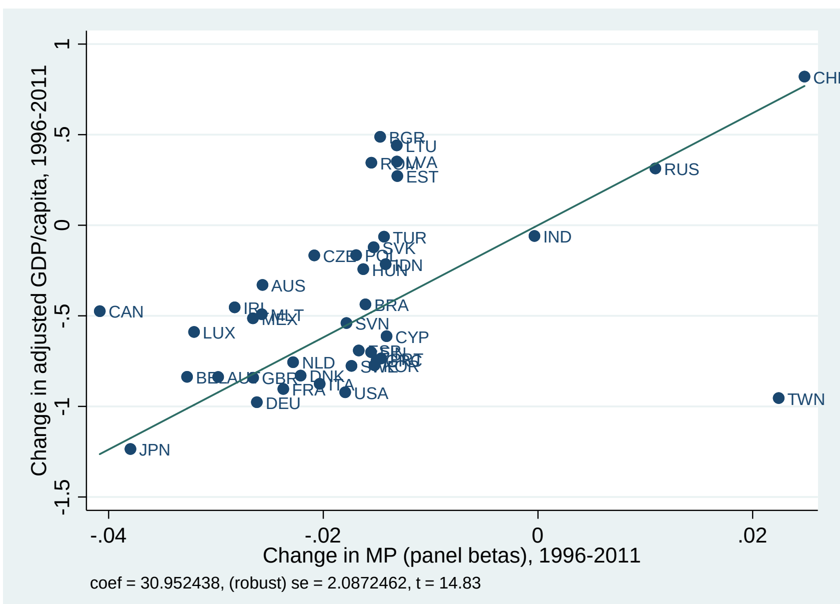


Notes: Income elasticities are estimated from gravity equation (3) for 2006.

Figures 2A-2B Changes in Adjusted GDP per capita 1996-2011 vs. Market Potential

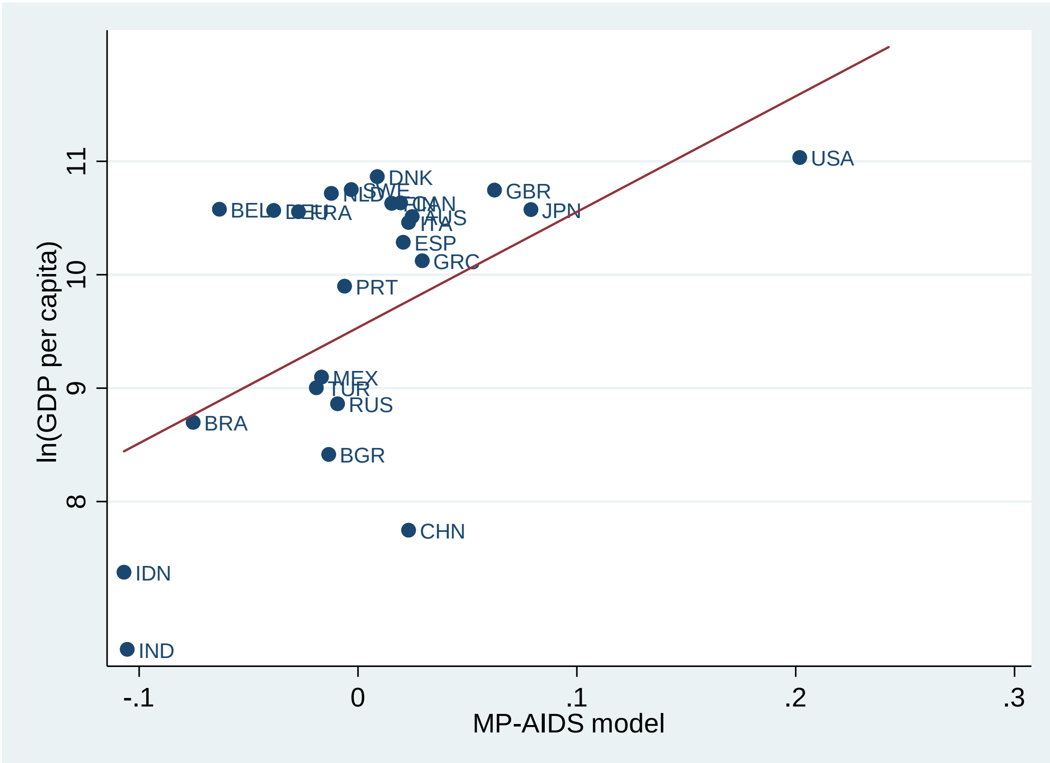


Notes: Figure shows the added variable plot from the population-weighted univariate regression of adjusted nominal GDP per capita on market potential (MP). Market potential is calculated from the cross-sectional non-homothetic gravity equation and equation (4).



