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BORDERS AND GROWTH

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ABSTRACT

This paper presents a framework to understand and measure the effects of political borders on economic growth and per capita income levels. We present a model providing a theoretical foundation to estimate empirically the effects of political borders on growth. In our model, political integration between two countries results in a positive country size effect and a negative effect through reduced openness vis-à-vis the rest of the world. We estimate the growth effects that would have resulted from the hypothetical removal of national borders between pairs of adjacent countries. We also identify country pairs where political integration would have been mutually beneficial.

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1 Introduction

What is the effect of national borders on economic growth? It is widely recognized that national borders constitute barriers to trade, thereby limiting the scale of economic activity.[1] Moreover, many observers have stressed the importance of economic scale as a determinant of growth and productivity.[2] Together, these ideas suggest that political borders should have an impact on economic growth and per capita income levels. In this paper, we offer a theoretical framework to understand the relationship between borders and growth, and we propose an empirical methodology to estimate this relationship.[3]

In principle, national borders could have ambiguous effects on a country's growth performance. To the extent that market size matters, borders can reduce the scale of economic activity. However, since larger countries tend to trade less with the rest of the world, removing a specific political border can also result in trade reduction vis-à-vis third countries.[4] Finally, borders can shield fast growing countries from slow growing neighbors, and vice versa, in which case the effect of political integration on growth depends on how it would affect the determinants of steady-state income levels.

[1] A vast theoretical and empirical literature documents the effect of national borders and country size on international trade. See for instance, among many other studies, Helliwell [1998] and McCallum [1988].

[2] This idea has given rise to a considerable volume of empirical research on the interaction between country size and trade openness as determinants of economic growth. See Ades and Glaeser [1999] and Alesina, Spolaore and Wacziarg [2000] for the relationship between growth and market size. A related literature deals more broadly with the effect of trade on growth, without examining specifically how this relationship is mediated by market size. See Frankel and Romer [1998], Rodríguez and Rodrik [2000], Wacziarg [2001] and Sachs and Warner [1995], among many others.

[3] In his important book on border effects in international trade, Helliwell [1998, chapter 6, p. 112] states that "assessing the possible growth implications of home preferences is not a job for a one-handed economist, nor for the faint of heart". We are not aware of research that tries to accomplish such measurement.

[4] This effect is referred to as *trade diversion* in the classical theory of customs unions. See for instance Vousden [1990], chapter 10. However, as will become clear below, by *trade reduction* we mean something different from classical trade diversion. Alesina and Wacziarg [1998] document empirically how larger countries tend to be more closed to trade, after controlling for a variety of determinants of *trade volumes*. Wacziarg [2001] shows empirically that larger countries tend to have *trade policy regimes* that are more closed, after controlling for a variety of determinants of trade policy. Both of these effects will be features of our theoretical model.

We present a theoretical framework accounting for these effects. We start with a simple thought experiment: consider two countries, for example France and Italy. What would the growth rate of per capita income in France have been if its border with Italy had not existed, that is, if they had been a single country? In our model, politically integrated economies can save on trading costs, generating a *market size effect* of political integration. Trade openness responds endogenously to political integration, generating a *trade reduction effect*. Finally, political integration can generate changes in the other determinants of steady-state income levels, besides openness and country size, an effect we call the *steady-state determination effect*.

We then turn to an empirical evaluation of the border effect on growth. Firstly, we estimate the effect of market size on economic growth in a cross-country context. In our specification, derived directly from the model, market size can be increased by two means: expanding the internal market or gaining greater access to foreign markets. Existing empirical evidence demonstrates that larger countries benefit less from trade openness than smaller ones in terms of economic growth, suggesting that trade openness affects growth through the channel of market size.[5] As a result, it is also the case that smaller countries face incentives to adopt more open trade regimes, as demonstrated formally in our model. Therefore, we also estimate the trade-reducing effect of a larger domestic market.

Together, these estimates allow us to quantify the impact of an exogenous change in country size on economic growth. We can estimate the effect of specific borders by creating hypothetical merged countries (for example the one that would result from France merging with Italy), and estimating their growth rate. This empirical exercise corresponds to our theoretical counterfactual. We present estimates of the market size effect, the trade reduction effect and the steady-state determination effect for all pairs of adjacent countries and proximate islands for which data is available. The methodology can be easily extended to a case in which more than two countries are considering integrating politically. We identify geographic

[5] In other words, the interaction term between country size and trade openness in a cross-country growth regression bears a robustly negative sign. See Alesina, Spolaore and Wacziarg [2000] and Ades and Glaeser [1999]. Previous findings pointing to no effects of country size on growth were likely due to the omission of openness and the interaction term between openness and country size from growth regressions. For example, the fact that smaller countries tend to be more open could lead researchers to wrongly conclude that country size did not matter for economic growth.

zones where political integration would be mutually beneficial to the merging countries, and discuss the conditions under which this occurs.

This paper is structured as follows: Section 2 presents a model of economic growth based on scale effects, and analyzes the effect of borders on growth in this context. Section 3 describes our empirical methodology for estimating the border effect and discusses extensions. Section 4 presents our empirical results, and Section 5 concludes.

2 A Model of Political Integration and Growth

2.1 Assumptions of the Model

This section presents a stylized model that links political borders, international openness and productive activity. In this model, market size affects growth and income levels, and depends both on the degree of openness of the economy and on country size. Openness, measured by the ratio of trade to output, is itself endogenous, and responds to country size via endogenous barriers to trade.

There is a continuum of regions, measured on the interval $[0, W]$. Time is continuous. The intertemporal utility function in each region i is given by:

$$U_i = \int_0^\infty \ln c_i(t) e^{-\rho t} dt \tag{1}$$

where $c_i(t)$ denotes consumption at time t by the representative household living in region i, and $\rho > 0$.[6] At time t region i's capital and labor are denoted, respectively, by $K_i(t)$ and $L_i(t)$. Both inputs are supplied inelastically and are not mobile across regions. Each region i produces a specific intermediate input $X_i(t)$ using the region-specific capital according to the following linear production function:

$$X_i(t) = K_i(t) \tag{2}$$

There exists a unique final good. Each region i produces $y_i(t)$ units of the final good, according to the production function:

$$y_i(t) = \left(\int_0^W x_{ji}^\alpha(t) dj \right) L_i^{1-\alpha}(t) \tag{3}$$

[6] As usual, the results generalize to any standard CRRA utility function $(C_{it}^{1-\sigma} - 1)/(1 - \sigma)$ with $\sigma > 0$.

with $0 < \alpha < 1$. $x_{ji}(t)$ denotes the amount of intermediate input j used in region i at time t.

Regions are divided into N countries. Country 1 includes all regions in the interval $[0\ ,\ S_1]$; country 2 includes all regions in the interval $[S_1\ ,\ S_1 + S_2]$, country n includes all regions in the interval $[S_{n-1}\ ,\ S_{n-1} + S_n]$, etc. Each region inelastically supplies one unit of labor (i.e., $L_i(t) = 1$ for every i at every t.). Hence, the "size" of country 1 (measured by total labor) is equal to S_1, the size of country 2 is S_2, the size of country n is S_n, etc.

Intermediate inputs can be traded across regions that belong to the same country at no cost (i.e., we assume no internal barriers to trade). By contrast, if one unit of an intermediate good j that belongs to country a is shipped to a region that belongs to a different country (say, country b), only $(1-\xi_a-\xi_b)$ units of the intermediate good will arrive, where $0 < \xi_a+\xi_b \leq 1$. Hence, the levels of ξ_n's measure barriers to trade across national borders.

2.2 Market Equilibrium

Intermediate inputs are sold in perfectly competitive markets. In equilibrium, each unit of each input will be sold at a price equal to its marginal product. All regions that belong to the same country will use identical levels of a given input. Hence, we can let x_{in} denote the amount of input i used in each region of country n. Let $P_i(t)$ denote the market price of intermediate input i, where region i belongs to country a. Therefore, for every input i belonging to a country a and for every country $n \neq a$ we must have:

$$P_i(t) = \alpha x_{ia}^{\alpha-1}(t) = \alpha(1 - \xi_a - \xi_n)^{\alpha} x_{in}^{\alpha-1}(t) \tag{4}$$

At each time t, the resource constraint for each input $i \in [0, W]$ produced in a region i belonging to a specific country a of size S_a is:

$$S_a x_{ia}(t) + \sum_{n \neq a} S_n x_{in}(t) = K_i(t) \tag{5}$$

Equations (4) and (5) imply that each region in country a will use the same amount of domestically produced input i:

$$x_{ia}(t) = \frac{K_i(t)}{S_a + \sum\limits_{n \neq a} S_n (1 - \xi_a - \xi_n)^{\frac{\alpha}{1-\alpha}}} \tag{6}$$

On the other hand, each region of a country $b \neq a$ will use the following amount of input i produced in country a:

$$x_{ib}(t) = \frac{(1-\xi_a-\xi_b)^{\frac{\alpha}{1-\alpha}} K_i(t)}{S_a + \sum\limits_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{\alpha}{1-\alpha}}} \tag{7}$$

The above equations show how ξ_a is inversely related to the international openness of country a : the lower is ξ_a, the more open is country a (i.e., the higher are its use of foreign inputs and its exports of domestic inputs).[7]

By substituting (6) into (4) we have that the price of input i produced in country a is given as follows:

$$P_i(t) = \alpha [S_a + \sum_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{\alpha}{1-\alpha}}]^{1-\alpha} K_i(t)^{\alpha-1} \tag{8}$$

Households' net assets in region i are identical to the stock of region-specific capital $K_i(t)$. Since each unit of capital yields one unit of intermediate input i, the net return to capital is equal to the market price of intermediate input $P_i(t)$ (for simplicity, we assume no depreciation). From standard intertemporal optimization we have the following Euler equation for consumption in region i belonging to country a:

$$\frac{dc_{it}}{dt}\frac{1}{c_{it}} = P_i(t) - \rho = \alpha [S_a + \sum_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{\alpha}{1-\alpha}}]^{1-\alpha} K_i(t)^{\alpha-1} - \rho \tag{9}$$

Hence, the steady-state level of capital in each region i belonging to country a is

$$K_i^{ss} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} [S_a + \sum_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{\alpha}{1-\alpha}}] \tag{10}$$

The steady-state level of output per capita in a region i of a country of size S_a is given by:[8]

$$y_i^{ss} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} [S_a + \sum_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{\alpha}{1-\alpha}}] \tag{11}$$

Our model has standard neoclassical implications as far as the growth rate is concerned. In particular, at each point in time the growth rate of income per capita is positively related to steady-state income per capita and negatively related to the current (initial) level of income:[9]

[7] Below we will explictly derive "openness" as the ratio of exports to output.

[8] Equation (11) is obtained from equation (3) by susbtituting domestically-produced and imported intermediate inputs with their equilibrium values, as specified in equations (6) and (7), and K_i with its stead-state value in (10) .

[9] For a derivation of these standard results see, for example, Barro and Sala-i-Martin (1995).

$$\frac{d\ln y_n(t)}{dt} = f(y_n^{ss} \quad , \quad y_{n,t-\tau}) \tag{12}$$

with

$$\frac{\partial f}{\partial y_n^{ss}} > 0 \quad , \quad \frac{\partial f}{\partial y_{n,t-\tau}} < 0 \tag{13}$$

Therefore, the effects of size, openness or other variables on the level of income per capita also translate into effects on the growth rate in the transition to the steady-state. Thus, in this theoretical section we will focus our analysis on steady-state income. Implications for growth will be studied in the empirical section.

2.3 Steady-state income, country size and openness

We are now ready to derive the relationship between income per capita, country size and barriers to trade. Specifically, equation (11) implies the following:

Proposition 1 - *A country's income per capita in steady-state is increasing in the country's size and decreasing in the country's barriers to trade. All other things equal, barriers reduce income more in smaller countries, and size is more important for countries with higher barriers to trade.*

Proof. See Appendix 1.

As we have mentioned, barriers to trade are directly related to degree of a country's openness. Let O_a measure the exports to output ratio in country a. We will refer to this measure as "openness."[10] Steady-state O_a can be easily derived as follows. Each region in country a will use x_{ia}^{ss} units of inputs locally, and will sell an equal amount x_{ia}^{ss} to each of the other $S_a - 1$ regions belonging to country a. Hence, total exports of input i will be given by $K_i^{ss} - S_a x_{ia}^{ss}$. Since all regions in country a export the same amount, total exports in country a are given by $(K_i^{ss} - S_a x_{ia}^{ss})S_a$. Country a's total output is given by $y_i^{ss} S_a$. Therefore, the exports to output ratio O_a in steady-state is given as follows:

$$O_a^{ss} = \frac{(K_i^{ss} - S_a x_{ia}^{ss})S_a}{y_i^{ss} S_a} \tag{14}$$

[10] In this model we abstract from international borrowing and lending - hence exports are always equal to imports in equilibrium. Therefore, measuring openness as exports/output is identical, up to a scalar multiplication, to measuring openness as (exports + imports)/output.

By substituting the corresponding steady-state values in the above equation we obtain

$$O_a^{ss} = \frac{\sum_{n \neq a} S_n (1 - \xi_a - \xi_n)^{\frac{\alpha}{1-\alpha}}}{S_a + \sum_{n \neq a} S_n (1 - \xi_a - \xi_n)^{\frac{\alpha}{1-\alpha}}} \tag{15}$$

Clearly, the above ratio O_a^{ss} is decreasing in ξ_a and in S_a:

Proposition 2 - *Openness in steady-state is inversely related to a country's size and to a country's barriers to trade.*

Equation 15 can be used to express steady-state output per capita in equation (11) as a function of a country's size and openness:

$$y_i^{ss} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \frac{S_a}{1 - O_a^{ss}} \tag{16}$$

As equation 15 clearly show, O_a^{ss} itself is a function of size S_a. However, it is useful to consider the partial effects of size and openness on income per capita and their interaction. That is, it is useful to consider the effect of size on income *for given openness* and the effect of openness of income *for a given size.* Since openness is inversely related to barriers, it is not surprising that these effects are reminiscent of Proposition 1:

Proposition 3: *Income per capita in steady-state is increasing in country size (for given openness) and increasing in openness (for given country size). The positive effect of size is higher the lower is openness, while the positive effect of openness is higher the smaller is size.*

Formally,

$$\frac{\partial y_i^{ss}}{\partial S_a} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \frac{1}{1 - O_a^{ss}} > 0 \tag{17}$$

$$\frac{\partial y_i^{ss}}{\partial O_a^{ss}} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \frac{S_a}{(1 - O_a^{ss})^2} > 0 \tag{18}$$

$$\frac{\partial (y_i^{ss})^2}{\partial S_a \partial O_a^{ss}} = -\left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \frac{1}{(1 - O_a^{ss})^2} < 0 \tag{19}$$

As we will see in the empirical section, the data seem to be consistent with Proposition 3's main insights, which point to: a) positive effects of size and openness on income per capita in steady-state (and hence growth in the transition to the steady-state), and b) a negative "interaction" between size and openness - meaning that the effect of size is smaller for more open countries, and the effect of openness is smaller for larger countries.

