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INTERNATIONAL FRIENDS AND ENEMIES

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ABSTRACT

To what extent do nations' economic interests influence their political behavior? We provide new evidence on this question using bilateral network measures of exposure to foreign economic growth and a range of measures of bilateral political behavior, including United Nations voting, strategic rivalries and formal alliances. Using exogenous variation from the natural experiments of China's emergence into the global economy and reductions in the cost of air travel over time, we show that as a country becomes more economically dependent on a trade partner, it realigns politically towards that trade partner.

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1 Introduction

“Throughout history, anxiety about decline and shifting balances of power has been accompanied by tension and miscalculation ... Traditionally the test of a great power was its strength in war. Today, however, the definition of power is losing its emphasis on military force ... The factors of technology ... and economic growth are becoming more significant in international power.” (Nye 1990, pp. 153-4)

To what extent do nations’ economic interests influence their political behavior? We provide new evidence on this question using network measures of the sensitivity of welfare in one country to productivity growth in another country. We propose a bilateral friends-and-enemies matrix representation of the first-order general equilibrium effect of productivity growth in one country on welfare in another: One country is a friend [enemy] for income or welfare in another country if its productivity growth raises [reduces] the income or welfare of the other country. Using China’s emergence into the global economy as a natural experiment, we show that as countries become more economically dependent on China relative to the United States over time, they realign politically away from the United States and towards China, with this pattern particularly strong for South-East Asian and resource-rich African countries. More broadly, using exogenous variation in bilateral trade costs within exporter-importer pairs over time from the declining cost of air travel, we show that as a country’s welfare becomes more exposed to productivity growth in another nation, it realigns politically towards that nation, along a range of measures including United Nations voting, strategic rivalries and formal alliances.¹

Analyzing the relationship between political behavior and economic interests raises several challenges. First, there is the problem of measuring the sensitivity of one country’s welfare to productivity growth in another country. Some studies use bilateral trade. However, one country’s economic exposure to another does not only depend on bilateral trade frictions, but also on trade frictions with other nations. Even taking this multilateral resistance into account yields an incomplete picture, because productivity growth in trade partners typically has other general equilibrium effects through the terms of trade. Another approach is to undertake counterfactuals for productivity shocks within a non-linear general equilibrium trade model. However, this approach also faces challenges, because it requires a measure of productivity growth to evaluate these counterfactuals. Although actual productivity growth can be measured using observed data, political behavior does not only depend on the actual shocks that occurred, but also on the counterfactual shocks that could have occurred. For example, a country’s political behavior can

¹Recent work emphasizing links between economics and politics includes research on trade and war (Martin et al. 2008), institutions and development (Acemoglu et al. 2001), foreign aid and development (Kuziemko and Werker 2006; Nunn and Qian 2014); and economic networks and conflict (König et al. 2017).

depend on expected events or policies in its trade partners, but such counterfactual shocks can take many possible values and are typically unobserved.

Our network measures address these challenges. First, they correspond to the elasticities of country welfare with respect to foreign productivity growth in the class of international trade models with a constant trade elasticity. Hence, they correspond exactly to the theoretically-consistent measure of the *sensitivity* of country welfare with respect to productivity growth in this influential class of models. Second, they can be computed directly from observed trade data alone, which avoids the requirement of having to measure counterfactual shocks that influenced country behavior but which did not in fact occur. Third, since our measures are derived from the general equilibrium conditions of this class of models, they capture not only multilateral resistance but all first-order general equilibrium effects. Finally, we show that our sensitivity measures are not only exact for small shocks but provide a good approximation to the full non-linear model solution for empirically-realistic shocks, such as cumulative changes in productivity over our sample period of more than forty years.

We obtain our friends-and-enemies measures of bilateral exposure from a matrix representation of the first-order comparative statics in constant elasticity trade models. An advantage of this matrix representation of the entire bilateral network of country income and welfare exposure is that we are able to use techniques from the networks literature to characterize the role of countries' positions within the network in influencing the effects of productivity shocks. We evaluate the extent to which each country's productivity growth affects others (its "authority score" from graph theory) and the extent to which each country is affected by others' productivity growth (its "hub score" from graph theory). We thus provide new data on countries' roles in the global economy, both in terms of our measures of income and welfare exposure, and the network statistics derived from them. Our use of the terms "friends" and "enemies" echoes its use in neoclassical trade theory for the general equilibrium relationships between factor and goods prices, or goods outputs and factor endowments.

We combine our economic exposure measures with a range of different measures of countries' political alignment. First, we use three different measures of the bilateral similarity of countries' voting patterns in the United Nations General Assembly (UNGA). Second, we use measures of countries' "ideal points" or preferences relative to the US-led liberal order, based on the UNGA voting data. Third, we use measures of strategic rivalries, based on the perceptions of contemporary political decisions, as to whether countries regard one another as actual or latent threats. We further disaggregate these strategic rivalries into those that are positional, spatial and ideological. Finally, we use measures of formal alliances between countries, including mutual defense pacts, neutrality and non-aggression treaties and ententes.

Another challenge in examining the relationship between political behavior and economic

interests is that causality can run in both directions, or both variables can be influenced by omitted third factors. We address this challenge in two ways. First, we use the natural experiment of China's liberalization in 1978. Following China's market-orientated reforms, we show that other countries realign politically towards China and away from the United States. We show that this realignment is stronger for Africa and Asia/Oceania, and weaker for Europe and North and South America. Over the same period, we observe an increase in other countries' welfare exposure to China relative to the United States. We find that this change in relative welfare exposure is stronger for Africa and Asia/Oceania, and weaker for Europe and North and South America. Therefore, there is a close relationship between the observed political realignment and the change in relative welfare exposure following China's emergence into the global economy, consistent with economic interests shaping political behavior. As further evidence in support of this relationship, we find that countries with *initially* higher levels of exposure to productivity growth in *any* nation, according to their initial network hub score, experience larger changes in political realignment towards China and away from the United States.

Second, we make use of the large-scale reduction in the cost of air travel that occurred over our sample period following [Feyrer \(2019\)](#). The key idea is that the position of land masses around the globe generates large differences between bilateral distances by sea and air, such that some bilateral pairs benefit more from the reduction in the cost of air travel than others. By exploiting variation in trade costs over time within exporter-importer pairs, we control for a host of time-invariant factors that are specific to individual pairs of countries (e.g. geographical location, institutions, legal origin, common language etc.). We also include exporter-year and importer-year fixed effects, which control for the sign and absolute magnitude of actual or expected exporter productivity growth, as well as policy changes that are common to all trade partners and macro shocks. Using these differential changes in relative trade costs from reductions in the cost of air travel within exporter-importer pairs, we find that increases in bilateral welfare exposure raise bilateral political alignment. We show that these results are robust across a range of econometric specifications (including panel and long-differences regressions) and measures of bilateral political alignment (including UN voting, strategic rivalries and formal alliances). Therefore, these findings provide further support for the view that as a country becomes more economically dependent on its trade partner, it realigns politically towards that trade partner.

We first introduce our friend-enemy exposure measures for the influential class of single-sector models with a constant trade elasticity. We next show that this same representation holds across a wide range of specifications, including a state of the art quantitative trade model with multiple sectors and input-output linkages. We use this quantitative specification for our main empirical results and report a number of further validation exercises. First, we show that our exposure measures are not well proxied by simpler measures of economic relationships between

countries, such as bilateral trade flows. Second, we provide evidence that our model-based exposure measures have predictive power for separate data not used in their estimation. We show that our exposure measures both predict country selection into preferential trade agreements (PTAs) and detect increases in economic interdependence following the formation of these PTAs.

Our research contributes to several strands of existing work. First, our paper is related to research on international political economy. One strand of this research has measured countries' bilateral political alignment using data on the similarity of their voting patterns in the United Nations General Assembly (UNGA), including [Scott \(1955\)](#), [Cohen \(1960\)](#), [Signorino and Ritter \(1999\)](#), [Häge \(2011\)](#) and [Dicaprio and Sokolova \(2018\)](#). Much of this literature focuses on the bilateral similarity of these voting patterns. In contrast, [Bailey et al. \(2017\)](#) uses information on the issues voted on to estimate countries' "ideal points," which correspond to their positions vis-a-vis the US-led liberal order.² Another line of this research has measured countries' bilateral political alignment using data on strategic rivalries, based on the perceptions of contemporary political decision markers, including [Thompson \(2001\)](#), [Colaresi et al. \(2010\)](#) and [Aghion et al. \(2018\)](#). Another branch of work has used data on formal alliances between countries, including [Eisensee and Strömberg \(2007\)](#), [Gartzke \(2007\)](#) and [de Mesquita and Siverson \(1995\)](#). A further vein of this research measures bilateral political attitudes using survey data and other information, including [Alesina and Spolaore \(2003\)](#), [Guiso et al. \(2009\)](#), [Head et al. \(2010\)](#), [Head and Mayer \(2013\)](#) and [Bao et al. \(2019\)](#). Our key contribution relative to this literature is to examine the relationship between these measures of bilateral political alignment and our new measures of the extent to which countries are economic friends and enemies.³

Second, our research connects with the empirical literature on war and trade. One strand of this work looks at the causal impact of war on trade, including [Blomberg and Hess \(2006\)](#) and [Glick and Taylor \(2010\)](#). Another line of this work looks at the opposite causal relationship of trade on the probability of conflict, including [Polachek \(1980\)](#), [Mansfield \(1995\)](#) and [Barbieri \(2002\)](#). Combining these two strands, [Martin et al. \(2008\)](#) provide theory and evidence that globalization *decreases* the likelihood of *global* conflict, but *increases* the chance of *bilateral* conflict, because globalization increases countries' multilateral dependence on one another as a whole, but decreases a country's bilateral dependence on any one trade partner. Although the use of military force is the ultimate expression of political power, it is relatively rare. Furthermore, the

²Using UN and US data, [Kuziemko and Werker \(2006\)](#) shows that aid to a country increases when it rotates onto the Security Council. Using US aid data, [Nunn and Qian \(2014\)](#) shows that an increase in food aid increases the incidence and duration of civil conflicts. Using trade data, [Meyersson et al. \(2008\)](#) examines the impact of China's demand for natural resources on human rights in Sub-Saharan Africa.