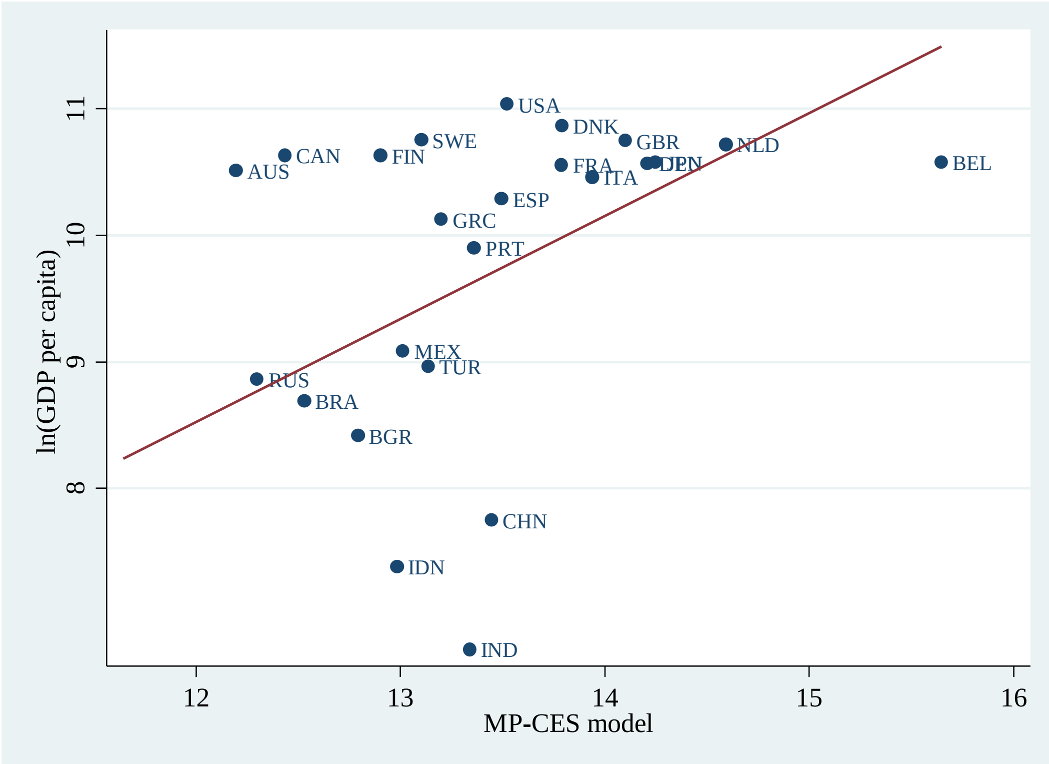
Notes: Figure shows the added variable plot from the population-weighted univariate regression of adjusted nominal GDP per capita on market potential (MP). Market potential is calculated from the pooled non-homothetic gravity equation with dyadic fixed effects.

Figure 3 Logarithm of GDP capita vs Market Potential (AIDS/Non-Homothetic model), 2006



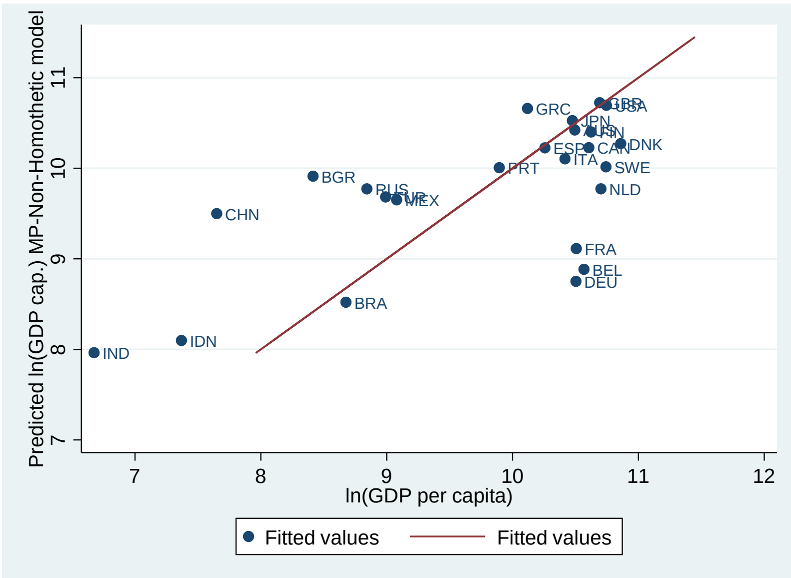
Notes: *MP-AIDS* is the non-Homothetic market potential measure from equation (3) encompassing both the trade cost term and the demand shifters. See the text for further explanation.