As we have already mentioned, "openness" is an endogenous variable, and even for given barriers, it does depend on size S_a. Moreover, as we will see below, barriers to trade should also be viewed as an endogenous function of size - a relationship that would introduce an additional channel through which size will affect openness. This endogenous link between openness and size will be taken into account in the empirical analysis.

2.4 Endogenous Barriers to Trade

So far, we have considered barriers to trade as given. We will now extend the analysis to allow for an endogenous determination of barriers. Specifically, we will assume that, for each country n:

$$\xi_n = \frac{\xi}{2} - \lambda_n \tag{20}$$

In equation (20), λ_n is the endogenous reduction in barriers by country n.

Lowering trade barriers may entail political and administrative costs, adjustment costs, costly improvements in trading infrastructure, etc. We capture the costs of reducing one's barriers in a stylized manner, by assuming a convex cost of barriers reduction:

$$B_n = \frac{\phi}{2}\lambda_n^2 \tag{21}$$

We assume that each country chooses its degree of barrier reduction λ_n in order to maximize income in steady-state minus the convex cost of barrier reduction.[11]

Therefore, the equilibrium level of barrier reduction λ_a^* for a country a of size S_a is given implicitly by the following first-order condition:

$$\frac{\alpha}{1-\alpha}\left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \sum_{n \neq a} S_n (1 - \xi + \lambda_a^* + \lambda_n^*)^{\frac{2\alpha-1}{1-\alpha}}] = \phi\lambda_a^* \tag{22}$$

[11] We assume that the costs of barriers reduction are expressed on a per capita basis, and are independent of country size. In particular, we do not assume that the reduction of barriers presents economies of scale (say, because barriers reduction is nonrival across regions) or diseconomies of scale (for example, because of coordination problems, congestion, heterogeneity, which may increase with the number of regions). An interpretation of our model is that economies and diseconomies of scale in barrier reduction, if they exist, cancel out. Our results can be extended to a more general model that include net economies or diseconomies of scale in barriers reduction. Such an extension is available upon request.

In general, the equilibrium level of barriers reduction in each country is a function of the size distribution of all countries.[12] Other things being equal, smaller countries tend to have lower barriers. For example, in a world of two countries ($W = S_a + S_b$), we have:[13]

$$\frac{d\lambda_a^*}{dS_a} = -\frac{1}{\phi}\frac{\alpha}{1-\alpha}\left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}}(1-\xi+\lambda_a^*+\lambda_b^*)^{\frac{2\alpha-1}{1-\alpha}} < 0 \quad (23)$$

A simple closed-form solution can be obtained for the case $\alpha = 1/2$. Then, the degree of barrier reduction λ_n^* that maximizes output per capita minus barriers reduction costs for a country of size S_n is

$$\lambda_n^* = \frac{W - S_n}{2\phi\rho} \quad (24)$$

which again implies a negative relationship between barrier reduction and size:[14]

$$\frac{d\lambda_n^*}{dS_n} = -\frac{1}{2\phi\rho} < 0 \quad (25)$$

Hence, we have the following:

Proposition 4 - *All other things equal, larger countries will have less open trade policies - that is, they will choose smaller reductions of barriers* (λ_n^*) *- and, consequently, higher barriers* ξ_n^*.

Similarly, countries with lower costs of reduction (ϕ) or a lower discount rates (ρ) will be more open (that is, will have a lower λ_n).

2.5 Political Mergers

Now, let us consider a merger between country a (of size S_a) and country b (of size S_b). To keep things simple we will assume $\alpha = 1/2$. The steady-state levels of income per capita in country a is:

$$y_a^{ss} = \left(\frac{1}{2\rho}\right)[S_a + \sum_{n\neq a} S_n(1-\xi_a-\xi_n)] \quad (26)$$

The steady-state income per capita in the new country of size $S_m = S_a + S_b$ will be:

$$y_m^{ss} = \left(\frac{1}{2\rho}\right)[S_m + \sum_{n\neq m} S_n(1-\xi_m-\xi_n)] \quad (27)$$

[12] We assume that each country will reduce barriers taking other countries' barriers as given (Nash equilibrium). Joint maximization of world welfare would imply lower barriers.

[13] The result can be generalized to the case of three or more countries.

[14] It is immediate to check that (23) reduces to (25) for $\alpha = 1/2$.

The net change in steady-state income for country a will be given by:

$$y_m^{ss} - y_a^{ss} = \left(\frac{1}{2\rho}\right)[S_b(\xi_a + \xi_b) - (W - S_a - S_b)(\xi_m - \xi_a)] \tag{28}$$

In equation (28), the first term, $(1/2\rho)\, S_b(\xi_a + \xi_b)$, measures the direct positive scale effect of the merger, which we call the *market size effect*. It is evaluated at the level of trade barriers prevailing before the merger and corresponds to adding the size of country b to country a.

The second term in equation (28), $(1/2\rho)\,(W - S_a - S_b)(\xi_m - \xi_a)$, measures the indirect negative effect of the merger, via a fall in openness. We call this effect the *trade reduction effect*. It corresponds to the increase in trade barriers between the regions of former country a and the rest of the world (i.e., all other countries except country b), brought forth by the larger size of the merged country (S_m). That is, this effect is due to the fact that the larger country will be less open with respect to the rest of the world.

Note that there is no guarantee that the net gain in terms of steady-state income (and growth) will be positive. That is, there is no guarantee that steady-state income per capita in the new, larger country will be higher than in country a - i.e., that $y_m^{ss} - y_a^{ss} > 0$.

From equation (24) we have:

$$\xi_a = \frac{\xi}{2} - \lambda_a = \frac{\xi}{2} - \frac{W - S_a}{2\phi\rho} \tag{29}$$

$$\xi_b = \frac{\xi}{2} - \lambda_b = \frac{\xi}{2} - \frac{W - S_b}{2\phi\rho} \tag{30}$$

$$\xi_m = \frac{\xi}{2} - \lambda_m = \frac{\xi}{2} - \frac{W - S_m}{2\phi\rho} \tag{31}$$

which, when substituted in equation (28), imply the following:

Proposition 5 - *A necessary and sufficient condition for* $y_m^{ss} - y_a^{ss} > 0$ *is:*

$$S_m = S_a + S_b > W - \xi\phi\rho \tag{32}$$

The intuition for this results is as follows. A higher S_m means a bigger positive effect from the merger via the market size effect, because the two merging counties had larger barriers between themselves before the merger. A larger S_m (relative to W) also means that the rest of the world is relatively smaller, and therefore the openness reduction effect (with respect to the rest of the world) has smaller costs.

It is important to notice that even if a merger increases income per capita, it does not necessarily imply an increase in consumption per capita and welfare. In order to calculate changes in consumption and welfare one should subtract the costs related to barriers reduction and any other costs associated with a merger. For example, a merger may bring about direct costs in order to eliminate internal barriers to trade. A merger may also imply higher "heterogeneity" costs due to different preferences over public goods, more costly coordination, etc.[15] In our empirical exercises we will focus on changes of income per capita.

2.6 Other Determinants of Steady-State Income Levels

In our model so far, different countries' steady-states differ only because 1) their size differs and 2) as a result, their level of openness also differs. There are obviously many other differences across countries, apart from size, that could yield differences in steady-state income levels and openness. In the context of our model, the ϕ and ρ parameters could differ across individual countries. Particularly patient countries, or countries where the costs of openness reduction are lower (for example through natural access to the sea, proximity to trading partners, and other geographic factors) will have higher levels of steady-state income and greater levels of openness, all else equal.

Such differences will not affect country a's growth performance under political integration with country b, unless they affect the other determinants of steady-state income levels and openness within country a. But it is easy to see that a merger between country a and country b, when they differ along these other dimensions, will change the growth effect of the merger on country a, *to the extent that the merger affects these parameters within country a.* We should stress again that this would only occur if country a's steady-state and openness determinants (other than its size and induced openness level) would change under political integration. This could occur as the result of factor movements such as migration or capital flows, or changes in geographic factors brought forth by the removal of borders.[16]

In the case where countries differ in ϕ and ρ, the thought experiment described above to

[15] On the costs of larger, more heterogeneous countries see Alesina and Spolaore (1997, 2002).

[16] For instance, a previously landlocked country can gain easier access to the sea as a result of a political merger. This could affect the level of openness of the country, and consequently its growth rate. See for instance Sachs [2001], and Gallup et al. [1999] for evidence on the importance of geography for growth.

evaluate the growth incidence of political mergers can be amended to account for changes in steady-state determinants under a merger. For example, if countries have different costs ϕ's, the analysis can be easily generalized as follows. Let ϕ_m denote the costs of barriers reduction in the unified country of size S_m. Then we have the following:

Proposition 6: *A political merger between a country of size S_a and a country of size S_b will increase income in country a in steady state (that is, $y_m^{ss} - y_a^{ss} > 0$) if and only if the following condition holds*::

$$S_b(\xi - \frac{W - S_a}{\rho\phi_a} - \frac{W - S_a}{\rho\phi_b}) > (W - S_a - S_b)(\xi - \frac{W - S_a - S_b}{\rho\phi_m} - \frac{W - S_a}{\rho\phi_a}) \qquad (33)$$

In what follows, we will label the effect of potential changes in steady-state determinants, besides openness and country size, as the *steady-state determination effect.*

3 Estimating the Growth Effect of Borders

3.1 Basic Methodology

The model presented above, specifically Proposition 3, suggests that income in steady-state is positively related to both country size and openness, and negatively related to their interaction. Hence, growth in the transition to the steady-state will also be a function of such variables. A specification consistent with those insights is:

$$\begin{aligned} \log \frac{y_{at}}{y_{at-\tau}} &= \beta_0 + \beta_1 \log y_{at-\tau} + \beta_2 O_{at} + \beta_3 \log S_{at} \\ &\quad + \beta_4 O_{at} \log S_{at} + \beta_5' Z_{at} + \varepsilon_{at} \qquad (34) \end{aligned}$$

where a refers to a country, S_{at} denotes country size, O_{at} denotes trade openness, y_{at} denotes per capita income, and Z_{at} is a vector of control variables. Compared to our model, we have simply added additional determinants of steady-state income levels (the Z_{at} variables), which the model abstracts from, and an error term. The predictions of our model are that $\beta_2 > 0$, $\beta_3 > 0$ and $\beta_4 < 0$.

In our model, Propositions 2 and 4 suggests that openness is negatively related to country size. The second part of our econometric model reflects the negative relationship between trade openness and country size:

$$O_{at} = \alpha_0 + \alpha_1 \log S_{at} + \alpha_2' W_{at} + \nu_{at} \qquad (35)$$

where W_{at} is a vector of additional determinants of trade openness and the model predicts $\alpha_1 < 0$. In this econometric model, the exogenous variables are S_{at}, Z_{at} and W_{at}. We are considering the growth effect of an exogenous change in a country's size brought about by merging with a neighbor. Substituting equation (35) into (34), we obtain:

$$\begin{aligned} \log \frac{y_{at}}{y_{at-\tau}} &= \gamma_0 + \gamma_1 \log y_{at-\tau} + \gamma_2 \log S_{at} + \gamma_3 (\log S_{at})^2 + \gamma_4' W_{at} \log S_{at} \\ &\quad + \gamma_5 \nu_{at} \log S_{at} + \gamma_6' W_{at} + \gamma_7' Z_{at} + \mu_{at} \end{aligned} \tag{36}$$

where the γ coefficients are functions of the parameters of the growth and trade equations, as defined in Appendix 2.

Define ΔG_{abt} as the change in growth of country i resulting from its merger with country b. Since the only exogenous variable that has changed under a merger is country size, we term this particular exercise a "size merger".[17] We focus on the expected effect on growth, as we have little knowledge of what the random component of growth or openness (captured by ε_{at} and ν_{at}) would have been had the countries been politically merged during the sample period.[18] Assuming $E(\nu_{at}|S_{at}, S_{mt}, W_{at}) = 0$, the expected effect on the growth rate of country a of merging with neighbor b, where the size of the merged country is denoted S_{mt} $(= S_{at} + S_{bt})$, is:

$$\begin{aligned} \Delta G_{abt} &\equiv E\left(\Delta \log \frac{y_{at}}{y_{at-\tau}} | S_{at}, S_{mt}, W_{at}\right) \\ &= \log\left(\frac{S_{mt}}{S_{at}}\right) \left[\gamma_2 + \gamma_3 \log (S_{at} S_{mt}) + \gamma_4' W_{at}\right] \end{aligned} \tag{37}$$

Thus, the effect of the merger on growth is a multiple of the percentage increase in country size, where the multiplicative factor depends on the determinants of openness, the estimated parameters of the model and the sizes of countries a and b. Since our model predicts that $\gamma_3 = \beta_4 \alpha_1$ is positive, Proposition 4 is also directly apparent in equation (37).

In this basic setup, the induced effect of political integration on growth will depend on the home country's size, the size of the country it is considering merging with, and the determinants of the home country's trade openness volume. This combines three distinct effects of political integration on growth. Firstly, the direct (positive) effect of an increase

[17] Below we will examine how to account for changes in the Z and W variables under a merger.

[18] In section 3.3 below, we discuss an alternative method that allows us to include the error term component of the growth effect of mergers, using the estimated values of error term in the original countries.

in country size, equal to β_3 times the percentage increase in country size resulting from the merger ($\log(S_{mt}/S_{at})$). Secondly, the indirect (negative) effect through openness reduction, which is equal to $\beta_2\alpha_1$ times the percentage increase in country size. Thirdly, the effect going through the interaction term, which captures the increasing impact of country size on growth as openness decreases. This effect, of ambiguous sign, depends on the determinants of a's openness level and the sizes of both a and b, and is equal to $\beta_4\left(\alpha_0 + \alpha_1 \log\left(S_{mt}S_{at}\right) + \alpha_2' W_{at}\right)$ times the percentage increase in country size. It should be noted that the determinants of openness (W_{at}) and the sizes of countries a and b can be such that the openness reducing effect of political integration outweighs the positive direct scale effect of merging. In this case, ΔG_{abt} will be negative.

Finally, an exogenous change in openness yielding an equivalent expected change in economic growth without a political merger can be computed using equation (34) as:

$$E(\Delta O_{at}|S_{at}, S_{mt}, W_{at}) = \frac{\Delta G_{abt}}{\beta_2 + \beta_4 \log S_{at}} \tag{38}$$

The benefits of exogenous increases in openness can thus be directly compared to those of bilateral political mergers.