³Several authors have drawn parallels between the current China-US tensions and earlier episodes of changing relative economic size, such as Japan and the United States in the 1980s, Britain and Germany at the turn of the 20th century, or Athens and Sparta in Ancient Greece. See [Brunnermeier et al. \(2018\)](#) and "China-US rivalry and threats to globalization recall ominous past," Martin Wolf, *Financial Times*, 26th May, 2020.

international relations literature emphasizes softer forms of political power, including international agreements, supra-national institutions, and back-room diplomacy (see for example [Nye 1990](#)). We provide new theory and evidence on the extent to which these softer forms of political power are influenced by economic interests.

Third, we build on the empirical literature that has developed instrumental variables for bilateral international trade, including [Frankel and Romer \(1999\)](#), [Rodriguez and Rodrik \(2001\)](#) and [Feyrer \(2019\)](#). Fourth, we also build on research on quantitative models and sufficient statistics in trade, including [Armington \(1969\)](#), [Jones and Scheinkman \(1977\)](#), [Wilson \(1980\)](#), [Eaton and Kortum \(2002\)](#), [Anderson and van Wincoop \(2003\)](#), [Arkolakis et al. \(2012\)](#), [Costinot et al. \(2012\)](#), [Caliendo and Parro \(2015\)](#), [Adão et al. \(2019\)](#), [Baqae and Farhi \(2019\)](#), [Huo et al. \(2019\)](#), [Caliendo et al. \(2019\)](#) and [Allen et al. \(2020\)](#).⁴ Our key departure from this literature is in the manipulation of the system of linearized market clearing conditions into two matrices of bilateral income and welfare exposure. This procedure generates two sets of bilateral statistics on the global trade network that can be taken as inputs for further empirical analysis. These matrices capture the full network of bilateral income and welfare elasticities, which allows us to make use of tools from the network analysis literature, and these measures can be integrated into other dyadic datasets. We show that our representation holds across a wide range of trade models, including specifications with multiple sectors and input-output linkages. We use this representation to provide an analytical characterization of the quality of the first-order approximation to the full non-linear model solution in terms of these observed matrices. In our empirical application, we use our network measures to provide new evidence on the substantive question of the extent to which countries' economic interests shape their political behavior.

The remainder of the paper is structured as follows. Section 2 derives our economic friends and enemies measures. Section 3 introduces our data. Section 4 reports our main empirical results on political and economic friends. Section 5 reports further specification checks. Section 6 concludes. A separate online appendix contains the derivations of the results in the paper and a number of further extensions.

2 Economic Friends and Enemies

In this section, we propose a bilateral friends-and-enemies matrix representation of the first-order comparative statics of productivity growth in one country on the income and welfare in another country in constant elasticity trade models. We first develop our exposure measures for an influential class of single-sector models. We next derive our measures for a state of the

⁴The earlier theoretical literature on foreign productivity growth and domestic welfare includes the classic contributions of [Hicks \(1953\)](#), [Johnson \(1955\)](#) and [Bhagwati \(1958\)](#).

art quantitative trade model with multiple sectors and input-output linkages. For simplicity, we focus on Armington trade models, in which goods are differentiated by origin. In Section C of the online appendix, we demonstrate isomorphisms with the entire class of trade models with a constant trade elasticity.

2.1 Model

Consider a world of many countries indexed by $n, i \in \{1, \dots, N\}$. Each country has an exogenous supply of ℓ_n workers, who are each endowed with one unit of labor that is supplied inelastically. Goods are differentiated by country of origin and the representative consumer in country n is assumed to have constant elasticity of substitution (CES) preferences, such that the indirect utility function (u_n) takes the following form:

$$u_n = \frac{w_n}{\left[\sum_{i=1}^N p_{ni}^{-\theta} \right]^{-\frac{1}{\theta}}}, \quad \theta = \sigma - 1, \quad \sigma > 1, \quad (1)$$

where w_n is the wage; p_{ni} is the price in country n of the good produced in country i ; $\sigma > 1$ is the elasticity of substitution and $\theta = \sigma - 1$ is the trade elasticity. Using Roy's Identity, country n 's share of expenditure on the good produced by country i (s_{ni}) is:

$$s_{ni} = \frac{p_{ni}^{-\theta}}{\sum_{m=1}^N p_{nm}^{-\theta}}. \quad (2)$$

Each country's good is produced with labor according to a constant returns to scale production technology, with productivity z_i in country i . Markets are perfectly competitive. Goods can be traded between countries subject to iceberg trade costs, such that $\tau_{ni} \geq 1$ units of a good must be shipped from country i in order for one unit to arrive in country n (where $\tau_{ni} > 1$ for $n \neq i$ and $\tau_{nn} = 1$). The cost in country n of consuming one unit of the good produced by country i is:

$$p_{ni} = \frac{\tau_{ni} w_i}{z_i}. \quad (3)$$

Goods market clearing requires that income in country i equals the expenditure on goods produced by that country:

$$w_i \ell_i = \sum_{n=1}^N s_{ni} w_n \ell_n, \quad (4)$$

where we begin by assuming for simplicity that is balanced, before later generalizing our approach to allow for trade imbalances. Finally, we choose world GDP as the numeraire:

$$\sum_{n=1}^N w_n \ell_n = 1. \quad (5)$$

Using these components of the model, we are now in a position to define general equilibrium.

Equilibrium Given fundamentals, i.e., the set of country-level productivities $\{z_i\}$ and bilateral trade costs $\{\tau_{ni}\}$, the general equilibrium of the model is the collection of factor prices $\{w_i\}$, goods prices $\{p_{ni}\}$, and expenditure shares $\{s_{ni}\}$, and welfare $\{u_n\}$ that satisfy equations (1)-(5).

Substituting the expenditure share (2) and pricing rule (3) into the market clearing condition (4), we can reduce the general equilibrium of the model to a single system of N equations that uniquely determines the N wages in each country.

2.2 First-Order Comparative Statics

We next derive familiar first-order comparative statics in this class of constant elasticity trade models,⁵ before introducing our new friend-enemy representation in the next section. Totally differentiating the expenditure share (2), the pricing rule (3) and the market clearing condition (4), the change in country income per capita satisfies:

$$d \ln w_i = \sum_{n=1}^N t_{in} \left(d \ln w_n + \theta \left(\sum_{h=1}^N s_{nh} [d \ln \tau_{nh} + d \ln w_h - d \ln z_h] - [d \ln \tau_{ni} + d \ln w_i - d \ln z_i] \right) \right), \quad (6)$$

where we have held country labor endowments constant ($d \ln \ell_i = 0$) and the share of value added that country i derives from each market n is defined as:

$$t_{in} \equiv \frac{s_{ni} w_n \ell_n}{w_i \ell_i}.$$

Totally differentiating the indirect utility function (1), the change in country welfare equals the change in income per capita minus the expenditure share weighted average of price changes:

$$d \ln u_n = d \ln w_n - \sum_{i=1}^N s_{ni} [d \ln \tau_{ni} + d \ln w_i - d \ln z_i]. \quad (7)$$

2.3 Friends-and-Enemies Representation

The friend-enemy representation of bilateral economic exposure stacks the first-order comparative statics into a matrix that captures the effect on each country (rows) of shocks in any other country (columns), where one country is a friend [enemy] for income or welfare in another country if its productivity growth raises [reduces] the income or welfare of the other country. The friend-enemy matrix therefore represents the entire bilateral network of country income and welfare exposure to foreign shocks and enables us to use techniques from the networks literature to characterize the role of countries' positions within the global economic network.

⁵See, for example, Jones and Scheinkman (1977), Wilson (1980), Arkolakis et al. (2012), Adão et al. (2019), Baqaee and Farhi (2019), and Huo et al. (2019).

We use boldface, lowercase letters for vectors, and boldface, uppercase letters for matrices. We use the corresponding non-bold, lowercase letters for elements of vectors and matrices. We use \mathbf{I} to denote the $N \times N$ identity matrix.