Figure 4 Logarithm of GDP capita vs Market Potential (CES model), 2006



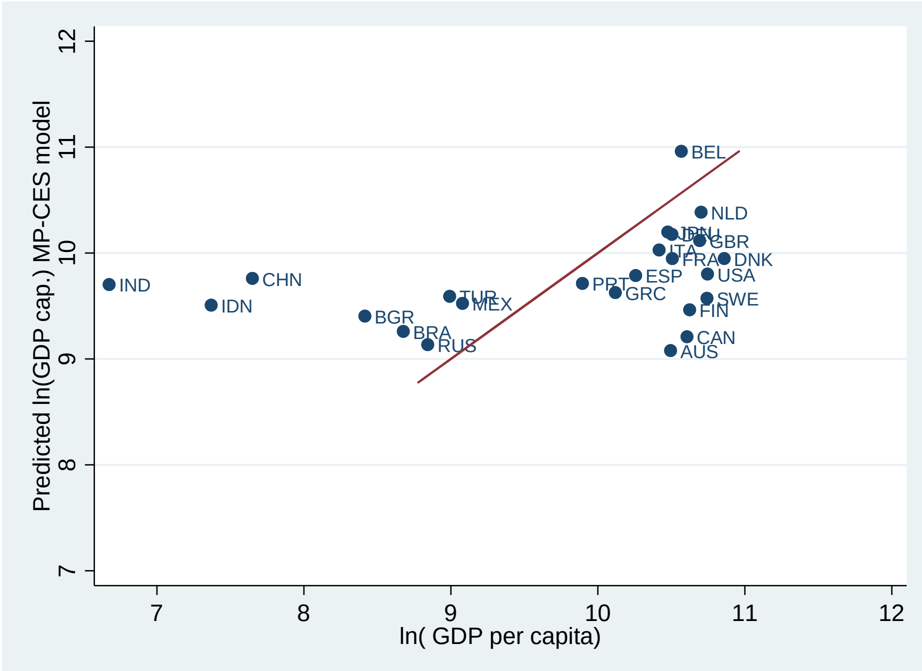
Notes: MP-CES is derived from a CES demand system and is further explained in Jacks and Novy (2016). The regression line is based on a univariate regression of the logarithm of GDP per capita on the CES-based market potential measure.

Figure 5 Level Predictions of ln (GDP per capita) vs. Actual in the AIDS/Non-Homothetic Model



Notes: The y-axis plots the predicted values of the logarithm of GDP per capita from a univariate regression of the logarithm of GDP per capita on MP (derived from the non-homothetic AIDS model).

Figure 6 Level Predictions of ln (GDP per capita) vs. Actual ln (GDP per capita) CES model



Notes: The y-axis plots the predicted values of the logarithm of GDP per capita from a univariate regression of the logarithm of GDP per capita on CES-MP (derived from a standard CES model of demand) See Jacks and Novy (2017) for further details.

Figure 7A Change in GDP per capita, 1996-2006 vs. Non-Homothetic Market Potential