3.2 Changes in Conditioning Variables

Equations (37) and (38) implicitly assume that a political merger does not affect the determinants of the home country's steady-state income level, or the determinants of its openness levels, *other than country size*. For example, if France were to merge with Italy, France and Italy would each retain their own Z_{at} and W_{at} variables. These may include the savings rate, investment in human capital, characteristics of governance and government involvement in the economy, and gravity type factors such as geographic variables. As suggested in Section 2.6, this is clearly an extreme assumption since factors other than the size of the population alone would likely be different in each merged country under political integration, affecting both growth and the degree of openness. For example, increased migration and capital mobility across countries a and b under a merger will imply that the rates of investment in human and physical capital will differ compared to what they would have been in the separate countries. Taking this *steady-state determination effect* into consideration generates an additional sources of ambiguity in the sign of the overall effect of political integration on economic growth. Clearly, this effect would tend to be negative for the home country when the hypothetical merger is with a country with "worse" overall determinants of the steady-state income level than itself.

We can relax the assumption that political integration affects growth only through country size and the induced effect of changes in country size on trade openness by assuming that other conditioning variables will change in both merged units after political integration, and in particular that they will take on the same value in a and b under a merger. We term this alternative scenario "full integration".

There are obviously many ways to specify what values the other determinants of growth (the Z variables) and openness (the W variables) will take under full political integration.[19] One reasonable assumption is that each of the merged countries would end up with the same population weighted average of the initial conditioning variables, which we can denote Z_{mt} and W_{mt}, where the subscript m denotes that a political merger has occurred and that the resulting variables are, where applicable, the population weighted averages of the regional measures.[20] The resulting effect of a political merger on growth, ΔG^m_{abt}, is then computed as:

$$\begin{aligned}\Delta G^m_{abt} &\equiv E\left(\Delta \log \frac{y_{at}}{y_{at-\tau}} | S_{at}, S_{mt}, W_{at}, W_{mt}, Z_{at}, Z_{mt}\right) \\ &= \log\left(\frac{S_{mt}}{S_{at}}\right)\left(\gamma_2 + \gamma_3 \log\left(S_{at} S_{mt}\right) + \gamma_4' W_{at}\right) \\ &\quad + \gamma_1 \log \frac{y_{mt-\tau}}{y_{at-\tau}} + \left[\gamma_4' \log S_{mt} + \gamma_6'\right]\left(W_{mt} - W_{at}\right) + \gamma_7'\left(Z_{mt} - Z_{at}\right)\end{aligned} \tag{39}$$

This formulation includes the same size effects as equation (37), namely those that occur through the direct effect of market size, the indirect effect through trade reduction and the changes in the interaction term. But in addition to these effects, we now have the steady-state determination effect, equal to the terms in the second line of equation (39).[21] An important

[19] For example, we could assume that the merged country is assigned the best - or worst - values of the Z and W variables from each of country a and b. We choose an intermediate - and more reasonable - assumption by assigning to the merged country the population-weighted average of these variables from countries a and b.

[20] Of course, in the case of the land area, the merged variable is the sum of the corresponding areas of countries a and b. For the dummy variables in our specification, the definitions of the merged variables are as follows: the merged country is landlocked if *both* a and b are landlocked; the merged country is an island if *both* a and b are islands; the merged country is an oil exporter if *either* a or b is an oil exporter.

[21] We can further decompose the steady-state determination effect into the term $\gamma_1 \log \frac{y_{mt-\tau}}{y_{at-\tau}}$ which reflects

consequence of this framework is that, under full political integration, expected growth will be equal for both country a and country b.[22]

To summarize, equations (37) and (39) result from two different assumptions about the effects of political integration on growth; one with complete averaging of steady-state determinants ("full integration"), the other with no changes in these variables ("size merger"). The effect of a hypothetical merger likely falls in between these two extremes. The corresponding estimates should therefore be viewed as extreme bounds on the effects of bilateral political mergers on economic growth.

3.3 Treatment of the Error Term

Above, we focused on estimating the *expected* effects of political mergers on growth, disregarding the unexplained portion of growth and openness in our counterfactual exercises. Whether to consider the residuals μ_t and ν_t from the growth and openness equations when evaluating the effects of borders on growth is largely a matter of interpretation. On the one hand, if one believes that they reflect omitted determinants of growth and openness, then they should be treated as another steady-state determination variable (analogous to the W and Z variables). As it turns out, since the explained portion of growth and openness are typically on the order of 50% and 60% respectively, in our baseline regressions, accounting for the unexplained components of growth and openness could alter our estimates of the merger effects. On the other hand, if one believes that the residuals reflect true "randomness", then there is no good justification for including them in the analysis: we do not know what the random component of growth would have been, had the countries been merged over the sample period.

Since both interpretations seem equally defensible, we also present merger effects that take into account the estimated residuals. Fortunately, we can easily accommodate this change in

differences in initial income and the terms that are functions of $(W_{mt} - W_{at})$ and $(Z_{mt} - Z_{at})$,which reflect differences in steady-state determinants proper. For identical values of the Z and W variables, if country a starts out with an initial income that is lower than country b's, full integration will slow a's growth simply because it will raise its initial income - the force of convergence implies that countries grow slower, the closer they are to their steady-states.

[22]This is not the case when we do not take into account the steady-state determination effect (section 3.1), because post-merger Z and W variables still differ across a and b.

our basic empirical methodology. Instead of computing the expected effect of a merger on growth, we can use:

$$\begin{aligned}\Delta G^{e}_{abt} &\equiv \Delta \log \frac{y_{at}}{y_{at-\tau}} \\ &= \log\left(\frac{S_{mt}}{S_{at}}\right)\left[\gamma_2 + \gamma_3 \log\left(S_{at}S_{mt}\right) + \gamma_4' W_{at} + \gamma_5 \nu_{at}\right] \end{aligned} \tag{40}$$

and replace γ_2, γ_3, γ_4 and ν_{at} with their regression estimates in computing the empirical ΔG^{e}_{abt}. In equation (40), the superscript "e" indicates that the residual terms are taken into account. Note that since the error term of the growth regression, μ_{at}, is assumed to be unchanged between the merged and unmerged states, it gets differenced away from equation (40).[23]

Similarly, and perhaps more interestingly, we could treat the error terms as additional (unobserved) growth determinants, and compute the empirical ΔG^{me}_{abt} directly using the appropriate population weighted averages of the estimated residuals:

$$\begin{aligned}\Delta G^{me}_{abt} &\equiv \Delta \log \frac{y_{at}}{y_{at-\tau}} \\ &= \log\left(\frac{S_{mt}}{S_{at}}\right)\left[\gamma_2 + \gamma_3 \log\left(S_{at}S_{mt}\right) + \gamma_4' W_{at} + \gamma_5 \nu_{at}\right] \\ &\quad + \gamma_1 \log \frac{y_{mt-\tau}}{y_{at-\tau}} + \left[\gamma_6' + \gamma_4' \log S_{mt}\right]\left[W_{mt} - W_{at}\right] \\ &\quad + \gamma_7' \left[Z_{mt} - Z_{at}\right] + \left(\nu_{mt} - \nu_{at}\right)\left[\gamma_5 \log S_{mt}\right] + \mu_{mt} - \mu_{at} \end{aligned} \tag{41}$$

where ν_{mt} and μ_{mt} are the population weighted averages of ν_{at} and ν_{bt} and μ_{at} and μ_{bt}. Again, this equation involves the same terms as equation (40), with the steady-state determination effect (including that which results from merging the estimated unexplained portion of growth) added on.

3.4 Effects of Borders on Steady-State Income Levels

As explained in the theoretical section, because our model shares the dynamic features of the neoclassical growth model, it is straightforward to present our results in terms of steady-state income levels rather than growth. We do not observe steady-state income, but it can be estimated readily under the assumptions of our framework, because the right-hand side

[23] The only reason ν_{at} remains in this equation is the nonlinearity of the effect of country size on growth brought forth by the interaction term between openness and size in the growth equation.

variables of equation (34) are the determinants of steady-state income levels. Theory delivers a growth equation of the following form, based on equation (12):

$$\log \frac{y_{at}}{y_{at-\tau}} = \lambda \left(\log y_a^{ss} - \log y_{at-\tau} \right) + \varepsilon_{at} \tag{42}$$

where y_{at} is current income per capita, $y_{at-\tau}$ is initial income per capita, and y_a^{ss} is (unobserved) income in steady-state.[24] Assume that the steady-state level of income takes the form:

$$\log y_a^{ss} = \delta_1 + \delta_2 O_{at} + \delta_3 \log S_{at} + \delta_4 O_{at} \log S_{at} + \delta_5' Z_{at} \tag{43}$$

This specification choice for $\log y_a^{ss}$ reflects the fact that the right-hand side variables of empirical growth regressions (except initial income) are to be interpreted as the determinants of the steady-state level of income in the neoclassical growth model. On the other hand, our actual growth specification is that of equation (34):

$$\begin{aligned} \log \frac{y_{at}}{y_{at-\tau}} &= \beta_0 + \beta_1 \log y_{at-\tau} + \beta_2 O_{at} + \beta_3 \log S_{at} \\ &\quad + \beta_4 O_{at} \log S_{at} + \beta_5' Z_{at} + \varepsilon_{at} \end{aligned} \tag{44}$$

Substituting equation (43) into equation (42), we can write:

$$\begin{aligned} \log \frac{y_{at}}{y_{at-\tau}} &= \lambda\delta_1 + \lambda\delta_2 O_{at} + \lambda\delta_3 \log S_{at} \\ &\quad + \lambda\delta_4 O_{at} \log S_{at} + \lambda\delta_5' Z_{at} - \lambda \log y_{at-\tau} + \varepsilon_{at} \end{aligned} \tag{45}$$

Thus, we can recover:[25]

$$\log y_a^{ss} = -\frac{\beta_0}{\beta_1} - \frac{\beta_2}{\beta_1} O_{at} - \frac{\beta_3}{\beta_1} \log S_{at} - \frac{\beta_4}{\beta_1} O_{at} \log S_{at} - \frac{1}{\beta_1} \beta_5' Z_{at} \tag{46}$$

This provides a methodology for backing out the effects of political mergers on steady-state income levels. The percentage change in the steady-state income level of country a after merging with country b can be computed in terms of the reduced form parameters defined in Appendix 2, under the two scenarios under consideration - a pure size merger or full political integration:

$$\begin{aligned} \Delta YSS_{abt} &\equiv E\left(\Delta \log y_a^{ss} | S_{at}, S_{mt}, W_{at} \right) \\ &= -\frac{1}{\gamma_1} \log \frac{S_{mt}}{S_{at}} \left[\gamma_2 + \gamma_3 \log \left(S_{at} S_{mt} \right) + \gamma_4' W_{at} \right] \end{aligned} \tag{47}$$

[24] See Barro and Sala-i-Martin (1995), p.37 and p.82 for a derivation of this standard specification in the context of the neoclassical growth model.

[25] Note that β_1, the conditional convergence coefficient, is negative.

and:

$$\begin{aligned} \Delta YSS_{abt}^{m} &\equiv E\left(\Delta \log y_a^{ss} | S_{at}, S_{mt}, W_{at}, W_{mt}, Z_{at}, Z_{mt}\right) \\ &= -\frac{1}{\gamma_1}[\log \frac{S_{mt}}{S_{at}} \left(\gamma_2 + \gamma_3 \log\left(S_{at} S_{mt}\right) + \gamma_4' W_{at}\right) \\ &\quad + \left(\gamma_4' \log S_{mt} + \gamma_6'\right)\left(W_{mt} - W_{at}\right) + \gamma_7'\left(Z_{mt} - Z_{at}\right)] \end{aligned} \tag{48}$$

Equations (47) and (48) are the analogs to equations (37) and (39), respectively, applied to income levels rather than growth. Note that equation (47) implies that ΔYSS_{abt} is simply $-1/\gamma_1$ times ΔG_{abt} - hence, since $\gamma_1 = \beta_1$ is negative, the effect of a size merger on steady-state income will have the same sign as its effect on economic growth. However, the signs of $\Delta YSS_{abt}^{m}$and ΔG_{abt}^{m} may differ. This is because we have:

$$\Delta G_{abt}^{m} = \gamma_1 \left(\log \frac{y_{mt-\tau}}{y_{at-\tau}} - \Delta YSS_{abt}^{m} \right) \tag{49}$$

A country a that has a positive steady-state level effect ΔYSS_{abt}^{m} of full integration may display a negative growth effect ΔG_{abt}^{m} simply because it has a sufficiently low initial level of income relative to country b (and hence enjoys relatively fast growth holding the steady-state level of income constant).

4 Empirical Results

4.1 Estimates of the Growth and Openness Equations

4.1.1 Data and Estimators

Equations (34) and (35) can be readily estimated using cross-country data on growth, country size, openness and other control variables. Our measure of openness consists of the ratio of imports plus exports to GDP, a commonly used indicator of a country's overall level of openness. Moreover, this is precisely the measure derived in the theory of Section 2 (see in particular Propositions 2 and 3) The measure of country size consists of the log of a country's population. The Z_{it} variables are the common determinants of steady-state income levels in the cross-country literature: male and female human capital, the fertility rate, the ratio of government consumption to GDP and the rate of physical capital investment (see Barro and Sala-i-Martin [1995], chapter 12). Finally, the W_{it} variables consist of common determinants of openness such as geographic factors (land area, whether a country is landlocked or an island, whether it is an oil exporter) and the terms of trade shocks. In order to capture long-term phenomena, variables are averaged, where appropriate, over the sample period.

Our base estimates for calculating merger effects are based on PPP per capita income data from version 5.6 of the Penn World Tables. This 1960-1989 sample consists of 96 countries. A preliminary issue of version 6.0 of this data has recently been circulated, extending the data to 1998.[26] We use this data for the purpose of reestimating equations (34) and (35), as a robustness check. However, because some of the other conditioning variables are not as readily available for recent years, the updated sample only features 77 countries. Moreover, some "important" countries such as Germany are not part of this dataset for the entire sample period, precluding any calculation of the effect of political mergers on growth for such a key country in Europe.[27] Therefore, in order to maximize the number of mergers we consider, and to base our estimates on the largest possible sample, we use estimates from version 5.6 of the Penn World Tables for the purpose of calculating merger effects. Since the estimates of equations (34) and (35) do not differ much between samples, we are confident that using the more recent data would not alter our results - other than by limiting the country coverage.