Expenditure Share and Income Share Matrices Let $\mathbf{S} \equiv [s_{ni}]$ be the $N \times N$ matrix with the ni -th element equal to importer n 's expenditure share on exporter i . Let $\mathbf{T} \equiv [t_{in}]$ be the $N \times N$ matrix with the in -th element equal to the fraction of income that exporter i derives from selling to importer n . We refer to \mathbf{S} as the *expenditure share* matrix and to \mathbf{T} as the *income share* matrix. Intuitively, s_{ni} captures the importance of i as a *supplier* to country n , and t_{in} captures the importance of n as a *buyer* for country i . Note the order of subscripts: in matrix \mathbf{S} , rows are buyers and columns are suppliers, whereas in matrix \mathbf{T} , rows are suppliers and columns are buyers. Both matrices have rows that sum to one.⁶

Let $\mathbf{q} \equiv [w_i \ell_n]$ be the $N \times 1$ vector with the i -th element equal to country i 's income relative to world GDP. We refer to \mathbf{q} simply as the *income vector*.

The \mathbf{q} vector and the \mathbf{S} and \mathbf{T} matrices are all equilibrium objects that can be obtained directly from observed trade data. Under trade balance, \mathbf{q}' is the dominant left-eigenvector of both \mathbf{S} and \mathbf{T} , with corresponding eigenvalue of one.

Friends-and-Enemies for Income Using the matrix notation, we can stack the comparative statics for income in equation (6) as:

$$\underbrace{d \ln \mathbf{w}}_{\text{income effect}} = \underbrace{\mathbf{T} d \ln \mathbf{w}}_{\text{market-size effect}} + \underbrace{\theta \cdot \mathbf{M} \times (d \ln \mathbf{w} - d \ln \mathbf{z})}_{\text{cross-substitution effect}}, \quad (8)$$

where we denote $\mathbf{M} \equiv \mathbf{T}\mathbf{S} - \mathbf{I}$. The income comparative statics in equation (8) have an intuitive interpretation. The first term on the right-hand side captures a *market-size effect*. If the productivity shocks raise income in another country n , this raises income in country i through increased expenditure on its goods. The magnitude of this effect depends on the share of income that country i derives from country n (as captured by the matrix \mathbf{T}).

The second term on the right-hand side captures a cross-substitution effect, where the in -th element of the cross-substitution matrix ($\mathbf{M} \equiv \mathbf{T}\mathbf{S} - \mathbf{I}$) is given by $m_{in} \equiv \sum_{h=1}^N t_{ih} s_{hn} - 1_{n=i}$. For $i \neq n$, the sum $\sum_{h=1}^N t_{ih} s_{hn}$ captures the overall competitive exposure of country i to country n , through each of their common markets h , weighted by the importance of market h for country

⁶For theoretical completeness, we maintain two assumptions on \mathbf{S} , which are satisfied empirically in all years of our data: for any i, n , there exists $k \in \mathbb{Z}^+$ such that $[\mathbf{S}^k]_{in} > 0$; (ii) for all i , $s_{ii} > 0$. The first assumption states that all countries are connected through trade, *directly* or *indirectly*. Theoretically, this assumption is important because shocks propagate in general equilibrium through changes in relative prices, which are only well-defined if countries are connected (potentially indirectly) to each other through trade. The second assumption states that every country consumes a positive amount of domestic goods.

i 's income (t_{ih}). As the competitiveness of country n increases, as measured by a decline in its wage relative to its productivity ($d \ln w_n - d \ln z_n$), consumers in all markets h substitute towards country n and away from other countries $i \neq n$, thereby reducing income in country i and raising it in country n . With a constant elasticity import demand system, the magnitude of this cross-substitution effect in market h depends on the trade elasticity (θ) and the share of expenditure in market h on the goods produced by country n (s_{hn}): consumers in market h increase expenditure on country n by $(s_{hn} - 1)$ and lower expenditure on country i by s_{hn} . Summing across all markets h , we obtain the overall impact on country i 's income.

Using our matrix representation of the income comparative statics in equation (8), we can immediately recover the elasticity of each country's income with respect to a productivity shock in any country from a simple matrix inversion problem.

Definition 1. The “friends-and-enemies” income exposure matrix is

$$\mathbf{W} \equiv -\frac{\theta}{\theta + 1} (\mathbf{I} - \mathbf{V})^{-1} \mathbf{M}, \quad \mathbf{V} \equiv \frac{\mathbf{T} + \theta \mathbf{TS}}{\theta + 1} - \mathbf{Q},$$

where \mathbf{Q} is an $N \times N$ matrix with the income row vector \mathbf{q}' stacked N times.

The elements of the matrix \mathbf{W} capture countries' bilateral income exposure to productivity shocks, as shown in Section B of the online appendix:

$$d \ln \mathbf{w} = \mathbf{W} d \ln \mathbf{z}, \tag{9}$$

In particular, the in -th element of this matrix is the elasticity of income in country i (row) with respect to a small productivity shock in country n (column). We refer to country n as being a “friend” of country i for income when this elasticity is positive and an “enemy” of country i for income when this elasticity is negative. In general, \mathbf{W} is not necessarily symmetric: i could view n as a friend, while n views i as an enemy.

Our choice of world GDP as the numeraire implies that $\sum_{i=1}^N q_i d \ln w_i = 0$ or $\mathbf{Q} d \ln \mathbf{w} = \mathbf{0}$, where \mathbf{Q} is an $N \times N$ matrix with the income row vector \mathbf{q}' stacked N times. The presence of the term \mathbf{Q} in the definition of the matrix \mathbf{V} in Definition 1 reflects this choice of numeraire.⁷ All of our predictions for relative country incomes are invariant to the choice of numeraire.

⁷Without this term, the matrix $\left(\mathbf{I} - \frac{\mathbf{T} + \theta \mathbf{TS}}{\theta + 1}\right)$ is not invertible, because the income shares and expenditure shares sum to one ($\sum_{n=1}^N t_{in} = 1$ and $\sum_{n=1}^N s_{ni} = 1$), which implies that the rows of $\frac{\mathbf{T} + \theta \mathbf{TS}}{\theta + 1}$ sum to one and the columns of $\left(\mathbf{I} - \frac{\mathbf{T} + \theta \mathbf{TS}}{\theta + 1}\right)$ are not linearly independent. This non-invertibility reflects the fact that the trade share matrices \mathbf{T} , \mathbf{S} and \mathbf{M} are homogeneous of degree zero, which implies that income can only be recovered from these trade shares up to a normalization or choice of units.

Since the spectral radius (largest absolute eigenvalue) of the matrix \mathbf{V} is less than one, the matrix inversion in Definition 1 has a power-series or Neumann-series representation:

$$\mathbf{W} = -\frac{\theta}{\theta + 1} (\mathbf{I} - \mathbf{V})^{-1} \mathbf{M} = -\frac{\theta}{\theta + 1} \sum_{k=0}^{\infty} \mathbf{V}^k \mathbf{M} = -\underbrace{\frac{\theta}{\theta + 1} \mathbf{M}}_{\text{partial equilibrium}} - \underbrace{\frac{\theta}{\theta + 1} (\mathbf{V} + \mathbf{V}^2 + \dots) \mathbf{M}}_{\text{general equilibrium}}. \quad (10)$$

In this representation, the overall first-order impact is expressed in terms of a partial equilibrium effect, which captures the direct impact of the productivity shocks at initial prices, and general equilibrium effects, which capture the endogenous adjustment of prices.

Friends-and-Enemies for Welfare We next stack the comparative statics for welfare in equation (7) in matrix form:

$$\underbrace{d \ln \mathbf{u}}_{\text{welfare effect}} = \underbrace{d \ln \mathbf{w}}_{\text{income effect}} - \underbrace{\mathbf{S} (d \ln \mathbf{w} - d \ln \mathbf{z})}_{\text{cost-of-living effect}}. \quad (11)$$

Again the welfare comparative statics in equation (11) have an intuitive interpretation. The change in welfare depends on the change in income and a cost of living effect, which reflects the impact of the productivity shocks on the price index in each country. This cost of living effect depends on the share of expenditure (s_{ni}) that each country n allocates to all countries i , as captured in the \mathbf{S} matrix.

Definition 2. The “friends-and-enemies” welfare exposure matrix is

$$\mathbf{U} \equiv (\mathbf{I} - \mathbf{S}) \mathbf{W} + \mathbf{S}.$$

The elements of the matrix \mathbf{U} capture countries’ bilateral welfare exposure to productivity shocks, as follows from equation (11):

$$d \ln \mathbf{u} = \mathbf{U} d \ln \mathbf{z}. \quad (12)$$

In particular, the ni -th element of this matrix is the elasticity of welfare in country n (row) with respect to a small productivity shock in country i (column). We refer to country i as being a “friend” of country n for welfare when this elasticity is positive and an “enemy” of country n for welfare when this elasticity is negative. As for income exposure, welfare exposure \mathbf{U} is not necessarily symmetric: i could view n as a friend, while n views i as an enemy. Unlike the income exposure, which captures nominal effects of productivity shocks and thus depends on the choice of numeraire, the welfare exposure in Definition 2 captures real effects of productivity shocks and is thus invariant to our choice of numeraire.

Exposure Network Our friends-and-enemies matrix representations of bilateral exposure lend themselves to the use of techniques from the networks literature to characterize the role of countries' positions within the network in influencing the effects of productivity shocks. In particular, we use the authority and hub scores from Kleinberg (1999), which are generalizations of the centrality measures used for symmetric networks. These generalizations take into account that the network is asymmetric and hence the direction of relationships matters. The authority score captures the extent to which a country affects others, while the hub score captures the extent to which a country is influenced by others.