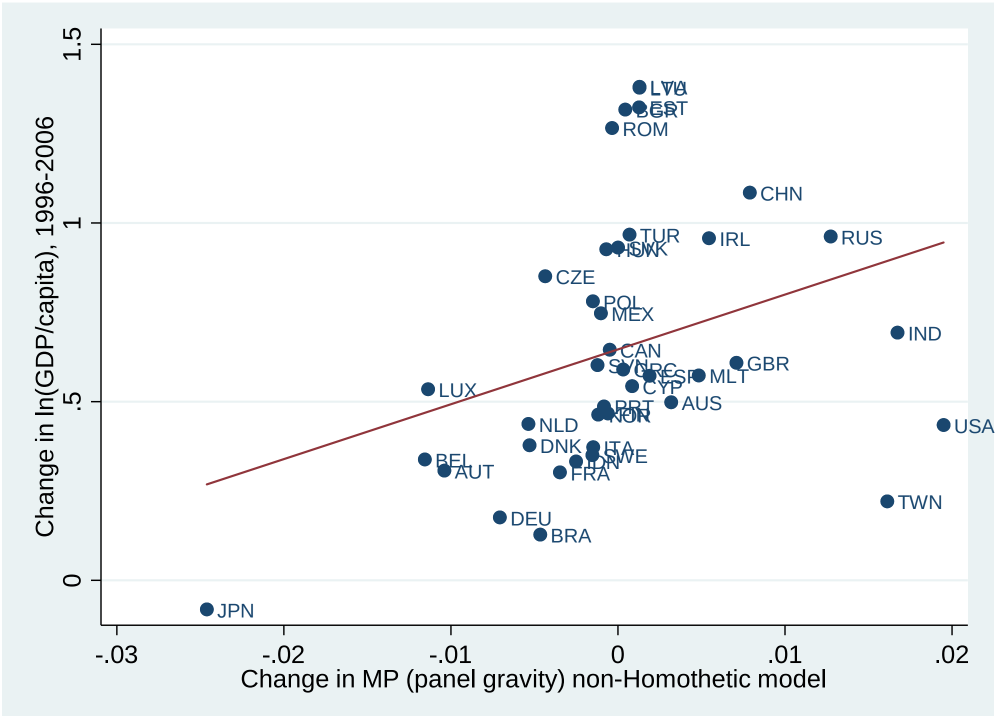


Figure 7B Change in GDP per capita, 1996-2006

vs. change in CES-Market Potential, 1996-2006

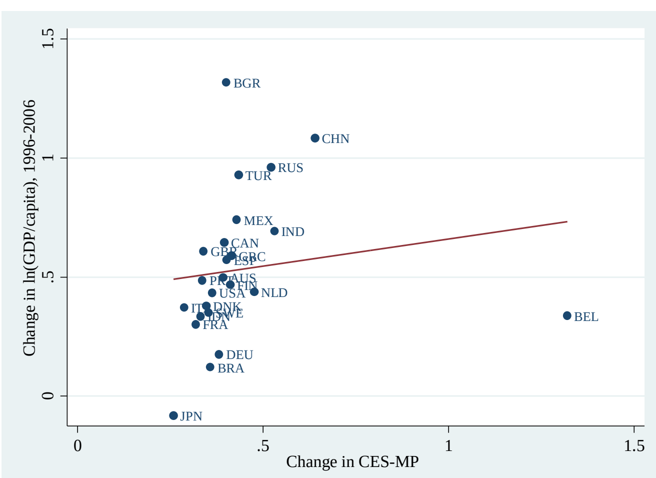
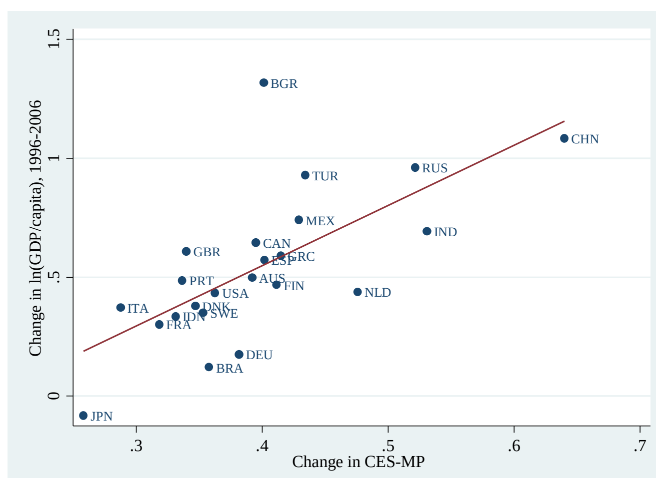


Figure 7C Change in GDP per capita, 1996-2006

vs. change in CES-Market Potential, 1996-2006
(excluding Belgium)



Notes: Figures use changes in the CES-MP measure or the AIDS *MP* measure between 2006 and 1996. See text for an explanation of their construction.