One issue that arises immediately from our empirical model is the endogeneity of openness (and the interaction term between openness and country size) in the growth equation. To address this, we treat equations (34) and (35) as a system of simultaneous equations to be estimated jointly. Our baseline results therefore consist of three-stage least squares estimates (3SLS). 3SLS treats all of the exogenous variables in the system (i.e. country size, initial per capita income, Z_{it} and W_{it}) as potential instruments for the endogenous variables in the system (growth, openness and the interaction term between openness and country size). Given that openness and the interaction term are the only endogenous variables to appear on the right hand side of either equation in the system, only the W_{it} variables serve as instruments for them in the growth regression. As noted above, these variables consist of plausibly exogenous geographic and terms of trade variables. In addition to these instruments, we can gain precision by using additional instruments which do not necessarily appear as exogenous

[26] See http://webhost.bridgew.edu/baten/.

[27] In the case of Germany, this is due to reunification in 1989. The new version of the Penn World Tables only features data for reunified Germany since 1990. Our estimates of merger effects refer to West Germany prior to 1990.

variables in either the trade or the growth equations.[28] Finally, 3SLS allows for cross-equation covariance in the error terms ε_{it} and ν_{it}, generating potential efficiency gains.[29] For the sake of robustness, we also present results obtained from seemingly unrelated regression (SUR), as well as regressions excluding the Z_{it} and W_{it} control variables.

4.1.2 Estimation Results

Tables 1 and 2 display results for the joint estimation of equation (34) and (35). The baseline estimates used for the merger calculations appear in column (1). The theoretical predictions are borne out empirically. Specifically, openness and country size are positively and significantly related to growth, while their interaction enters negatively and significantly. This is consistent with the model's results 1 and 3, and extends related findings in Alesina, Spolaore and Wacziarg [2000]. Moreover, as expected, country size affects openness negatively. This is consistent with our theoretical results 2 and 4, and extends previous findings in Alesina and Wacziarg [1998].

Several additional observations are called for. Firstly, the pattern of signs and statistical significance is unchanged when the Z_{it} and the W_{it} control variables are excluded from the system, and the magnitude of the coefficients of interest is raised. While this specification is likely to be tainted by omitted variables bias, it corresponds directly to the relationships derived from theory, where countries differed in no other way than size and openness. It is therefore reassuring that the predictions of the theory hold unconditionally as well as conditionally. Secondly, as in Frankel and Romer [1999], instrumenting for openness using geographic variables increases the magnitude of the estimated coefficient on trade openness compared to the specifications that do not account for the endogeneity of openness (SUR).

These results hold up when using the updated dataset for the period 1960-1998, despite the loss of 15 data points. Due to this, estimates are sometimes less statistically significant,

[28] Following Alesina, Spolaore and Wacziarg [2000], these are dummy variables for small countries, small islands, and the interaction terms between population and the each of dummy variables for small countries, small islands, islands, and landlocked countries. Geographic variables such as these are likely to be plausibly exogenous with respect to growth, yet affect the level of openness. See Frankel and Romer [1999] for a further details on employing geographic variables to instrument for openness in growth regressions.

[29] See Wacziarg [2001] for further technical details on the use of 3SLS to estimate systems of equations in a cross-country growth context.

but the pattern of signs and the magnitude of the coefficients are unchanged compared to the 1960-1989 dataset. Therefore, we are confident that our estimates of the border effects on growth would be robust to using coefficients from the updated dataset. As explained above, we refrain from using these estimates as this would result in a loss of 15 countries, in particular Germany.

Finally, Table 3 presents F-tests on the instruments, from simple OLS regressions of openness and the interaction term on all of the exogenous variables in the system, for the 1960-1989 data. These F-tests demonstrate that the instruments are jointly related to the variables they are instrumenting for, at high levels of statistical significance.

4.2 The Effects of Hypothetical Mergers

4.2.1 Effects on Expected 1960-1989 Growth

The parameter estimates presented in Tables 1 and 2 can be used to calculate, for pairs of adjacent countries, what their growth rate would have been had they formed a single country over the sample period under consideration.[30] Namely, we can now calculate the impact of specific borders on growth, under alternative definitions of political integration. As described above, under a "size merger", which is reflected in equation (37), a political merger simply entails full access to the neighbor's markets, without any change in the home country's W_{at} and Z_{at} variables. Under "full integration", reflected in equation (39), both hypothetically merged countries share the same W_{at}^m and Z_{at}^m, and therefore the same growth rate under political integration. Since there is no *a priori* reason to prefer one definition over the other, we calculate the effect of borders under both definitions, and further decompose this effect into the direct positive effect of an increase in country size, the indirect negative effect via openness reduction, the ambiguous effect via the interaction term, and the steady-state determination effect.

Table 4 shows summary statistics for these various effects based on 123 hypothetical pairwise mergers. A salient feature of these statistics is the wide dispersion of the various effects. The pure size effect on growth, ΔG, has a standard deviation of 0.377 and a positive mean of

[30] We also considered mergers between proximate islands and up to five neighboring countries, such as the United Kingdom and Ireland, or the United Kingdom and France. Our results pertain to a total of 123 hypothetical mergers of country pairs (i.e. 246 merger experiments).

0.123 percentage points of growth annually, suggesting that the average country would benefit from merging with a neighbor based on increased size alone. Indeed, the direct effect of size on growth, on average, more than outweighs the indirect effect via openness reduction (while the interaction effect is on average very close to zero). Under a full integration scenario, however, a typical country would lose slightly, on the order of $\Delta G^m = -0.112$ percentage points of annual growth. Since the difference between ΔG^m and ΔG is equal to the steady-state determination effect, the latter is on average negative (and equal to -0.235). Therefore, borders shield the average country from slow growing neighbors. There is, however, a wide dispersion of effects around this mean. This suggests that these simple summary statistics mask relevant country-specific features of the border effect on growth.

Figures 1 through 8 provide perhaps a more complete picture. They plot the distributions of the estimated effects. The total size effect ΔG is generally positive but moderate, in most cases smaller than 0.5 percentage points of annual growth. The effect of full political integration ΔG^m is more symmetrically distributed around zero, with slightly fatter tails. Turning to the decomposed effects confirms previous observations, namely that the interaction term effect is tightly distributed around zero, while the steady-state determination effect is slightly skewed, with a negative mean.

4.2.2 An Example: France and Italy

While these summary statistics and plotted distributions are useful, they are no substitute for the estimates obtained individually for each pair of adjacent countries. To illustrate the results, we can examine more specifically the example of France and Italy (Table 5). The effect on France from merging with Italy would have been quite large and positive. We estimate that the total size effect would have resulted in a gain of 0.281 points of growth annually for France. To achieve a similar increase in growth via openness, France would have had to increase her trade to GDP ratio by 27.79 percentage points (for comparison, the average trade to GDP ratio of France over the sample period was 36%). Since Italy started with a lower level of per capita income than France in 1960, but has a higher estimated steady-state income level given its observed steady-state determinants, France would also have gained from the steady-state determination effect. This effect alone would have accounted for $\Delta G^m - \Delta G = 0.492$

additional points of growth.[31]

Turning to the effect on Italy from merging with France, it follows from what precedes that the steady-state determination effect would have been negative for Italy. Moreover, the positive size effect of a merger on Italian growth, equal to 0.237, would not have been sufficient to outweigh the negative steady-state determination effect. Under full integration, Italy would have lost -0.316 points of growth annually. A possible interpretation of these results is that, if France and Italy could somehow have achieved the more restrictive form of political integration implied by the "size merger" definition, i.e. a removal of the border without changes in national savings rates, human capital, etc., both could have benefited in terms of growth.

Interested readers can ponder upon the estimated effects of their favorite hypothetical political merger among the 246 examples listed in Table 6.

4.2.3 Residual Effects

Section 3.3 above outlined a methodology to include the residuals from the growth and openness regressions into our analysis. Table 6 (columns 9 and 10) presents estimates of ΔG^{me} and ΔG^{e} as in equations (40) and (41). The distribution of these effects is also displayed in Figures 9 and 10. Interestingly, the results do not change as much as expected given that the explained portions of growth and openness in the baseline regressions are only 60% and 50%, respectively. The simple correlation of ΔG with and without the residual effect is 0.737, while the corresponding figure for ΔG^{m} is 0.640. Out of 246 mergers, accounting for the residual leads to a change in the sign of the effect in 31 cases for ΔG (12.6% of the cases) and 75 cases for ΔG^{m} (30.1%).[32]

Again, the case of France and Italy is illustrative (Table 5). Because France's explained

[31] This is another way of saying that Italy was a faster growing country than France over the time period covered in the sample. In fact, the average *observed* annual growth rate of per capita income in Italy over the 1960-1989 period was 3.40%, while for France it was 2.94%. Our model *predicts* that, if France and Italy had merged, their unified growth rate over this period would have been 3.15% per year (under "full integration").

[32] In general, accounting for the residual effect has a much smaller effect on estimates of pure size mergers than it does on estimates of full integration, because the former only involves the residual from the openness regression (multiplied by the coefficient on openness in the growth regression), while the latter involves the population weighted average of the residual from the growth regression. See equations (40) and (41).

annual growth falls short of its observed growth by 0.56 points, while Italy's observed and explained growth are about equal, accounting for the residual in the merger experiment is now slightly beneficial to Italy - which would have gained both under a size merger and full integration.

4.2.4 Effects on Steady-State Income Levels

Columns 11 and 12 of Table 6 presents, for each country pair, the estimated effect of a merger on the steady-state income level of country a, while the last row of Table 4 presents summary statistics for the steady-state level effects (the distribution of these level effects is displayed in Figures 11 and 12 for a size merger and full integration, respectively). On average, size mergers would raise a country's steady-state income level by 10.98 percentage points and full integration would reduce it by 2.07 percentage points. These averages reflect the generally positive effect of a size merger and the ambiguous effect of full integration. However, they again mask considerable case-specific differences. The effect of full integration ranges from -421.07 percentage points (the effect on Malta from merging with Algeria - a small rich country merging with a relatively large poor country) to 325.63 percentage points (the effect on Papua New Guinea from merging with Australia - a small poor country merging with a rich country with five times its population). Logically, large effects such as these are found in cases where neighbors have very different sizes and income determinants.

More moderate effects are found in regions that are homogeneous in terms of income and size. For example, Table 5 shows that a size merger between France and Italy would have raised both countries' steady-state income levels by 25.1 percentage points for France and 21.12 points for Italy. Full integration would have reduced Italy's steady-state income by 15.89 percentage points. This partly reflects compounding the negative growth effect on Italy of full integration with France, as discussed earlier. The merger would raise France's steady-state income by 57.01 points, reflecting Italy's superior steady-state determinants.

4.3 Convergent Interests in Political Integration

An interesting application of our framework is to examine pairs of countries that would have *both* benefited from merging politically. As suggested above, it is much easier for two countries to have convergent interests in a size merger than in full integration, because the effect of the former is far more likely to be positive for any given country. Out of the 123 political mergers we considered in this paper, 94 entail growth gains for both country a and country b based on a *size merger alone*, and only 6 cases did the trade reduction effect dominate in both countries - so that both would have experienced reduced growth under a merger. These cases pertain to pairs of very small and already open countries, such as Singapore and Hong Kong or Jamaica and Haiti.

More interestingly perhaps, in only 14 cases would both countries in a merging pair have benefited from full integration in terms of economic growth.[33] These pairs are listed in Table 7. Salient examples include Argentina and Chile, France and Germany, Canada and the US, India and Pakistan, as well as several country pairs involving Brazil. Of course, many more cases would entail a winner and a loser among the merging pair. 92 cases out of 123 entail exactly one country that would have gained from full political integration, while the other would have lost, and in the remaining 17 cases both countries would have lost. The conclusion is that, in 109 of the 123 cases we considered, borders shield at least one country from the other.

An implication of these observations is that, when unions of country pairs are considered, it may be easier to gain mutual support for a form of political integration that shields countries from having to share their Z_{at} and W_{at} variables but focuses instead on taking advantage of scale effects, through the formation of free trade areas and the reduction of physical trading costs.

5 Conclusion

This paper has provided a theoretical framework to understand the relationship between political borders and growth. We suggested that, whenever scale effects are present, political borders affect steady-state per capita income levels and transitional growth rates by reducing the extent of the market. We also pointed out that, in a world of more than two countries, the removal of only one border will result in trade reduction from the merging countries vis-à-vis the rest of the world, with correspondingly adverse effects on growth and income. We examined formal conditions under which the extent of the market effect dominates the

[33] All of these pairs are also composed of countries that would both have benefited from size mergers with each other.

trade reduction effect, and discussed situations in which countries might differ in more that just size and openness levels.

We then derived an empirical specification directly from the theoretical model, and found strong empirical support for the predictions of our theory. The parameter estimates from this empirical model were used to estimate, for specific countries, the growth effects of merging with another country. We have applied this framework to 123 pairs of adjacent countries and proximate islands.

Our framework can be extended in several directions. Firstly, we have limited our investigation to hypothetical mergers involving only two countries. However, our framework is readily applicable to studying the growth effects of more than one political border. We could apply our methodology, for example, to the removal of all borders within Europe, in order to study the growth implications of proposals for European political integration. Our results for France and Germany suggest that both would have benefited, in terms of growth, from merging politically. Whether European countries would have benefited from the removal of all intra-European borders is an open and equally interesting question.

Secondly, our estimation method focuses exclusively on growth and income levels. There are obviously many other reasons, beyond growth, why countries would want to merge or stay separate. We can interpret our estimates of the growth effects of borders, whenever they are negative, as the amount of growth a country is willing to forego in order to avoid the non-economic costs of sharing a single polity with a neighbor. These may include increases in cultural, ethnic, religious or linguistic heterogeneity. Future work could relate changes in heterogeneity resulting from political integration to the magnitude of the growth costs or benefits. One interesting hypothesis to test is whether countries that remained separate despite large potential growth effects of merging have done so because political integration would have entailed large increases in heterogeneity.

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Appendix 1

Proof of Proposition 1.

1) Output in steady-state in each region i belonging to country a is decreasing in the country's barriers to trade ξ_a. That is, more "open" countries have higher income per capita.

Formally:

$$\frac{\partial y_i^{ss}}{\partial \xi_a} = -\frac{\alpha}{1-\alpha}\left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} \sum_{n \neq a} S_n (1-\xi_a-\xi_n)^{\frac{2\alpha-1}{1-\alpha}} < 0 \tag{50}$$

2) Output in steady-state in each region i belonging to country a, is increasing in size S_a.