More formally, the hub and authority scores for welfare exposure can be retrieved as the dominant eigenvector of UU' and $U'U$, respectively, such that $\mathbf{a} \propto U'U\mathbf{a}$ and $\mathbf{h} \propto UU'\mathbf{h}$. Therefore, we can write these hub and authority scores, $\{h_i, a_i\}_{i=1}^N$, as follows:

$$a_i = \lambda \sum_{n=1}^N U_{ni} h_n, \quad h_n = \mu \sum_{i=1}^N U_{ni} a_i, \quad (13)$$

where λ and μ are scaling constants that are equal to the inverse norms of the vectors $\mathbf{a} \equiv [a_i]$ and $\mathbf{h} \equiv [h_n]$, respectively. Intuitively, countries with higher authority scores are those whose productivity growth has a larger impact on other countries. In contrast, countries with higher hub scores are those more highly exposed to productivity growth in other countries. From the bilateral country-partner network of exposure, we can thus obtain measures for each country of the extent to which it influences others and the extent to which it is influenced by others, for both income and welfare exposure.

Non-linearities Our exposure measures in equations (9) and (12) are derived from a linearization that is exact for small shocks. In Section 5 below and in Section H.2 of the online appendix, we show that these exposure measures provide a good approximation to the full non-linear model solution more generally. First, we derive analytical bounds on the absolute magnitude of the non-linearities not captured by our exposure measures in terms of the observed trade shares and the trade elasticity (θ). We implement these analytical bounds empirically and confirm that the non-linearities are indeed small compared with the first-order effect captured by our measures. Second, we directly show that our linearization closely approximates the predictions of the full non-linear model solution for the empirical distribution of cumulative productivity growth over our sample period of more than forty years from 1970-2012.

Multiple Sectors and Input-Output Linkages To illustrate our approach as clearly as possible, we have so far focused exposition on the influential class of single-sector trade models with a constant trade elasticity. An advantage of our friends-and-enemies representation is that it also

holds for constant trade elasticity models with multiple industries, such as [Costinot et al. \(2012\)](#), and state-of-the-art models with cross-sector input-output linkages, such as [Caliendo and Parro \(2015\)](#). In both of these extensions, the income and welfare exposures matrices \mathbf{W} and \mathbf{U} continue to follow Definitions 1 and 2, and the economic forces shaping these cross-country exposures have the exact same interpretation of market size, cross-substitution, and cost-of-living effects, respectively captured by the income share (\mathbf{T}), cross-substitution (\mathbf{M}), and expenditure share (\mathbf{S}) matrices. These extensions require richer data on industry-level trade and input-output flows. This additional information not only modifies the market size, cross-substitution and cost of living effects, and hence changes income and welfare exposure, but also generates extra, industry-level predictions for the impact of foreign shocks.

As shown in detail in Sections D.3-D.6 of the online appendix, the differences between the exposure measures in these richer models and the single-sector Armington model lie in the construction of these \mathbf{S} , \mathbf{T} , and \mathbf{M} matrices. For the multi-sector model without input-output linkages, the \mathbf{S} and \mathbf{T} matrices continue to represent country-to-country expenditure shares and income shares, and the only adjustment to be made relative to the single-sector model is to the cross-substitution \mathbf{M} matrix. In the single sector model, recall that the in -th element of the \mathbf{M} matrix for $i \neq n$ is given by $\sum_{h=1}^N t_{ih}s_{hn}$, which captures the overall competitive exposure of country i to country n , through each of their common markets—countries indexed by h —where in each market h the exposure is the product between the importance of that market for country i 's income (t_{ih}) and the expenditure share of h 's consumers on the goods produced by country n (s_{hn}). In the multi-sector model, the cross-substitution \mathbf{M} matrix accounts for the fact that a market is no longer a third country but is instead a country-industry. The competitive exposure of country i to country n in a country-industry market hk —for instance, countries i and n may compete for the textiles (k) in Singapore (h)—is the product between the income that country i derives from exporting textiles to Singapore and Singapore's within-sector expenditure share on textile produced by country n .

For the multi-sector input-output model ([Caliendo and Parro 2015](#)), the elements of all three matrices must be adjusted to take into account the network structure of production, using the observed industry-to-industry flows in the input-output matrix. For the \mathbf{S} and \mathbf{T} matrices, this is largely a matter of accounting. We take into account that the gross value of trade includes not only the direct value-added created in this exporter and industry but also indirect value-added created in previous stages of production, and we unwind production chains so that \mathbf{S} and \mathbf{T} capture expenditure and income shares in terms of value-added. For the \mathbf{M} matrix, this adjustment also takes into account that the effect of a foreign productivity shock now differs depending on whether it reduces intermediate input costs or competitors' output prices, as well as the fact that now competitive pressure is present at every stage of a production chain. For this

multi-sector input-output model, the elements of the \mathbf{S} , \mathbf{T} and \mathbf{M} matrices are now given by:

$$\mathbf{S}_{ni} \equiv \sum_{h=1}^N \sum_{k=1}^K \alpha_n^k s_{nh}^k \Lambda_{hi}^k, \quad \mathbf{T}_{in} \equiv \sum_{h=1}^N \sum_{k=1}^K \Pi_{ih}^k \vartheta_{hn}^k, \quad \mathbf{M}_{in} \equiv \sum_{h=1}^N \sum_{k=1}^K \sum_{o=1}^N \Pi_{io}^k \left(\vartheta_{oh}^k + \sum_{j=1}^N \Theta_{oh}^{kj} \right) \Upsilon_{hon}^k,$$

where Λ_{hi}^k captures the share of production cost in industry k in country h that is spent on value-added in country i ; Π_{ih}^k is the network-adjusted income share that country i derives from selling to industry k in country h ; ϑ_{hn}^k is the share of revenue that industry k in country h derives from selling to country n ; Θ_{oh}^{kj} captures the fraction of revenue in industry k in country o derived from selling to producers in industry j in country h ; Υ_{hon}^k captures the responsiveness of country h 's expenditure on industry k in country o with respect to a shock to costs in country n ; and the full derivation is reported in Section D.6 of the online appendix.

Relation to Existing Results in the Quantitative Trade Literature Our friends-and-enemies exposure matrices build upon the recent literature on sufficient statistics in trade, including in particular Allen et al. (2020) and Baqaee and Farhi (2019). Similar to this literature, our measures are derived from observed expenditure shares and a small number of model parameters. Our key departure from this literature is in the manipulation of the system of linearized market clearing conditions into two matrices of bilateral income and welfare exposure (\mathbf{W} and \mathbf{U}). This procedure generates two sets of bilateral statistics on the global trade network that can be taken as inputs for further empirical analysis, as in our analysis of the substantive question of how economic exposure shapes international political relations below. These matrices capture the full network of bilateral income and welfare elasticities, and can be integrated into other dyadic datasets. The network nature of these exposure measures also allows us to utilize tools from the network analysis literature—the hub and authority scores in particular—to provide additional unilateral summary statistics of country exposure and influence in the network.

Our representation in terms of the expenditure share (\mathbf{S}), income share (\mathbf{T}) and cross-substitution matrices (\mathbf{M}) to capture cost-of-living, market-size, and cross-substitution effects, respectively, has two additional advantages. First, the same representation holds across a wide range of trade models, including specifications with multiple sectors and input-output linkages, after making appropriate changes to the elements of the \mathbf{S} , \mathbf{T} , and \mathbf{M} matrices, as discussed above, and developed in further detail in Sections C-D of the online appendix. Second, we show that our representation can be used to provide an analytical characterization of the quality of the first-order approximation to the full non-linear model solution in terms of these same matrices, as discussed above, and shown in Propositions A.2-A.6 of Section H.2 of the online appendix.

Extensions In the online appendix, we report a number of further extensions and generalizations of our approach. In Section D.1, we derive analogous income and welfare exposure measures for reductions in bilateral trade costs. In Section D.2, we show that our approach naturally accommodates trade imbalances, following the standard approach in the quantitative trade literature of treating these trade imbalances as exogenous. In Section D.3, we consider the multi-sector model without an input-output structure. In Section D.4, we show that our analysis can be further generalized to allow for heterogeneous trade elasticities (θ^k) across sectors k . In Section E, we consider a neoclassical trade model with a variable trade elasticity, and derive sensitivity bounds for our exposure measures with respect to departures from a constant trade elasticity.

3 Data

In this section, we discuss our economic and political data, while further information on the data sources and definitions is provided in Section I of the online appendix.

3.1 Economic Data

Our data on international trade are from the NBER World Trade Database, which reports values of bilateral trade between countries for around 1,500 4-digit Standard International Trade Classification (SITC) codes. The ultimate source for these data is the United Nations COMTRADE database and we use an updated version of the original dataset from Feenstra et al. (2005) for the time period 1970-2012.⁸ We augment these trade data with information on countries' gross domestic product (GDP), population and geographical characteristics from the GEODIST and GRAVITY datasets from CEPII.⁹ We measure bilateral air distance as the population-weighted average of the bilateral distances between countries' largest cities. We measure bilateral sea distance as the least-cost path by sea between countries' largest ports, for all bilateral pairs of countries that are connected by sea, as in Feyrer (2019).