Figure 8A Predicted changes in GDP per capita (1996-2006) vs. Actual Changes in GDP per capita (1996-2006)

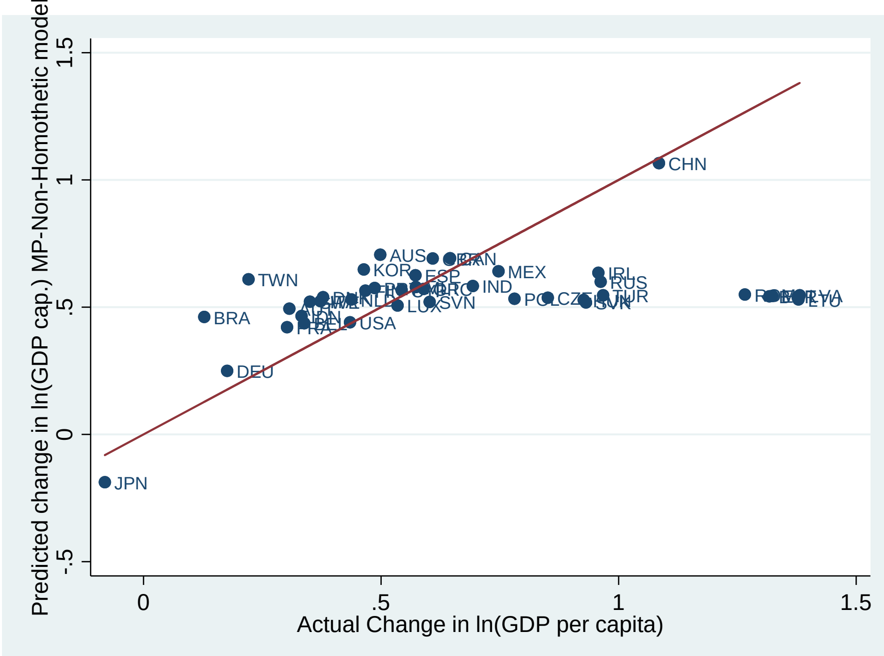
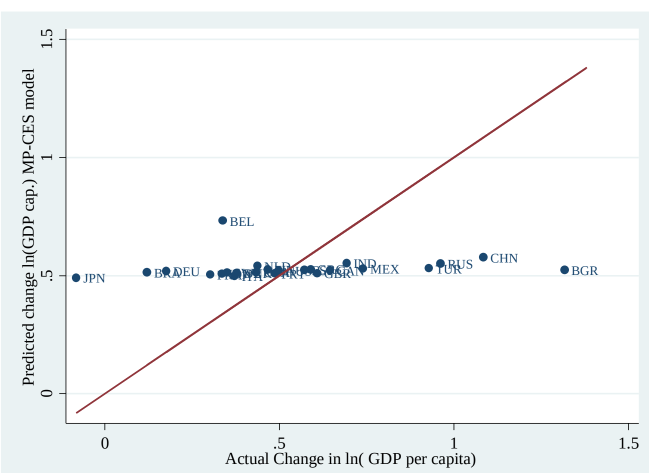
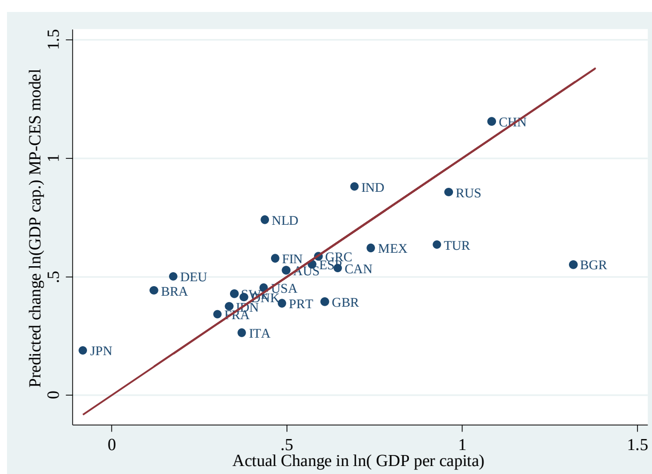


Figure 8B Predicted Change in GDP per capita, 1996-2006 vs. Actual Change in GDP per capita CES-Market Potential

Figure 8C Predicted Change in GDP per capita, 1996-2006 vs. Actual Change in GDP per capita CES-Market Potential (excluding Belgium)





Notes: Figures use changes in the CES-MP measure or the AIDS *MP* measure between 2006 and 1996. See text for an explanation of their construction. The y-axis predictions come from univariate regressions of the logarithm of GDP per capita on each measure of market potential. Belgium is excluded from this regression in Figure 8C.

Figure 9 Change in Welfare due to Non-Homotheticicities versus Expenditure-Share-Weighted Income Elasticity Differences

Notes: Figure plots the values of $\widehat{W}_{N,d}$ versus the pre-trade cost change in the expenditure-share-weighted sum of income elasticity differences defined as $\sum_{s=1}^{S} S_{sd}(\hat{\beta}_d - \hat{\beta}_s)$. See text for construction of $\widehat{W}_{N,d}$.