Consider a change in size S_a that leaves the total size of the world W unchanged. Hence, such increase must change the size of at least another country. Without loss of generality, assume that the change affects a country b of size S_b, while leaving all other countries different from a and b unaffected.[34] Hence, by substituting $S_b = W - S_a - \sum_{n \neq a,b} S_n$ in (11) and taking the partial derivative of y_i^{ss} with respect to S_a we have:

$$\frac{\partial y_i^{ss}}{\partial S_a} = \left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} [1-(1-\xi_a-\xi_b)^{\frac{2\alpha-1}{1-\alpha}}] > 0 \tag{51}$$

3) The positive effect of size S_a on steady-state output is larger for less open countries (i.e., for countries with a larger ξ_a). The negative effect of barriers on steady-state output is larger (in absolute terms) for smaller countries.

[34] The result can be easily generalized to the case in which the increase in country a's size is matched by reductions in the size of two or more other countries.

Formally,

$$\frac{\partial (y_i^{ss})^2}{\partial \xi_a \partial S_a} = \frac{\alpha}{1-\alpha}\left(\frac{\alpha}{\rho}\right)^{\frac{\alpha}{1-\alpha}} (1-\xi_a-\xi_b)^{\frac{2\alpha-1}{1-\alpha}} > 0 \tag{52}$$

QED.

Appendix 2

Reduced Form Parameters in equation (36):

$$\begin{cases} \gamma_0 = \beta_0 + \beta_2\alpha_0 \\ \gamma_1 = \beta_1 \\ \gamma_2 = \beta_3 + \beta_2\alpha_1 + \beta_4\alpha_0 \\ \gamma_3 = \beta_4\alpha_1 \\ \gamma_4 = \beta_4\alpha_2 \\ \gamma_5 = \beta_4 \\ \gamma_6 = \beta_2\alpha_2 \\ \gamma_7 = \beta_5 \\ \mu_{it} = \varepsilon_i + \beta_2\nu_{it} \end{cases}$$

Table 1 - System Estimates of the Growth Equation

	1960-1989			1960-1998		
	3SLS	**3SLS**	**SUR**	**3SLS**	**3SLS**	**SUR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Intercept	2.217 (3.327)	-14.447 (2.760)**	8.676 (2.662)**	9.783 (4.697)**	-16.243 (3.574)**	15.415 (3.127)**
Log population	**0.678** **(0.185)****	**1.337** **(0.254)****	**0.263** **(0.134)****	**0.472** **(0.249)***	**1.387** **(0.311)****	**0.130** **(0.136)**
Open* Log pop	**-0.007** **(0.003)****	**-0.007** **(0.004)***	**-0.003** **(0.002)***	**-0.005** **(0.004)**	**-0.009** **(0.006)***	**-0.001** **(0.002)**
Openness	**0.081** **(0.023)****	**0.118** **(0.032)****	**0.040** **(0.017)****	**0.055** **(0.036)***	**0.124** **(0.048)****	**0.010** **(0.019)**
Log 1960 per capita income	-1.120 (0.269)**	0.120 (0.205)	-1.262 (0.245)**	-1.437 (0.321)	0.322 (0.216)	-1.611 (0.263)**
Fertility Rate	-0.185 (0.121)		-0.308 (0.114)**	-0.601 (0.152)		-0.717 (0.136)**
Male human capital	1.550 (0.443)**		1.745 (0.402)**	0.079 (0.317)		0.010 (0.295)
Female human capital	-1.183 (0.472)**		-1.415 (0.433)**	0.162 (0.395)		0.165 (0.373)
Government consumption ratio	-0.053 (0.020)**		-0.061 (0.019)**	-0.024 (0.018)		-0.031 (0.017)*
Investment rate	0.091 (0.024)**		0.087 (0.022)**	0.073 (0.026)		0.075 (0.021)**
R-Squared	0.558	-0.277	0.683	0.662	-0.221	0.726

(Standard errors in parentheses)
* Denotes significance at the 90% confidence level; ** denotes significance at the 95% level.
92 observations in specifications for 1960-1989 and 77 observations in the specifications for 1960-1998.
Estimated jointly with the openness equation.

Table 2 – System Estimates of the Openness Equation

	1960-1989			1960-1998		
	3SLS	**3SLS**	**SUR**	**3SLS**	**3SLS**	**SUR**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Intercept	161.089 (33.890)**	169.337 (34.354)**	152.610 (34.432)**	253.343 (47.309)**	196.654 (49.215)**	255.884 (47.731)**
Log population	**-6.744 (2.671)****	**-15.003 (2.254)****	**-5.862 (2.699)****	**-7.723 (3.185)****	**-15.356 (2.935)****	**-7.093 (3.213)****
Log 1960 per capita income	1.335 (3.868)	3.378 (4.139)	1.888 (3.902)	1.526 (4.802)	0.753 (5.314)	1.696 (4.826)
Log land area	-9.868 (2.124)**		-10.537 (2.179)**	-10.511 (2.542)**		-11.271 (2.596)**
Terms of trade shocks	-45.202 (205.930)		48.984 (221.254)	373.600 (291.622)		377.467 (302.285)
Oil dummy	13.999 (21.898)		9.771 (23.596)	-13.199 (28.132)		-15.031 (29.393)
Landlock Dummy	-2.472 (8.889)		1.807 (9.602)	-6.386 (10.285)		-5.702 (10.772)
Island Dummy	3.186 (7.766)		4.337 (8.351)	12.643 (9.934)		11.276 (10.385)
R-Squared	0.508	0.333	0.511	0.506	0.270	0.507

(Standard errors in parentheses)
* Denotes significance at the 90% confidence level; ** denotes significance at the 95% level.
92 observations in all specifications for 1960-1989 and 77 observations for 1960-1998. Estimated jointly with the growth equation.

Table 3 - First stage F-Tests for the Instruments

Specification	**Test**	**Openness**	**Openness*Log Population**
(1)	F(11, 73) (p-value)	3.11 (0.002)	3.09 (0.002)
(2)	F(11, 78) (p-value)	3.55 (0.0005)	3.72 (0.0003)

Table 4 – Summary Statistics of the Effects of Border Removals
Based on Specification (1) estimates

Variable	Mean	Std. Dev.	Min	Max
Observed average growth	2.127	1.671	-1.231	6.580
Fitted growth	2.167	1.369	-0.006	6.150
Direct effect of size	0.745	0.743	0.005	3.452
Indirect effect via openness reduction	-0.601	0.600	-2.784	-0.004
Effect via change in interaction term	-0.021	0.405	-2.400	1.056
Steady-state determination effect	-0.235	0.678	-3.442	2.350
ΔG ("size merger")	0.123	0.377	-1.733	1.367
ΔG^M ("full integration")	-0.112	0.914	-4.965	3.350
Openness equivalent ("size merger")	10.184	22.517	-40.281	184.332
Openness equivalent ("full integration")	0.403	43.089	-144.379	315.772
ΔG^e ("size merger" with residual effect)	0.097	0.524	-4.214	1.511
ΔG^{me} ("full integration" with residual effect)	-0.092	1.047	-4.036	4.220
ΔSSY (steady–state level effect of a "size merger") (%)	10.976	33.623	-154.651	121.956
ΔSSY^m (steady–state level effect of "full integration") (%)	-2.068	83.400	-421.068	325.630

(Based on 246 effects calculated from 123 hypothetical political mergers)

Table 5 - An Example: France and Italy

Effect on (country a):	France	Italy
of merging with (country b):	**Italy**	**France**
Observed Growth (country a)	2.936	3.404
Fitted Growth (country a)	2.374	3.464
Direct effect of size	0.491	0.451
Indirect effect via openness	-0.396	-0.364
Effect via change in interaction term	0.186	0.149
Steady-state determination effect	0.492	-0.553
ΔG ("size merger")	0.281	0.237
ΔG^m ("full integration")	0.773	-0.316
Openness equivalent ("size merger")	27.789	24.300
Openness equivalent ("full integration")	76.423	-32.492
ΔG^e ("size merger" with residual effect)	0.294	0.265
ΔG^{me} ("full integration" with residual effect)	0.474	0.006
ΔSSY (steady–state level effect of a "size merger") (%)	25.099	21.122
ΔSSY^m (steady–state level effect of "full integration") (%)	57.011	-15.894

Table 6 – Country-Specific Merger Estimates

Country a	Country b	a's Fitted Growth	ΔG	ΔG^m	direct	indirect	interact	ΔG^e	ΔG^{me}	ΔSSY (%)	ΔSSY^m (%)
1	**2**	**3**	4	5	**6**	**7**	**8**	9	10	**11**	12
Algeria	Mali	1.124	0.103	-0.178	0.232	-0.187	0.058	0.076	-0.392	9.209	-37.268
	Malta	1.124	0.015	0.061	0.035	-0.028	0.008	0.011	0.026	1.330	4.839
	Niger	1.124	0.087	-0.170	0.198	-0.160	0.049	0.064	-0.418	7.789	-32.517
	Tunisia	1.124	0.101	0.219	0.228	-0.184	0.057	0.074	0.417	9.015	8.828
Argentina	Bolivia	0.987	0.075	0.134	0.122	-0.099	0.051	0.089	0.136	6.658	0.786
	Brazil	0.987	0.779	1.340	1.107	-0.893	0.565	0.907	2.301	69.529	56.585
	Chile	0.987	0.143	0.110	0.230	-0.186	0.098	0.169	0.452	12.734	-0.268
	Paraguay	0.987	0.044	0.011	0.073	-0.059	0.030	0.053	0.157	3.943	-5.183
	Uruguay	0.987	0.047	-0.008	0.077	-0.062	0.032	0.056	0.110	4.167	-1.919
Australia	Fiji	2.291	0.021	-0.059	0.035	-0.028	0.015	0.018	-0.072	1.915	-7.981
	Indonesia	2.291	1.232	0.531	1.613	-1.301	0.920	1.065	0.781	109.960	-128.110
	New Zealand	2.291	0.089	-0.030	0.142	-0.115	0.061	0.074	-0.156	7.905	-2.256
	Papua New Guinea	2.291	0.082	-0.550	0.131	-0.106	0.056	0.068	-0.449	7.279	-63.385
	Sri Lanka	2.291	0.310	-0.587	0.473	-0.382	0.218	0.261	-0.882	27.626	-105.326
Austria	rmany, Fed. Rep.	4.128	0.403	-1.464	1.496	-1.207	0.114	0.460	-0.345	35.996	-108.690
	Italy	4.128	0.379	-0.535	1.436	-1.159	0.101	0.433	0.405	33.817	-58.122
	Switzerland	4.128	0.067	-0.404	0.408	-0.329	-0.012	0.083	-0.588	6.016	-5.444
Bangladesh	India	0.851	0.926	2.501	1.509	-1.217	0.634	1.273	0.579	82.667	204.027
Barbados	Colombia	4.310	-1.673	-2.428	3.081	-2.485	-2.268	-1.041	-1.337	-149.268	-261.782
	Trinidad & Tobago	4.310	-0.806	-2.249	1.100	-0.887	-1.019	-0.581	-2.359	-71.976	-138.866
	Venezuela	4.310	-1.549	-3.881	2.653	-2.140	-2.063	-1.006	-3.836	-138.287	-261.606
Belgium	France	3.051	0.199	-0.530	1.250	-1.008	-0.043	-0.217	-0.008	17.731	-42.409
	Germany, Fed. Rep.	3.051	0.225	-0.493	1.340	-1.081	-0.034	-0.221	-0.323	20.059	-28.483
	Netherlands	3.051	0.056	-0.025	0.585	-0.472	-0.058	-0.139	-0.407	4.971	3.541
Benin	Niger	-0.006	0.063	-0.012	0.661	-0.533	-0.064	0.190	0.160	5.653	-39.016
	Togo	-0.006	0.028	0.810	0.398	-0.321	-0.049	0.104	0.784	2.506	39.002
Bolivia	Argentina	1.951	0.578	-0.830	1.266	-1.021	0.333	0.522	-0.819	51.610	50.535
	Brazil	1.951	1.152	0.589	2.132	-1.720	0.739	1.057	1.719	102.778	95.070

Country a	**Country b**	**a's Fitted Growth**	**ΔG**	**ΔG^{m}**	**direct**	**indirect**	**interact**	**ΔG^{e}**	**ΔG^{me}**	**ΔSSY (%)**	**ΔSSY^{m} (%)**
1	**2**	**3**	4	5	**6**	**7**	**8**	9	10	**11**	12
Bolivia	Chile	1.951	0.320	-0.704	0.780	-0.629	0.169	0.285	0.042	28.560	8.816
	Paraguay	1.951	0.115	-0.230	0.314	-0.254	0.054	0.101	0.224	10.250	-19.665
	Peru	1.951	0.411	-0.162	0.962	-0.776	0.225	0.369	-0.640	36.723	30.274
Botswana	South Africa	1.341	0.666	-0.241	2.438	-1.967	0.195	-0.191	-3.395	59.460	117.516
	Zimbabwe	1.341	0.278	-0.182	1.509	-1.217	-0.014	-0.253	-4.036	24.780	39.610
Brazil	Argentina	2.488	0.149	-0.161	0.164	-0.132	0.118	0.132	-0.382	13.330	14.310
	Bolivia	2.488	0.041	0.052	0.045	-0.037	0.032	0.036	-0.009	3.658	3.047
	Colombia	2.488	0.136	0.114	0.149	-0.120	0.107	0.120	0.097	12.144	9.214
	Guyana	2.488	0.018	0.012	0.019	-0.016	0.014	0.015	-0.021	1.562	0.960
	Paraguay	2.488	0.029	0.017	0.032	-0.026	0.023	0.025	0.025	2.577	0.640
	Peru	2.488	0.094	0.070	0.104	-0.084	0.074	0.083	-0.161	8.404	7.790
	Uruguay	2.488	0.030	-0.029	0.033	-0.027	0.023	0.026	-0.027	2.664	1.431
	Venezuela	2.488	0.081	-0.115	0.089	-0.072	0.063	0.071	-0.232	7.202	10.716
Cameroon	Central Afr. Rep.	1.371	0.056	-0.317	0.183	-0.148	0.020	0.061	-0.769	4.957	-26.023
	Congo	1.371	0.040	-0.230	0.132	-0.107	0.014	0.044	-0.162	3.528	-9.715
Canada	U.S.A	1.777	1.367	1.288	1.608	-1.297	1.056	0.888	-0.738	121.956	143.482
Central Afr. Rep.	Cameroon	0.137	0.289	0.918	1.042	-0.841	0.087	0.194	2.466	25.775	74.775
	Congo	0.137	0.075	0.037	0.357	-0.288	0.006	0.043	1.064	6.736	23.269
	Zaire	0.137	0.578	0.650	1.699	-1.370	0.249	0.423	0.151	51.575	25.503
Chile	Argentina	0.991	0.377	0.107	0.866	-0.699	0.209	0.427	-0.646	33.621	43.039
	Bolivia	0.991	0.103	0.257	0.273	-0.220	0.050	0.119	-0.101	9.193	2.374
	Peru	0.991	0.253	0.481	0.617	-0.497	0.134	0.289	-0.525	22.615	24.426
Colombia	Barbados	1.880	0.011	0.002	0.022	-0.018	0.007	0.013	-0.001	1.021	1.057
	Brazil	1.880	0.740	0.723	1.178	-0.950	0.512	0.811	0.802	66.018	69.280
	Ecuador	1.880	0.102	0.131	0.192	-0.155	0.065	0.114	0.096	9.129	8.639
	Panama	1.880	0.033	-0.003	0.063	-0.051	0.021	0.036	-0.016	2.913	-0.694
	Peru	1.880	0.192	0.077	0.350	-0.282	0.124	0.213	-0.576	17.120	14.304
	Venezuela	1.880	0.164	-0.466	0.302	-0.244	0.106	0.183	-0.803	14.655	21.271
Congo	Cameroon	0.455	0.190	0.687	1.274	-1.027	-0.056	-0.223	-0.063	16.991	15.983
	Central Afr. Rep.	0.455	0.057	-0.282	0.640	-0.516	-0.067	-0.151	-2.072	5.053	-51.830
	Zaire	0.455	0.423	0.330	1.962	-1.583	0.044	-0.213	-2.862	37.755	-46.654
Costa Rica	Nicaragua	1.272	-0.033	-0.561	0.562	-0.454	-0.142	0.065	-1.446	-2.981	-64.023