We construct expenditure on domestic goods (X_{nnt}) using information on gross output, exports and imports, as discussed further in Section I of the online appendix. In our multi-sector models, we distinguish 20 tradeable and 20 non-tradeable sectors according to the International Standard Industrial Classification (ISIC). In our input-output specification, we use a common input-output matrix for all countries, based on the median input-output coefficients across the country sample in Caliendo and Parro (2015).¹⁰ We use these datasets to construct the \mathbf{S} , \mathbf{T} and

⁸See <https://cid.econ.ucdavis.edu/wix.html>.

⁹See http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp.

¹⁰In Section I of the online appendix, we report a robustness test, in which we construct domestic expenditure shares and country-specific input-output tables using the EORA Global Supply Chain Database (<https://www.worldmrio.com/>), for the shorter time period (1990-2015) and more aggregated industry classification for which these

M matrices for both the single-sector model and the multi-sector model with input-output linkages. Our baseline sample consists of a balanced panel of 143 countries over the 43 years from 1970-2012.

We combine these international trade data with the World Bank’s “Content Of Deep Trade Agreements” database (Hofmann et al. 2017).¹¹ This database covers 279 agreements signed by 189 countries between 1958 and 2015, which reflects the entire set of preferential trade agreements (PTAs) in force and notified to the World Trade Organization as of 2015. Our main PTA measure is an indicator variable that equals one if a pair of countries participates in a PTA in a given year and zero otherwise.

3.2 Political Data

We use a number of different measures of countries’ bilateral political alignment from the political science and international relations literature. First, we use data on observed voting behavior in the United Nations General Assembly (UNGA) to reveal countries’ bilateral political alignment. Second, we use measures of strategic rivalries, as classified by political scientists, based on contemporary perceptions of political decision makers. Third, we use information on formal alliances, including mutual defense pacts, neutrality and non-aggression treaties and ententes. A key advantage of each of these measures relative to data on military conflict is that much international political influence does not involve open hostilities, including international treaties, other supra-national agreements, international institutions, and back-room diplomacy.

United Nations Voting Country votes in the UNGA are recorded as “no” (coded 1), “abstain” (coded 2) or “yes” (coded 3). Our first measure of the similarity of countries’ bilateral political attitudes is the S -score of Signorino and Ritter (1999), which equals one minus the sum of the squared actual deviation between a pair of countries’ votes scaled by the sum of the squared maximum possible deviations between their votes. By construction, this S -score measure is bounded between minus one (maximum disagreement) and one (maximum agreement).

A limitation of this S -score measure is that it does not control for properties of the empirical distribution function of country votes. In particular, country votes may align by chance, such that the frequency with which any two countries agree on a “yes” depends on the frequency with which each country individually votes “yes.” Therefore, we also consider two alternative measures of bilateral voting similarity that control in different ways for properties of the empirical distribution of votes. First, the π -score of Scott (1955) adjusts the observed variability of the

data are available. We find a strong correlation between our baseline measures using the NBER World Trade Database data and those using the EORA database where both data are available, for our input-output measures of income (W^{IO}) and welfare (U^{IO}) exposure, and expenditure (S^{IO}) and income shares (T^{IO}).

¹¹See <https://datacatalog.worldbank.org/dataset/content-deep-trade-agreements>.

countries' voting similarity using the variability of each country's own votes around the average vote for the two countries taken together. Second, the κ -score of [Cohen \(1960\)](#) adjusts this observed variability of the countries' voting similarity with the variability of each country's own votes around its own average vote.

Finally, a potential limitation of these three measures of the bilateral similarity of voting patterns is that they do not control for heterogeneity in the resolutions being voted on. To address this concern, [Bailey et al. \(2017\)](#) use the observed UN votes to estimate a time-varying measure of each country's political preferences or "ideal points." They show that these ideal points consistently capture the position of states vis-à-vis the US-led liberal order. We use this approach to derive a measure of bilateral distance between countries' political attitudes by taking the absolute difference between the ideal points of countries i and j in each year t .

Strategic Rivalries Our second set of measures of countries' bilateral political alignment are indicator variables that pick up whether country i is a strategic rival of j in year t , as classified by [Thompson \(2001\)](#) and [Colaresi et al. \(2010\)](#). These rivalry measures capture the risk of conflict with a country of significant relative size and military strength, based on contemporary perceptions by political decision makers, gathered from historical sources on foreign policy and diplomacy. Specifically, rivalries are identified by whether two countries regard each other as competitors, a source of actual or latent threats that pose some possibility of becoming militarized, or enemies. These rivalries are also further disaggregated into the following different types: (i) positional, where rivals contest relative shares of influence over activities and prestige within a system or subsystem; (ii) spatial, where rivals contest the exclusive control of a territory; and (iii) ideological, where rivals contest the relative virtues of different belief systems relating to political, economic or religious activities.

Strategic rivalry is much more prevalent than military conflict, as shown in [Aghion et al. \(2018\)](#). In our sample from 1970-2012, we find that a total of 42 countries have had at least one strategic rival; 74 country-pairs have been strategic rivals at some point; and the total number of country-pair-years that exhibit strategic rivalry is 2,452. For example, China is classified as a strategic rival of the U.S. (1970–1972 and 1996–present), India (the entire sample period), Japan (1996–present), the former Soviet Union (1970–1989), and Vietnam (1973–1991). By comparison, the United States is coded as a strategic rival of China (1970-72 and 1996-2012), Cuba (1970-2012), and the former Soviet Union (1970-89 and 2007-2012).

Formal Alliances Our third set of political alignment measures are indicator variables for whether country i is in a formal alliance with country j in year t from the Correlates of War Formal Alliances v4.1 ([Gibler 2008](#)). This dataset records all formal alliances among states between

1816 and 2012, including mutual defense pacts, neutrality and non-aggression treaties, and ententes. A defense pact is the highest level of military commitment, requiring alliance members to come to each other's aid militarily if attacked by a third party. Neutrality and non-aggression pacts pledge signatories to either remain neutral in case of conflict or not use force against the other alliance members. Ententes obligate members to consult in times of crisis or armed attack. Over our entire sample period from 1970-2012, 1,946 country-pairs are in a formal alliance, and 117 countries have at least one formal ally. In the year 2010, China had four allies: Iran, North Korea, Russia, and Pakistan. In contrast, the United States was in alliance with 49 nations in the same year, a significantly greater number than the median country, which has 10 allies.

4 Economic and Political Friends and Enemies

In this section, we present our main empirical results using our quantitative specification with multiple sectors and input-output linkages from Section 2.3. In Section 4.1, we provide evidence on global patterns of income and welfare exposure. In Section 4.2, we use China's emergence into the global economy as a natural experiment to provide evidence on the relationship between political behavior and economic interests. In Section 4.3, we use quasi-experimental variation from the secular reduction in the cost of air travel over our sample period to provide further evidence on the role of economic interests in shaping political behavior.

4.1 Economic Friends and Enemies

We first provide some descriptive evidence on the evolution of our economic exposure measures over our sample period.

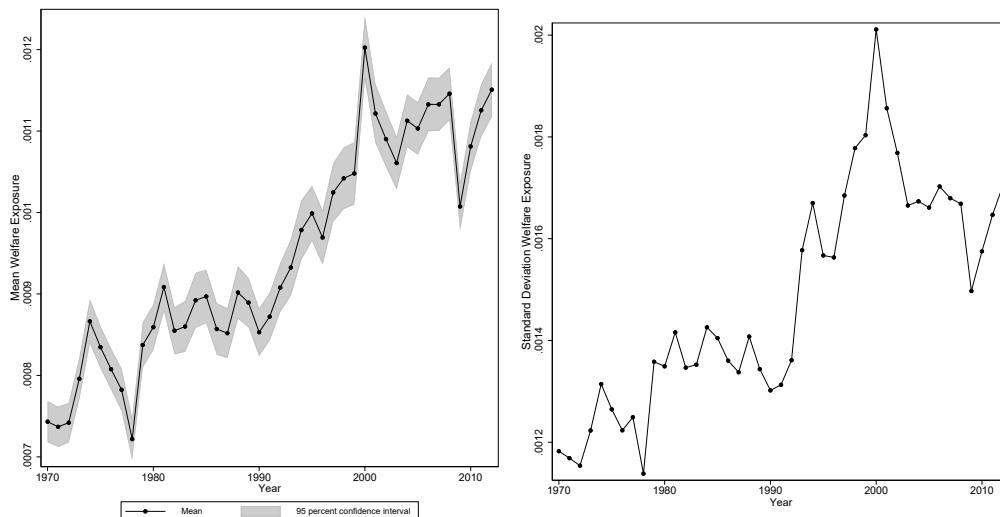
Global Welfare Exposure In Figure 1, we show the mean and standard deviation of welfare exposure to foreign productivity shocks (excluding own productivity shocks). Four main features are apparent. First, we find that on average foreign productivity shocks raise domestic welfare, because the net effect of the market-size, cross-substitution and cost of living effects is typically positive.¹² Second, we find that the mean elasticity is small, because foreign trade is a small share of income for most countries, most individual trade partners are a small share of foreign trade, and many individual trade relationships have zero flows.¹³ Third, we observe substantial

¹²Around 30 percent of bilateral pairs are enemies, although these negative values for welfare exposure are typically small in absolute magnitude. Enemies are frequently raw materials exporters that compete for markets, such as Chile and South Africa, and Saudi-Arabia and Niger. The absence of direct trade increases the probability that bilateral pairs are enemies, consistent with the cross-substitution effect being particularly strong in this case.