Country a	Country b	a's Fitted Growth	ΔG	ΔG^m	direct	indirect	interact	ΔG^e	ΔG^{me}	ΔSSY (%)	ΔSSY^m (%)
1	2	3	4	5	6	7	8	9	10	11	12
Costa Rica	Panama	1.272	-0.031	-0.001	0.445	-0.359	-0.118	0.046	-0.077	-2.807	-12.696
Cyprus	Greece	4.934	-0.524	-1.323	1.870	-1.509	-0.886	-0.217	-0.647	-46.761	-115.560
	Israel	4.934	-0.423	-2.252	1.241	-1.001	-0.663	-0.219	-1.346	-37.718	-156.765
	Turkey	4.934	-0.533	-2.165	2.812	-2.268	-1.077	-0.073	-2.068	-47.599	-215.453
Denmark	Germany, Fed. Rep.	2.198	0.261	0.236	1.747	-1.409	-0.077	0.543	0.171	23.294	18.404
	Iceland	2.198	0.000	-0.267	0.029	-0.023	-0.006	0.004	-0.255	-0.040	-24.818
Dominican Rep.	Haiti	2.074	0.018	-0.538	0.486	-0.392	-0.076	0.159	-1.368	1.615	-61.046
	Jamaica	2.074	0.004	-0.048	0.247	-0.199	-0.044	0.075	-0.495	0.314	10.464
Ecuador	Colombia	2.127	0.310	-0.117	1.017	-0.820	0.113	0.444	0.173	27.662	0.758
	Peru	2.127	0.226	-0.273	0.796	-0.642	0.072	0.331	-1.188	20.148	-1.150
El Salvador	Guatemala	0.841	-0.024	-0.168	0.646	-0.521	-0.149	0.159	0.000	-2.156	-5.590
	Honduras	0.841	-0.025	-0.055	0.413	-0.333	-0.105	0.093	-0.056	-2.204	-17.273
Fiji	Australia	2.621	-0.430	-0.388	2.191	-1.767	-0.853	-0.171	0.108	-38.344	93.211
	New Zealand	2.621	-0.359	-0.653	1.256	-1.013	-0.602	-0.211	-0.848	-32.053	63.566
Finland	Norway	2.486	0.090	0.201	0.413	-0.333	0.010	0.118	-0.140	8.018	20.619
	Sweden	2.486	0.165	-0.414	0.678	-0.547	0.034	0.212	-0.725	14.727	-12.821
France	Belgium	2.374	0.063	0.147	0.118	-0.095	0.041	0.067	-0.026	5.663	12.174
	Germany, Fed. Rep.	2.374	0.303	0.245	0.526	-0.425	0.202	0.317	0.020	27.083	28.662
	Italy	2.374	0.281	0.773	0.491	-0.396	0.186	0.294	0.474	25.099	57.011
	Spain	2.374	0.197	0.470	0.352	-0.284	0.129	0.206	0.509	17.566	21.476
	Switzerland	2.374	0.042	0.142	0.078	-0.063	0.026	0.044	-0.072	3.706	18.897
	United Kingdom	2.374	0.286	-0.364	0.498	-0.402	0.189	0.299	-0.140	25.496	-23.711
Germany, Fed. Rep.	Austria	2.432	0.039	0.231	0.079	-0.064	0.023	0.038	0.099	3.438	18.175
	Belgium	2.432	0.049	0.125	0.101	-0.082	0.030	0.049	0.026	4.409	8.848
	Denmark	2.432	0.026	0.001	0.054	-0.044	0.016	0.026	0.029	2.329	0.341
	France	2.432	0.217	0.187	0.419	-0.338	0.136	0.213	0.387	19.352	11.411
	Netherlands	2.432	0.066	0.180	0.135	-0.109	0.040	0.065	0.010	5.924	14.802
	Switzerland	2.432	0.032	0.125	0.066	-0.054	0.019	0.032	-0.022	2.865	14.891
Ghana	Togo	1.545	0.044	0.091	0.157	-0.126	0.013	0.076	0.308	3.899	-3.164
Greece	Cyprus	3.605	0.009	0.006	0.046	-0.037	0.000	0.019	-0.009	0.760	0.345
	Turkey	3.605	0.324	-0.634	1.121	-0.904	0.108	0.577	-1.059	28.947	-75.536
	Yugoslavia	3.605	0.211	0.321	0.811	-0.654	0.054	0.393	-0.416	18.797	22.824

Country a	**Country b**	**a's Fitted Growth**	**ΔG**	**ΔG^m**	**direct**	**indirect**	**interact**	**ΔG^e**	**ΔG^{me}**	**ΔSSY (%)**	**ΔSSY^m (%)**
1	**2**	**3**	4	5	**6**	**7**	**8**	9	10	**11**	12
Guatemala	El Salvador	0.815	0.053	-0.142	0.360	-0.290	-0.017	0.155	-0.029	4.692	-18.431
	Honduras	0.815	0.043	0.046	0.304	-0.245	-0.016	0.129	0.039	3.813	-9.188
	Mexico	0.815	0.436	1.022	1.629	-1.314	0.121	0.900	1.416	38.943	140.856
Guinea Bissau	Senegal	2.243	-0.141	-2.056	1.444	-1.165	-0.420	0.472	-0.780	-12.559	-117.343
Guyana	Brazil	1.286	0.726	1.214	3.410	-2.750	0.067	-0.846	4.220	64.789	119.398
	Venezuela	1.286	0.150	-0.882	1.981	-1.598	-0.233	-0.764	0.851	13.365	53.913
Haiti	Dominican Rep.	1.288	-0.008	0.247	0.477	-0.385	-0.100	0.207	1.433	-0.727	34.801
	Jamaica	1.288	-0.010	0.156	0.237	-0.191	-0.055	0.097	0.315	-0.849	37.999
Honduras	El Salvador	1.314	0.049	-0.527	0.576	-0.465	-0.062	0.108	-0.320	4.396	-27.723
	Guatemala	1.314	0.077	-0.452	0.753	-0.607	-0.068	0.153	-0.197	6.879	-6.797
	Nicaragua	1.314	0.029	-0.472	0.414	-0.334	-0.051	0.071	-0.891	2.580	-20.166
Hong Kong	Singapore	5.622	-0.098	-0.251	0.282	-0.228	-0.153	-0.288	-0.878	-8.755	-32.005
Iceland	Denmark	3.396	-0.363	-1.465	2.170	-1.750	-0.783	0.002	-1.270	-32.409	-100.837
	Norway	3.396	-0.367	-0.441	2.020	-1.629	-0.758	-0.027	-0.227	-32.768	-27.661
	Sweden	3.396	-0.340	-1.553	2.489	-2.008	-0.822	0.079	-1.189	-30.363	-96.927
India	Bangladesh	3.424	0.097	-0.072	0.092	-0.074	0.079	0.087	0.199	8.652	-3.850
	Pakistan	3.424	0.092	0.157	0.087	-0.070	0.075	0.082	0.329	8.170	12.410
	Sri Lanka	3.424	0.029	0.028	0.027	-0.022	0.023	0.026	0.050	2.561	3.923
Indonesia	Australia	3.392	0.052	-0.569	0.079	-0.064	0.037	0.048	-0.616	4.658	23.824
	Malaysia	3.392	0.048	0.051	0.072	-0.058	0.034	0.044	0.055	4.259	13.995
	Papua New Guinea	3.392	0.017	-0.046	0.026	-0.021	0.012	0.016	-0.045	1.533	-2.267
	Philippines	3.392	0.135	-0.069	0.201	-0.162	0.096	0.125	-0.329	12.075	10.221
	Sri Lanka	3.392	0.052	-0.049	0.078	-0.063	0.037	0.048	-0.129	4.614	4.570
Iran	Pakistan	1.219	0.448	1.015	0.801	-0.646	0.293	0.467	1.632	39.960	12.156
	Turkey	1.219	0.300	1.072	0.559	-0.451	0.192	0.313	1.509	26.740	65.722
Ireland	United Kingdom	2.333	0.272	-0.982	1.986	-1.602	-0.112	-0.010	-0.950	24.301	-18.009
Israel	Cyprus	2.515	-0.017	0.168	0.137	-0.111	-0.044	0.007	0.058	-1.539	5.720
	Jordan	2.515	-0.037	-0.721	0.360	-0.291	-0.107	0.027	-0.357	-3.347	-99.526
	Syria	2.515	-0.049	-0.865	0.811	-0.654	-0.206	0.096	-0.350	-4.398	-124.013
Italy	Austria	3.464	0.043	0.129	0.087	-0.071	0.026	0.048	0.014	3.820	13.090
	France	3.464	0.237	-0.316	0.451	-0.364	0.149	0.265	0.006	21.122	-15.894
	Malta	3.464	0.002	0.001	0.005	-0.004	0.001	0.003	-0.004	0.210	-0.389

Country a	Country b	a's Fitted Growth	ΔG	ΔG^m	direct	indirect	interact	ΔG^e	ΔG^{me}	ΔSSY (%)	ΔSSY^m (%)
1	**2**	**3**	4	5	**6**	**7**	**8**	9	10	**11**	12
Italy	Switzerland	3.464	0.036	0.008	0.073	-0.059	0.022	0.040	-0.128	3.187	10.499
Jamaica	Dominican Rep.	2.698	-0.165	-0.672	0.848	-0.684	-0.329	-0.052	0.723	-14.750	-84.722
	Haiti	2.698	-0.165	-1.254	0.847	-0.683	-0.329	-0.052	-1.268	-14.747	-153.034
Japan	Korea	5.361	0.108	0.119	0.185	-0.149	0.072	0.139	0.353	9.645	-4.978
	Philippines	5.361	0.129	-0.759	0.220	-0.177	0.087	0.166	-0.934	11.530	-82.917
	Taiwan	5.361	0.053	-0.070	0.092	-0.074	0.035	0.069	0.156	4.740	-12.355
Jordan	Israel	1.634	0.016	0.159	0.636	-0.513	-0.107	-0.041	-0.356	1.434	88.681
	Syria	1.634	0.062	-0.111	1.010	-0.814	-0.133	-0.029	-0.294	5.515	13.099
Kenya	Uganda	1.385	0.184	-0.323	0.426	-0.343	0.102	0.121	-0.492	16.459	-33.066
Korea	Japan	5.788	0.425	-0.308	0.990	-0.798	0.234	0.459	-0.934	37.952	75.304
	Taiwan	5.788	0.096	-0.344	0.265	-0.214	0.044	0.105	-0.068	8.528	-19.555
Lesotho	South Africa	2.713	0.035	-1.556	2.122	-1.712	-0.376	-0.440	-2.612	3.086	51.695
Malawi	Zambia	1.396	0.085	-0.396	0.463	-0.374	-0.004	0.102	-1.226	7.616	19.143
Malaysia	Indonesia	3.161	0.749	0.282	1.690	-1.363	0.422	0.117	-0.427	66.863	-45.458
	Singapore	3.161	0.037	0.215	0.126	-0.102	0.013	-0.010	-0.226	3.300	21.953
	Thailand	3.161	0.380	-0.371	1.006	-0.812	0.185	0.004	0.103	33.894	-62.738
Mali	Algeria	0.260	0.414	0.685	0.904	-0.729	0.239	0.422	1.202	36.942	156.763
	Niger	0.260	0.171	0.043	0.417	-0.336	0.091	0.175	-0.079	15.290	3.572
	Senegal	0.260	0.174	-0.192	0.422	-0.341	0.092	0.177	-0.025	15.501	19.067
Malta	Algeria	6.150	-1.523	-4.965	2.614	-2.108	-2.028	-1.677	-3.673	-135.894	-421.068
	Italy	6.150	-1.733	-2.685	3.452	-2.784	-2.400	-1.937	-2.026	-154.651	-120.031
	Tunisia	6.150	-1.257	-4.330	1.942	-1.566	-1.632	-1.371	-2.282	-112.143	-406.793
Mexico	Guatemala	1.885	0.057	-0.048	0.084	-0.067	0.041	0.059	-0.038	5.075	-8.159
	U.S.A	1.885	0.833	1.038	1.074	-0.866	0.625	0.865	-0.041	74.304	204.256
Netherlands	Belgium	3.094	0.051	-0.068	0.373	-0.301	-0.021	-0.020	-0.002	4.588	-10.388
	Germany, Fed. Rep.	3.094	0.248	-0.481	1.162	-0.938	0.023	0.025	0.066	22.147	-36.458
	United Kingdom	3.094	0.234	-1.410	1.119	-0.902	0.018	0.019	-0.191	20.893	-116.219
New Zealand	Australia	2.196	0.204	0.065	1.164	-0.939	-0.021	0.362	0.727	18.251	3.998
	Fiji	2.196	0.009	-0.228	0.122	-0.098	-0.014	0.026	-0.146	0.821	-31.372
Nicaragua	Costa Rica	0.631	0.019	0.080	0.426	-0.343	-0.063	0.073	0.939	1.693	19.823
	Honduras	0.631	0.035	0.211	0.584	-0.471	-0.078	0.109	0.882	3.108	-2.783
Niger	Algeria	0.231	0.457	0.723	1.015	-0.819	0.261	0.471	1.488	40.765	164.683