¹³To obtain the percentage change in welfare in response to productivity shocks, one needs to multiply the elasticities in Figures 1 by the size of the productivity shock. When we do so, we obtain predictions for the impact of productivity shocks of similar size to the existing quantitative trade literature, as shown in Section 5.2 below.

heterogeneity in welfare exposure across individual pairs of trading partners, with the standard deviation larger than the mean. Fourth, we observe an increase in both the mean and standard deviation of welfare exposure over time, consistent with increased globalization over our sample period enhancing countries' interdependence.

Figure 1: Mean and Standard Deviation of Welfare Exposure to Productivity Shocks in Other Countries over Time



Note: Left panel shows mean welfare exposure (black line) and the 95 percent confidence interval (gray shading); right panel shows the standard deviation of welfare exposure (black line); both panels exclude own productivity shocks; NBER World Trade Database and authors' calculations using our input-output specification.

In Section F of the online appendix, we compare our input-output welfare exposure (U^{IO}) and income exposure (W^{IO}) measures to a number of simpler measures of trading relationships between countries: (i) log value of bilateral trade; (ii) aggregate import shares (the expenditure share matrix from our single-sector model (S^{SSM})); (iii) the expenditure share matrix from our input-output model (S^{IO}); (iv) the income share matrix from our input-output model (T^{IO}); and (v) the cross-substitution matrix from our input-output model (M^{IO}). While our economic exposure measures have statistically significant correlations with all of these variables, we show that they are all imperfect proxies for our theoretically-consistent exposure measures.

Hub and Authority Scores As our approach recovers the bilateral network of country income and welfare exposure from a single matrix inversion, we can use techniques from the networks literature to characterize the role of countries' positions within the network in shaping the impact of productivity growth. In particular, we use the authority and hub scores from Kleinberg (1999), which capture the extent to which a country affects others (authority score) and the extent to which a country is influenced by others (hub score), as discussed in Section 2.3 above. We compute these hub and authority scores for welfare exposure (U) for each year of our sample

period. We set the diagonal entries of U to zero, in order to focus on welfare exposure to foreign productivity growth. We report 5-year moving averages to abstract from short-run fluctuations in international trade flows.

In Table 1, we list the five countries with the highest authority and hub scores for the years 1980 and 2010.¹⁴ Countries with higher authority scores—the productivity growth of which generates the greatest welfare impact to others—tend to be larger, although country-level GDP is only moderately correlated with authority scores, with a correlation coefficient of 0.66. The authority scores spotlight the decline of Japan, the growth of which had more global impact than that of the United States in 1980, and the rise of China, which was outside of top-5 in 1980, but had the greatest authority score in 2010. Table 1 also lists the countries that are most exposed to foreign productivity changes. The hub score weakly and negatively correlates (coefficient -0.10) with a country’s GDP.

Table 1: Countries with the Highest Welfare Authority and Hub Scores, 1980 and 2010

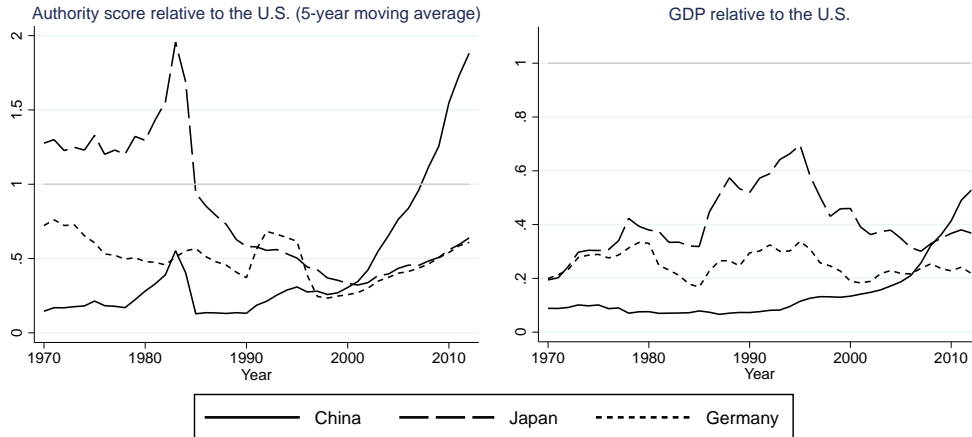
Countries with the highest authority scores		Countries with the highest hub scores	
1980	2010	1980	2010
1. Japan	1. China	1. Vietnam	1. Syria
2. United States	2. United States	2. Cambodia	2. Singapore
3. France	3. France	3. Singapore	3. Djibouti
4. Saudi Arabia	4. Germany	4. Belize	4. Vietnam
5. Singapore	5. Japan	5. Lebanon	5. Malaysia

Note: Authority and hub scores for welfare exposure computed using equation (13) above in our input-output specification.

Even though correlated with GDP, the authority score has substantial independent variation. We find that countries more integrated into global value chains (including the South-East Asian countries of Singapore, Thailand, Malaysia, Taiwan towards the end of our sample period) tend to have greater authority scores relative to GDP. In contrast, commodity exporters (such as Brazil, Mexico, Chile, and Colombia) tend to have lower authority scores relative to GDP.

¹⁴In Section F of the online appendix, we provide further evidence on the evolution of the network of global bilateral welfare exposure over our sample period using network graphs.

Figure 2: Welfare Authority scores and GDP relative to the U.S. for China, Japan, and Germany



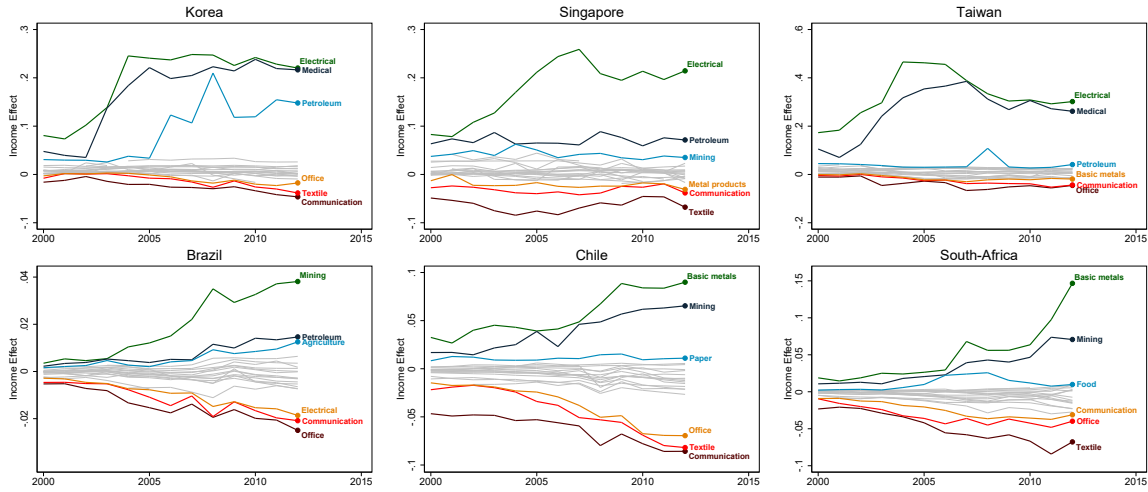
Source: NBER World Trade Database and authors' calculations using our input-output specification.

In the left panel of Figure 2, we show the authority score of China, Japan, and Germany relative to that of the U.S. over our sample period. In the right panel, we show the GDP of the same group of countries relative to that of the U.S.. A striking feature is that while the GDPs of Japan and China never exceed 70 percent of the U.S. level between 1970 and 2012, the authority scores of Japan and China far exceed those of the U.S. in the 1980s and 2010s, respectively. Therefore, these authority scores sharply illustrate the growing dependence of other countries on Chinese productivity growth over the course of our sample period.

Sector Income Exposure We now provide further evidence on the mechanisms underlying these aggregate changes in economic exposure. In our multi-sector framework with input-output linkages, even foreign productivity growth that is common across industries can have heterogeneous effects on industry income across countries. These heterogeneous effects depend on the extent to which countries share similar patterns of industry comparative advantage in output markets or source intermediate inputs from one another. We use our linearization to construct analogous measures of *industry* income exposure, which capture these heterogeneous effects across industries, as shown in Section D.6.10 of the online appendix.

In Figure 3, we show the effects of Chinese productivity growth on industry income relative to the income-weighted average of OECD countries for South-East Asian and resource-rich emerging economies. For both the South-East Asian countries and resource-rich emerging economies, we find some of the most negative effects for the Textiles sector. In contrast, we find striking differences between the two groups of countries in the sectors with the most positive income effects. For the South-East Asian countries, the sectors that benefit most from Chinese productivity growth include the Electrical, Medical and Office Equipment sectors, which is consistent with input-output linkages between related sectors through global value chains in Factory Asia.