Country a	Country b	a's Fitted Growth	ΔG	ΔG^{m}	direct	indirect	interact	ΔG^{e}	ΔG^{me}	ΔSSY (%)	ΔSSY^{m} (%)
1	2	3	4	5	6	7	8	9	10	11	12
Niger	Benin	0.231	0.136	-0.249	0.351	-0.283	0.068	0.141	-0.273	12.117	12.430
	Mali	0.231	0.228	0.072	0.562	-0.453	0.120	0.236	0.234	20.387	6.741
Norway	Finland	3.044	0.103	-0.357	0.534	-0.430	-0.001	-0.018	-0.035	9.152	-35.034
	Iceland	3.044	0.005	-0.089	0.036	-0.029	-0.002	-0.003	-0.090	0.470	-8.468
	Sweden	3.044	0.162	-0.824	0.757	-0.611	0.015	-0.009	-0.783	14.442	-52.154
Pakistan	India	2.728	1.223	0.853	1.558	-1.257	0.921	1.213	-0.726	109.106	92.826
	Iran	2.728	0.187	-0.494	0.282	-0.228	0.132	0.185	-0.775	16.674	30.518
Panama	Colombia	1.766	0.169	0.111	1.838	-1.482	-0.187	0.155	0.324	15.050	16.157
	Costa Rica	1.766	-0.018	-0.495	0.535	-0.431	-0.121	-0.022	-0.323	-1.594	-28.217
Papua New Guinea	Australia	-0.005	0.293	1.746	1.226	-0.989	0.056	0.099	0.981	26.192	325.630
	Indonesia	-0.005	1.000	3.350	2.655	-2.142	0.487	0.578	2.782	89.271	234.815
Paraguay	Argentina	1.362	0.500	-0.363	1.620	-1.307	0.186	0.809	-1.370	44.581	94.667
	Bolivia	1.362	0.159	0.359	0.718	-0.579	0.020	0.296	-0.348	14.200	30.436
	Brazil	1.362	0.997	1.143	2.522	-2.035	0.509	1.478	1.181	88.935	142.764
Peru	Bolivia	1.660	0.102	0.129	0.210	-0.169	0.061	0.105	0.274	9.089	-0.240
	Brazil	1.660	0.867	0.898	1.439	-1.160	0.589	0.886	2.482	77.403	69.299
	Chile	1.660	0.186	-0.188	0.372	-0.300	0.114	0.191	0.532	16.617	0.354
	Colombia	1.660	0.346	0.297	0.656	-0.529	0.219	0.355	1.361	30.892	15.746
	Ecuador	1.660	0.136	0.194	0.277	-0.224	0.083	0.140	0.673	12.153	8.172
Philippines	Indonesia	2.301	0.521	1.021	0.977	-0.788	0.332	0.550	1.828	46.470	50.146
	Japan	2.301	0.470	2.301	0.895	-0.722	0.297	0.497	2.889	41.957	286.007
Portugal	Spain	2.831	0.266	0.304	1.050	-0.847	0.063	0.317	-0.399	23.751	68.910
Rwanda	Uganda	0.890	0.043	-0.395	0.871	-0.703	-0.126	0.461	-0.862	3.815	-27.551
	Zaire	0.890	0.113	-0.077	1.280	-1.032	-0.134	0.728	-1.226	10.092	-14.783
Senegal	Guinea Bissau	0.032	0.016	0.156	0.102	-0.082	-0.003	0.012	0.060	1.462	6.680
	Mali	0.032	0.112	0.036	0.550	-0.444	0.006	0.089	-0.183	9.989	-27.679
	The Gambia	0.032	0.014	0.074	0.086	-0.070	-0.003	0.010	-0.031	1.223	2.475
Singapore	Hong Kong	5.955	-0.313	-0.584	0.761	-0.614	-0.460	-1.675	-1.049	-27.943	-31.349
	Malaysia	5.955	-0.465	-2.579	1.291	-1.041	-0.715	-2.775	-2.661	-41.522	-242.860
	Thailand	5.955	-0.587	-3.269	2.027	-1.635	-0.979	-4.214	-2.409	-52.401	-343.783
South Africa	Botswana	1.138	0.019	-0.038	0.035	-0.028	0.012	0.012	0.023	1.666	-5.351
	Lesotho	1.138	0.025	0.019	0.047	-0.038	0.016	0.016	0.037	2.203	-2.360

Country a	Country b	a’s Fitted Growth	ΔG	ΔG^m	direct	indirect	interact	ΔG^e	ΔG^{me}	ΔSSY (%)	ΔSSY^m (%)
1	**2**	**3**	4	5	**6**	**7**	**8**	9	10	**11**	12
South Africa	Swaziland	1.138	0.015	-0.008	0.028	-0.023	0.009	0.009	-0.009	1.331	-1.400
	Zimbabwe	1.138	0.085	0.064	0.157	-0.127	0.055	0.054	-0.182	7.585	-3.887
Spain	France	3.156	0.333	-0.312	0.617	-0.498	0.214	0.393	-0.295	29.710	13.967
	Portugal	3.156	0.082	-0.021	0.164	-0.133	0.050	0.098	0.198	7.275	-11.475
Sri Lanka	Australia	2.270	0.092	-0.565	0.482	-0.389	-0.002	0.095	-0.312	8.182	78.756
	India	2.270	1.031	1.182	2.612	-2.107	0.526	1.048	0.038	91.987	57.212
	Indonesia	2.270	0.486	1.073	1.622	-1.308	0.172	0.497	1.837	43.352	36.718
Swaziland	South Africa	1.088	-0.287	0.042	2.734	-2.205	-0.816	-1.132	-1.018	-25.599	59.321
Sweden	Finland	1.865	0.092	0.206	0.311	-0.251	0.031	0.090	0.412	8.171	6.416
	Iceland	1.865	0.005	-0.023	0.018	-0.015	0.001	0.005	-0.022	0.429	-2.844
	Norway	1.865	0.078	0.354	0.269	-0.217	0.026	0.076	0.248	6.975	22.735
Switzerland	Austria	3.486	0.043	0.238	0.539	-0.435	-0.061	0.092	0.529	3.856	-8.557
	France	3.486	0.264	-0.971	1.518	-1.224	-0.029	0.403	0.968	23.597	-128.333
	Germany, Fed. Rep.	3.486	0.296	-0.929	1.614	-1.302	-0.016	0.443	0.651	26.413	-115.087
	Italy	3.486	0.276	-0.014	1.553	-1.252	-0.025	0.417	1.380	24.599	-63.826
Syria	Israel	1.575	0.061	0.075	0.279	-0.225	0.008	0.102	-0.051	5.482	39.063
	Jordan	1.575	0.043	-0.052	0.202	-0.163	0.004	0.073	0.004	3.838	-12.032
	Turkey	1.575	0.406	1.061	1.281	-1.033	0.158	0.594	-0.220	36.215	97.229
Taiwan	Japan	4.608	0.347	0.683	1.429	-1.153	0.071	0.339	-0.815	30.963	140.384
	Korea	4.608	0.145	0.836	0.798	-0.643	-0.009	0.141	0.249	12.958	52.901
Thailand	Malaysia	2.573	0.104	0.217	0.197	-0.159	0.066	0.091	-0.053	9.317	30.663
	Singapore	2.573	0.028	0.113	0.053	-0.043	0.017	0.024	-0.130	2.454	14.431
The Gambia	Senegal	2.044	-0.398	-1.938	1.576	-1.271	-0.703	-0.125	-0.755	-35.532	-121.751
Togo	Benin	2.597	0.002	-1.794	0.592	-0.477	-0.112	-0.070	-1.730	0.205	-83.591
	Ghana	2.597	0.065	-0.960	1.145	-0.923	-0.156	-0.074	-1.887	5.827	-8.000
Trinidad & Tobago	Barbados	2.034	-0.069	0.027	0.155	-0.125	-0.099	-0.030	0.149	-6.135	-10.413
Tunisia	Algeria	1.727	0.228	-0.385	0.916	-0.739	0.051	0.204	-1.039	20.340	-0.229
	Malta	1.727	0.009	0.093	0.051	-0.041	-0.001	0.007	-0.039	0.760	10.058
Turkey	Cyprus	2.742	0.014	0.028	0.025	-0.020	0.009	0.016	0.036	1.225	2.993
	Greece	2.742	0.089	0.229	0.159	-0.128	0.058	0.107	0.408	7.947	27.006
	Iran	2.742	0.250	-0.451	0.426	-0.344	0.168	0.298	-0.759	22.355	-10.525
	Syria	2.742	0.073	-0.106	0.130	-0.105	0.048	0.087	0.182	6.486	-9.886

Country a	Country b	a's Fitted Growth	ΔG	ΔG^m	direct	indirect	interact	ΔG^e	ΔG^{me}	ΔSSY (%)	ΔSSY^m (%)
1	2	3	4	5	6	7	8	9	10	11	12
U.S.A	Canada	2.995	0.069	0.069	0.070	-0.056	0.055	0.060	0.221	6.137	3.764
	Mexico	2.995	0.162	-0.072	0.163	-0.132	0.131	0.141	0.203	14.469	-19.768
Uganda	Kenya	0.426	0.203	0.636	0.580	-0.468	0.091	0.370	0.938	18.092	62.210
	Rwanda	0.426	0.080	0.069	0.252	-0.203	0.031	0.153	0.498	7.145	3.105
	Zaire	0.426	0.298	0.379	0.803	-0.647	0.143	0.530	0.051	26.588	20.015
United Kingdom	France	1.308	0.209	0.702	0.444	-0.358	0.123	0.211	0.509	18.670	55.590
	Ireland	1.308	0.016	0.042	0.038	-0.030	0.009	0.016	0.025	1.447	1.118
	Netherlands	1.308	0.064	0.376	0.145	-0.117	0.036	0.065	0.035	5.731	31.593
Uruguay	Argentina	0.639	0.311	0.341	1.563	-1.261	0.008	0.824	-0.129	27.727	40.951
	Brazil	0.639	0.702	1.820	2.462	-1.986	0.226	1.511	2.417	62.674	86.575
Venezuela	Barbados	0.393	0.013	0.036	0.042	-0.034	0.005	0.015	0.049	1.126	1.382
	Brazil	0.393	0.700	1.980	1.565	-1.262	0.397	0.806	3.021	62.479	70.930
	Colombia	0.393	0.276	1.021	0.749	-0.604	0.132	0.327	1.745	24.669	21.418
	Guyana	0.393	0.020	0.011	0.066	-0.053	0.007	0.025	-0.137	1.789	-4.311
Yugoslavia	Greece	4.050	0.073	-0.124	0.247	-0.199	0.025	0.109	0.311	6.508	-8.321
Zaire	Central Afr. Rep.	0.810	0.047	-0.023	0.078	-0.063	0.032	0.043	0.004	4.162	1.888
	Congo	0.810	0.035	-0.025	0.059	-0.048	0.024	0.032	0.127	3.150	4.830
	Rwanda	0.810	0.081	0.003	0.135	-0.109	0.055	0.075	0.325	7.269	1.737
	Uganda	0.810	0.171	-0.005	0.277	-0.224	0.117	0.157	0.241	15.267	5.880
	Zambia	0.810	0.089	0.097	0.148	-0.119	0.061	0.082	-0.076	7.963	23.515
Zambia	Malawi	1.000	0.178	-0.001	0.521	-0.420	0.077	-0.008	0.731	15.904	-38.779
	Zaire	1.000	0.496	-0.093	1.215	-0.980	0.261	0.063	0.273	44.304	-61.472
	Zimbabwe	1.000	0.197	0.175	0.567	-0.458	0.087	-0.006	0.672	17.541	16.938
Zimbabwe	Botswana	1.316	0.028	-0.157	0.107	-0.087	0.008	0.017	0.251	2.543	-19.579
	South Africa	1.316	0.424	-0.114	1.158	-0.934	0.200	0.298	0.687	37.870	59.791
	Zambia	1.316	0.127	-0.140	0.429	-0.346	0.044	0.080	-0.755	11.351	-13.648

Table 7 – Pairs of countries that would both have gained from full political integration ($\Delta G^m > 0$ for both countries)

Argentina	Chile
Bolivia	Brazil
Brazil	Colombia
Brazil	Guyana
Brazil	Paraguay
Brazil	Peru
Canada	U.S.A
Colombia	Peru
Denmark	Federal Republic of Germany
France	Federal Republic of Germany
India	Pakistan
India	Sri Lanka
Indonesia	Malaysia
Mali	Niger