Figure 3: Industry Income Exposure in South-East Asia and Resource-Rich Emerging Economies to Chinese Productivity Growth (Relative to the Income-Weighted Average of OECD Countries)



Source: NBER World Trade Database and authors' calculations using our input-output specification.

However, for the resource-rich emerging economies, the sectors that benefit most include the Mining, Agricultural and Basic Metals sectors, which is in line with a form of “Dutch Disease,” where the growth of resource-intensive sectors propelled by Chinese demand competes away factors of production from less resource-intensive sectors. Therefore, we find an intuitive pattern of changes in sectoral income exposure across both groups of economies.

4.2 China’s Emergence into the Global Economy

We next use China’s emergence into the global economy as a natural experiment to shed light on the relationship between political behavior and economic interests. Following Autor et al. (2013), a large empirical literature argues that China’s rapid economic growth was driven by a domestic supply-side shock from its market-orientated reforms in 1978. Therefore, we use this domestic shock as an exogenous source of variation in other countries’ welfare exposure.

Geography of Welfare Exposure and Political Alignment In the top panel of Figure 4, we show maps of country welfare exposure to Chinese productivity growth in 1980 (shortly after its market-orientated reforms) and 2010 (close to the end of our sample period). We divide the welfare exposure distribution into five discrete cells, with darker red shading denoting more positive welfare effects. We hold the boundaries between these five discrete cells constant over time, so that the intensity of shading is comparable over time. We find positive welfare effects of Chinese productivity growth on most countries.¹⁵ In 1980, these effects are relatively modest,

¹⁵In contrast, we find negative income effects for a number of countries, highlighting the importance of distinguishing welfare from income exposure, because of the strength of the cost of living effect in the model.

with the most positive welfare effects concentrated in South-East Asia, Oceania and a number of African countries. By 2010, we find a substantial increase in the absolute magnitude of these welfare effects, which are again geographically concentrated in South-Asia, Oceania and much of North and Sub-Saharan Africa, but now extend to a number of Latin American countries.

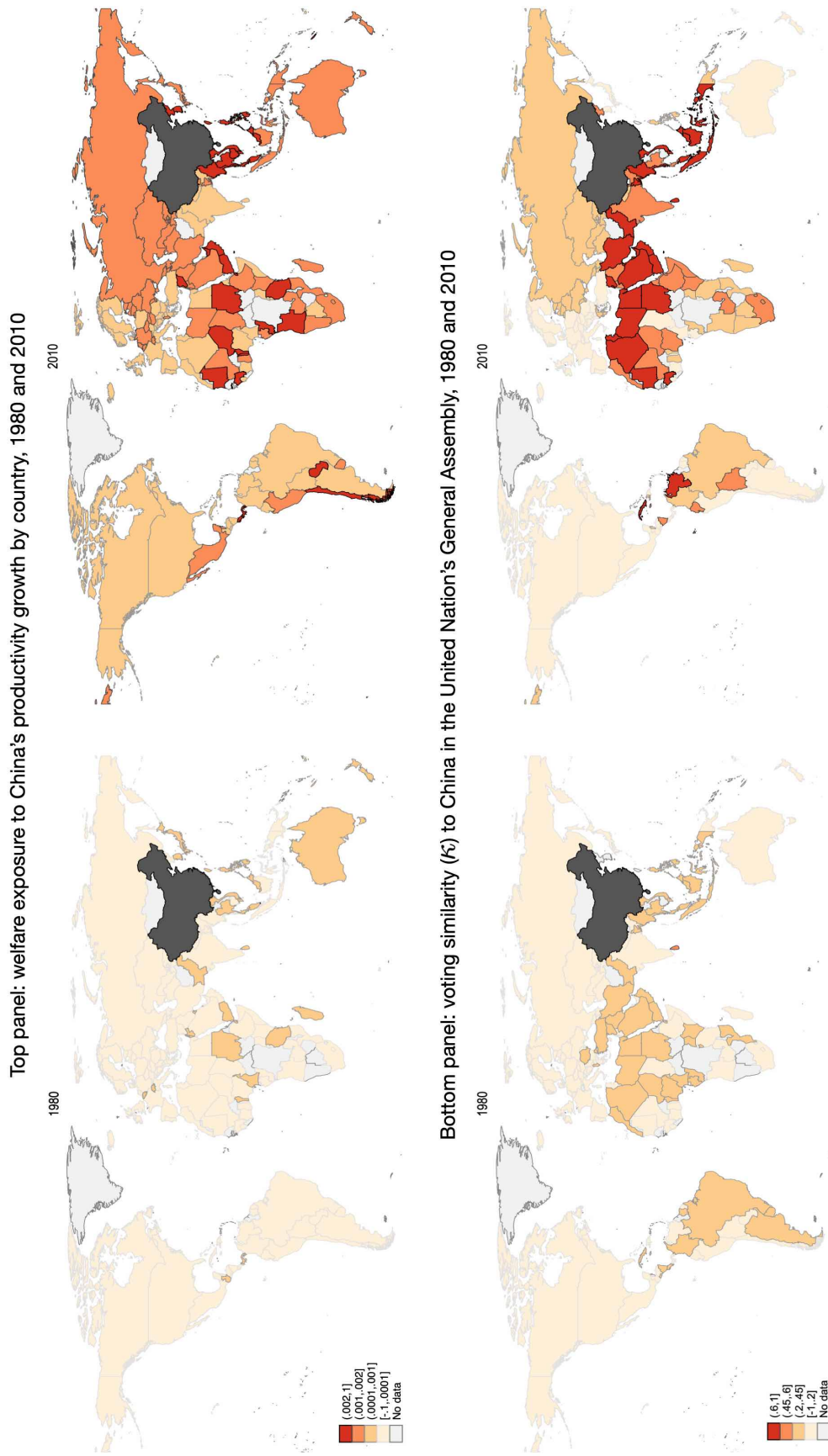
In the bottom panel of Figure 4, we show maps of the similarity of countries' voting patterns to China in the UNGA in both 1980 and 2010. We use our baseline κ -score measure of voting similarity, which controls for the empirical distribution of yes, no or abstain votes. We again divide the voting similarity measure into five discrete cells, holding the boundaries between these cells constant, and using darker red shading to denote greater voting similarity. Alongside the dramatic increase in welfare exposure in the top panel, we find a large-scale increase in voting similarity in the bottom panel, consistent with a growing economic dependence on China inducing a political realignment towards it. We find a striking resemblance in both levels and changes between the geographic patterns of voting similarity and welfare exposure. The countries with the highest degrees of voting similarity to China are clustered in South-East Asia and a number of North and sub-Saharan African countries, again supporting the idea that increased economic dependence on China has induced a political realignment towards it.

Changes in Welfare Exposure and Political Alignment We now provide further evidence on the relationship between changes over time in political alignment and voting similarity, both across regions of the world, and across individual countries.

We begin by constructing a measure of relative political alignment towards China and the United States, which differences out any common changes in political alignment to these two countries over time.¹⁶ In our baseline specification, we again use our κ -score measure of the bilateral similarity of countries' voting patterns in the UNGA, which controls for the empirical distribution of yes, no or abstain votes, but we find a similar pattern of results with our other measures. First, for all other countries n and years t , we compute the difference between each country's political alignment to China and its alignment to the United States ($\mathbf{A}_{n,China,t}^{\kappa} - \mathbf{A}_{n,USA,t}^{\kappa}$), and subtract the initial value of this variable in 1980 shortly after China's liberalization in 1978. Second, for each year t , we take the average of this relative political alignment across countries within each of the following geographical areas of Africa, Asia/Oceania, Europe and North and South America. In Figure 5a, we display the evolution of this mean relative political alignment over time. Following China's opening up, we observe that other countries realign politically towards China relative to the United States. We find that this realignment is stronger for Africa and Asia/Oceania, and weaker for Europe and North and South America.

¹⁶While we report results for relative political alignment and relative welfare exposure to difference out any common time effects, we find a similar relationship without differencing relative to the United States.

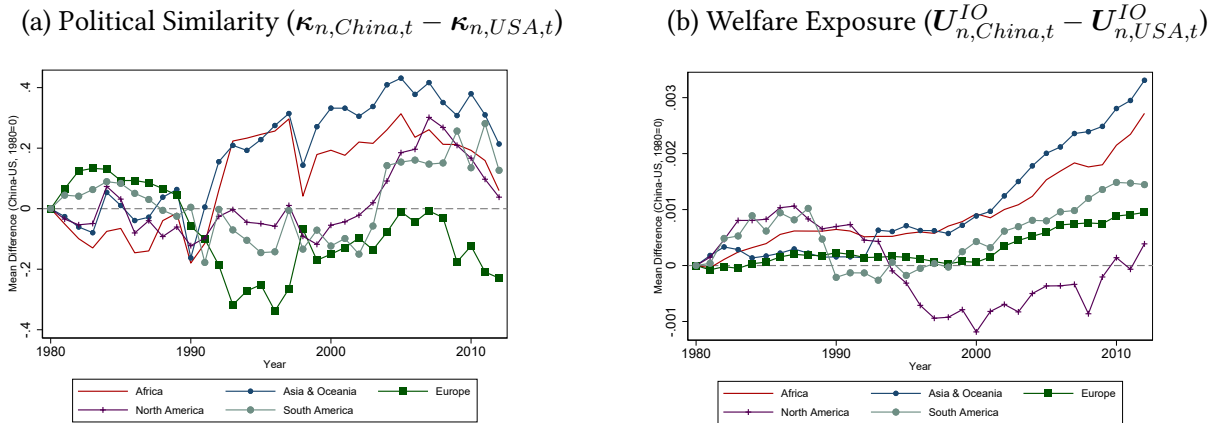
Figure 4: Country Welfare Exposure and Voting Similarity to China, 1980 and 2010



Note: Top panel shows country welfare exposure to China in 1980 and 2010 using our input-output specification; bottom panel shows the similarity of countries' votes in the UNGA to China in 1980 and 2010, using our baseline κ -score measure of voting similarity; darker shades of red denote more positive values; the boundaries between the five discrete cells are held constant over time, such that the intensity of red shading is comparable over time. Source: NBER World Trade Database and authors' calculations.