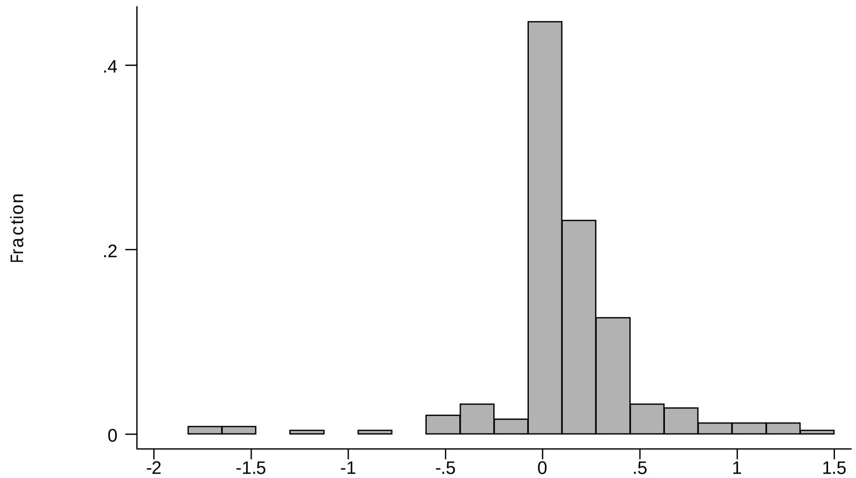

Figure 1 - Total Effect of Size Merger on Growth

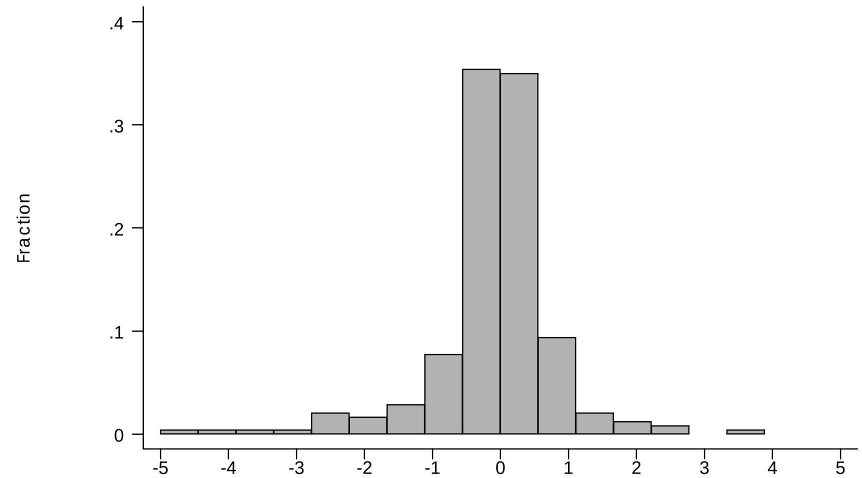

Figure 2 - Total Effect of Full Integration on Growth

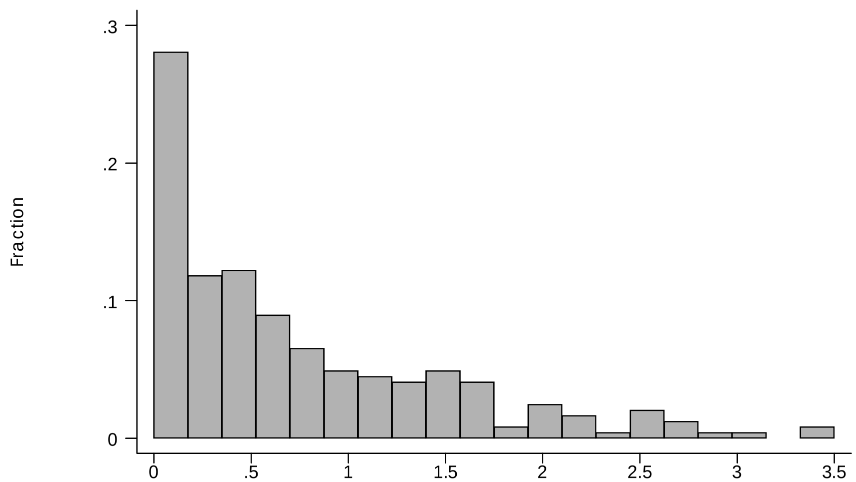

Figure 3 - Direct Size Effect

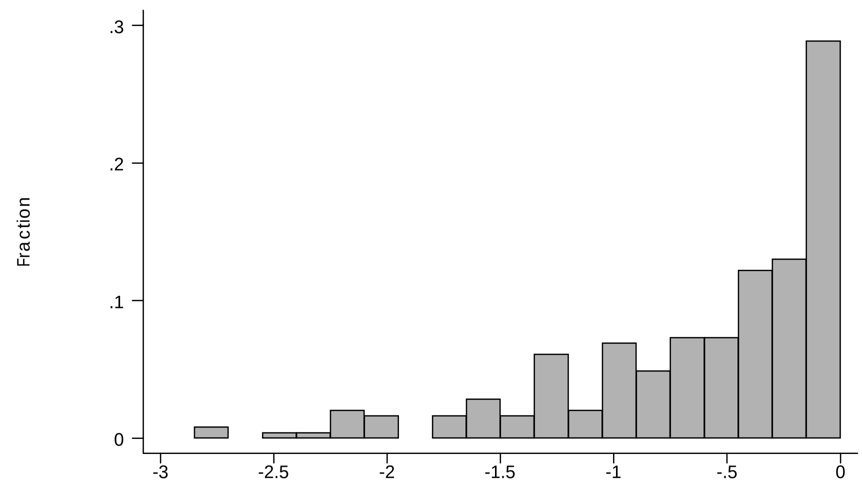

Figure 4 - Indirect Effect via Openness Reduction

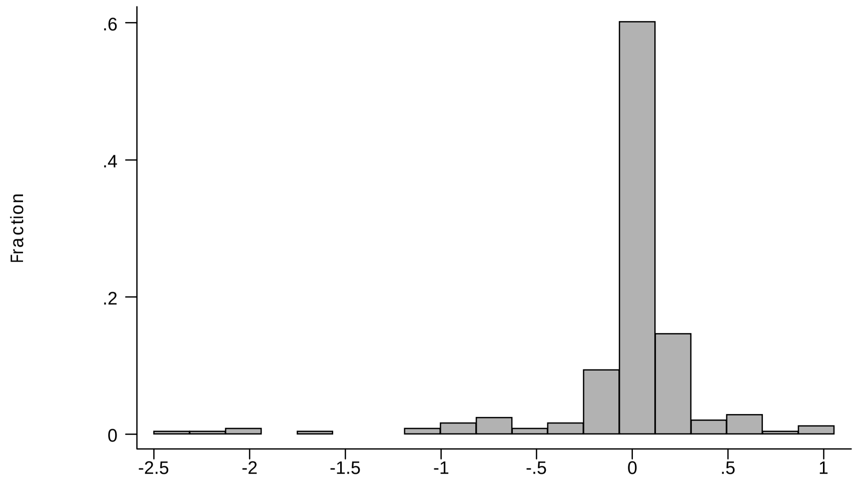

Figure 5 - Interaction Term Effect

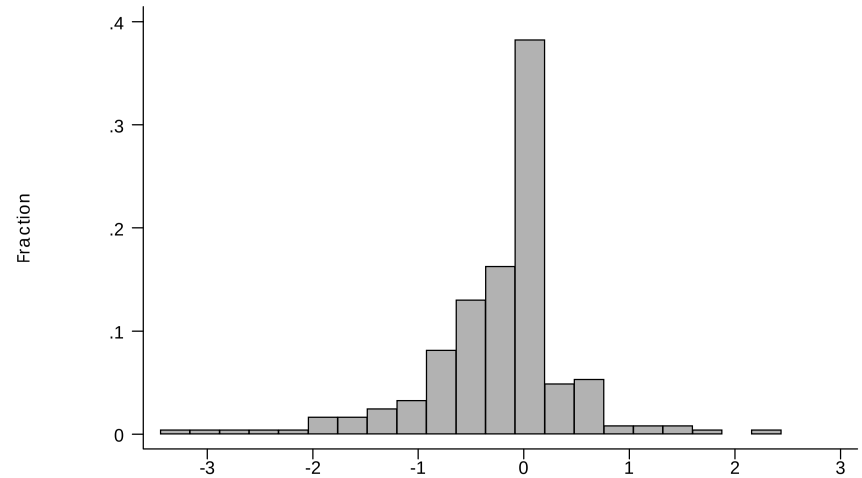

Figure 6 - Steady-State Determination Effect

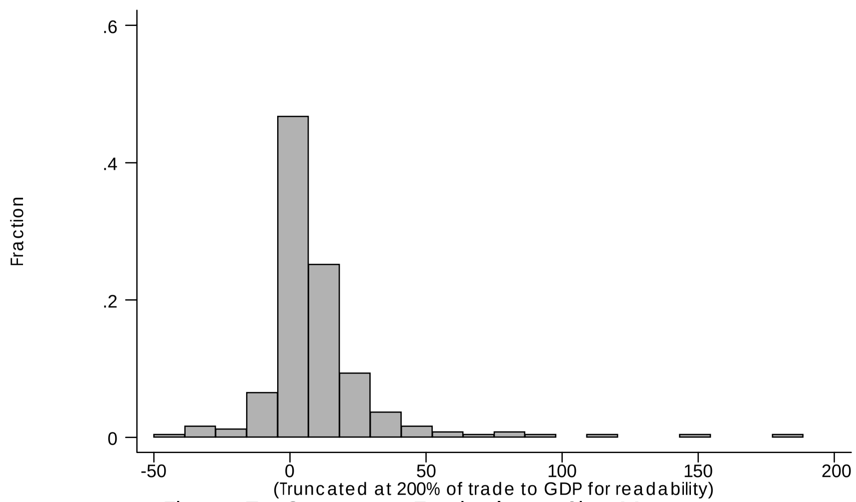

Figure 7 - Openness Equivalent - Size Merger

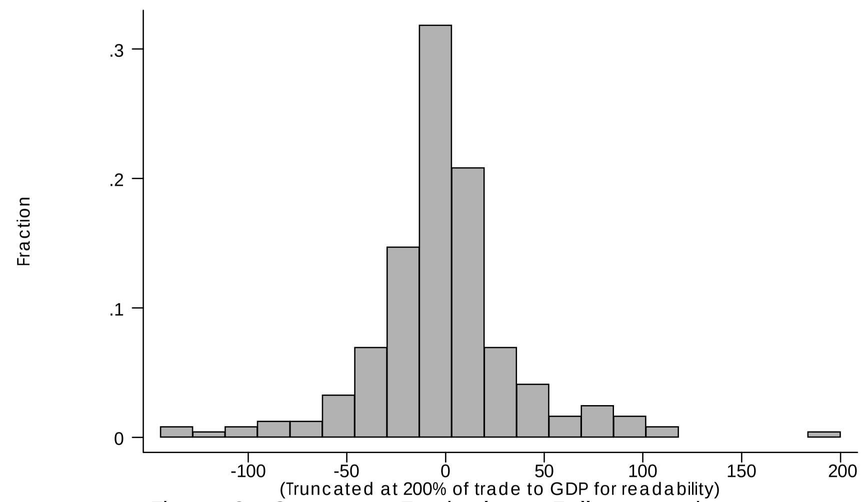

Figure 8 - Openness Equivalent - Full Integration

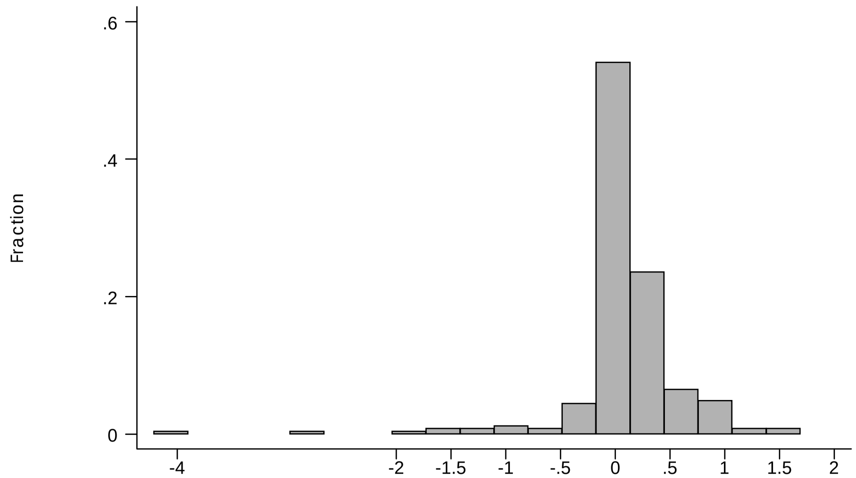

Figure 9 - Effect of Size Merger on growth - with Residual

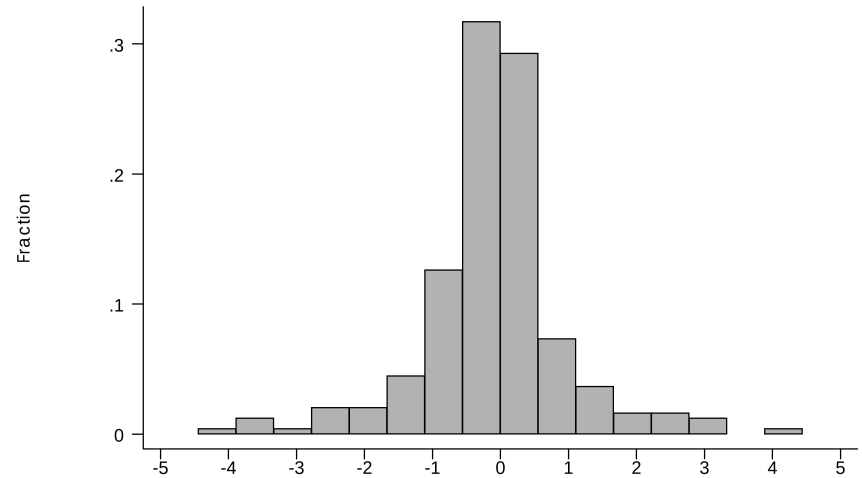

Figure 10 - Effect of Full Integration on growth - with Residual

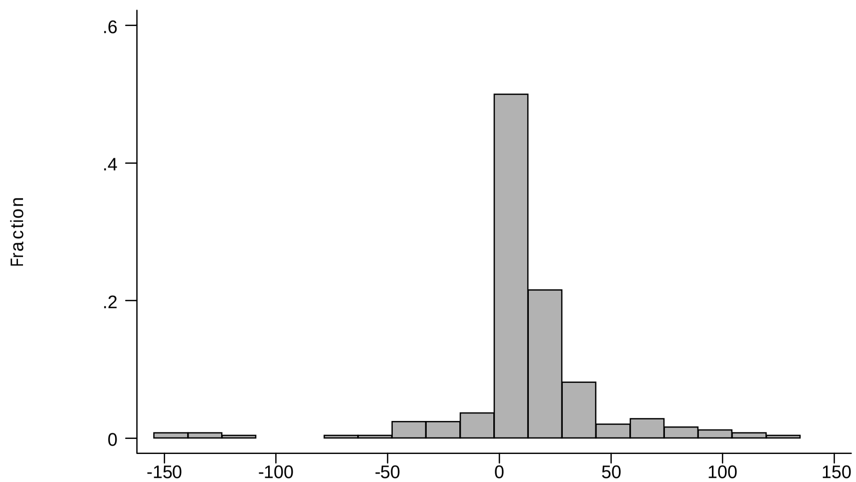

Figure 11 - Effect of Size Merger on Steady-State Income (%)

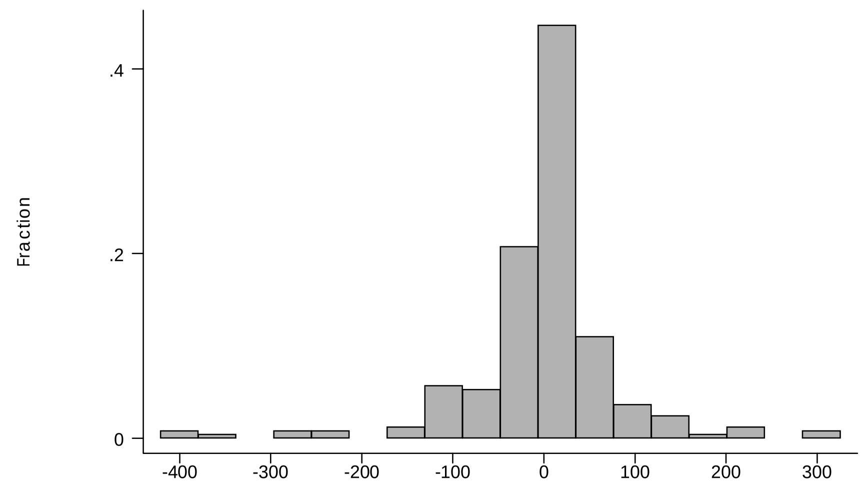

Figure 12 - Effect of Full Integration on Steady-State Income (%)