We next construct an analogous measure of relative welfare exposure towards China and the United States, which again differences out any common changes in welfare exposure to these two countries over time. First, for all other countries n and years t , we compute the difference between each country's welfare exposure to China and its welfare exposure to the United States ($U_{n,China,t}^{IO} - U_{n,USA,t}^{IO}$), and subtract the initial value of this variable in 1980 shortly after China's market-orientated reforms. Second, for each year t , we take the average of this relative welfare exposure across countries within each of the same geographical areas. In Figure 5b, we display the evolution of this mean relative welfare exposure over time. Following China's opening up, we observe an increase in other countries' welfare exposure to China relative to the United States. Furthermore, we find that this change in the pattern of relative welfare exposure is stronger for Africa and Asia/Oceania, and weaker for Europe and North and South America. Therefore, we again find a close relationship between changes in political alignment and changes in welfare exposure following China's emergence into the global economy, consistent with economic interests shaping political behavior.

Figure 5: Relative Political Alignment and Welfare Exposure by Continent Over Time (Average Towards China Minus Average Towards the United States)



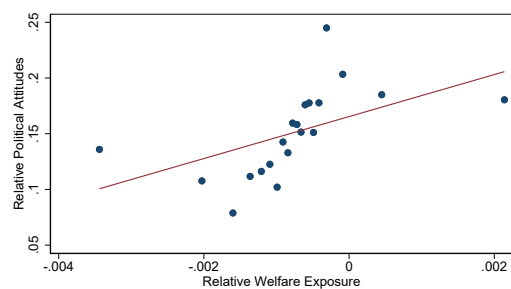
Notes: In the left panel, we first measure the bilateral political alignment of each country n to each country i in each year t using the κ -score measure (κ_{nit}) of the similarity of country votes in the United Nations General Assembly (UNGA); we next compute each country's political alignment to China minus its political alignment to the United States in each year ($A_{n,China,t}^{\kappa} - A_{n,USA,t}^{\kappa}$), normalizing the difference in 1980 to 0 by subtracting its level from all subsequent years; finally, we take averages of this relative political alignment in each year across all countries within each region (excluding China and the United States); in the right panel, we first measure the welfare exposure of each country n to each country i in each year t (U_{nit}^{IO}) in our input-output specification from Section 2.3; we next compute each country's welfare exposure to China minus its welfare exposure to the United States in each year ($U_{n,China,t}^{IO} - U_{n,USA,t}^{IO}$), again normalizing the difference in 1980 to 0 in a similar manner; finally, we take averages of this relative welfare exposure in each year across all countries within each region (excluding China and the United States).

While Figure 5 shows the average relationship for each continent, Figure 6a displays this relationship across individual countries. In particular, we display ventiles from a binscatter of

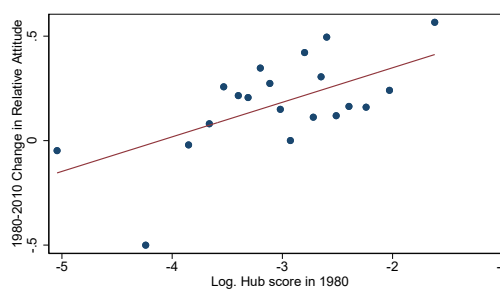
the change in relative political alignment ($A_{n,China,t}^\kappa - A_{n,USA,t}^\kappa$) against the change in relative welfare exposure ($U_{n,China,t}^{IO} - U_{n,USA,t}^{IO}$), after conditioning on country and year fixed effects and each importer's aggregate self-expenditure share in each year. The inclusion of these fixed effects implies that this relationship is identified from differential changes in relative political alignment and welfare exposure within countries over time. We also display the corresponding linear fit between the two variables. As shown in the figure, we find a positive and statistically significant relationship, with an estimated coefficient of 18.833 (standard error 2.998). Therefore, individual countries with larger increases in welfare exposure towards China relative to the United States exhibit greater political realignment towards China and away from the United States.

Figure 6: Binscatters of Relative Political Alignment and Relative Welfare Exposure

(a) Changes in Relative Political Alignment and Changes in Relative Welfare Exposure



(b) Changes in Relative Political Alignment and Initial Hub Score



Notes: Left panel shows a binscatter of country relative political alignment against country relative welfare exposure, after conditioning on country and year fixed effects and each importer's aggregate self-expenditure share; relative political alignment equals each other country's κ -score for China minus its κ -score for the United States in each year ($A_{n,China,t}^\kappa - A_{n,USA,t}^\kappa$); relative welfare exposure equals each other country's welfare exposure to China minus its welfare exposure to the United States in each year ($U_{n,China,t}^{IO} - U_{n,USA,t}^{IO}$); the inclusion of country and year fixed effects implies that the figure shows the relationship between changes in relative political alignment and changes in relative welfare exposure; the red line shows the linear fit with coefficient 18.833 (standard error 2.998); each blue dot corresponds to a ventile (twenty quantile) of the country-year distribution; Right panel shows a binscatter of changes in countries' relative political alignment ($A_{n,China,t}^\kappa - A_{n,USA,t}^\kappa$) from 1980-2012 against countries' initial hub score in 1980 as computed from equation (13) in our input-output specification.

In Figure 6b, we provide a further piece of evidence in support of the view that changes in welfare exposure are driving changes in political alignment. We display ventiles from a binscatter of the change in countries' relative political alignment ($A_{n,China,t}^\kappa - A_{n,USA,t}^\kappa$) from 1980-2012 against their initial hub scores in 1980 shortly after China's market-orientated reforms. We find that countries that *initially* have the highest levels of exposure to productivity growth in *any* nation experience the largest changes in political realignment towards China and away from the United States. We also display the corresponding linear fit, with a positive and statistically significant coefficient of 0.135 (standard error 0.033). This pattern of results is consistent with the idea that these countries with high initial hub scores were the most vulnerable to the change in relative welfare exposure following China's emergence into the global economy.

Taking the results of this section as a whole, we find strong evidence that following the natural experiment of China's emergence into the global economy, the countries' that are more economically dependent on China have exhibited greater political realignment towards China.

4.3 Reductions in the Cost of Air Travel

We next provide further evidence on the relationship between political behavior and economic interests, using the large-scale reduction in the cost of air travel that occurred over our sample period as an alternative source of quasi-experimental variation.

Time-varying Geographic Instrument The key empirical challenge is that bilateral welfare exposure depends on bilateral trade flows, which in general are endogenous to bilateral political alignment. Therefore, there could be reverse causality from bilateral political alignment to bilateral welfare exposure, or omitted third variables (such as geographical proximity) could affect all three variables of bilateral trade, welfare exposure and political alignment. As a first approach to addressing this challenge, we used the natural experiment of China's emergence into the global economy in the previous section. We now develop a second approach that can be implemented across all bilateral pairs of countries using secular reductions in the cost of air travel.

This empirical challenge is similar to that faced by the literature concerned with the relationship between trade and growth, in which both trade and growth are endogenous. Early attempts to estimate this relationship using exogenous sources of variation in trade exploited instruments based on geography, including [Frankel and Romer \(1999\)](#). However, while geographical variables such as bilateral distance are free of reverse causality, they can still violate exclusion restrictions, because they can be correlated with omitted third factors that affect both trade and income. For example, countries close to the equator generally have longer bilateral trade routes and can have low income for other reasons, such as unfavorable disease environments or unproductive colonial institutions, as argued in for example [Acemoglu et al. \(2001\)](#) and [Rodriguez and Rodrik \(2001\)](#).

The problem with these geographical instruments is that they are typically limited to the cross-section, which makes it difficult to control for time-invariant unobserved heterogeneity that can be correlated with the proposed instruments. To overcome this challenge, we follow the recent empirical literature in international trade that has developed time-varying geographic instruments. In particular, we follow [Feyrer \(2019\)](#), in using the large-scale reductions in the cost of air travel that occurred over our sample period as an exogenous source of variation in bilateral trade costs.¹⁷ The key idea underlying this approach is that the position of land masses

¹⁷Between 1955 and 2004, the cost of moving goods by air fell by a factor of ten ([Hummels 2007](#)). Before 1960, the air transport share of trade for the United States was negligible. By 2004, air transport accounted for over half of US exports by value, excluding Canada and Mexico ([Feyrer 2019](#)).

around the globe generates large differences between bilateral distances by sea and the great circle distances that are more typical of air travel. As a result, countries with long sea routes relative to air routes benefit disproportionately from reductions in the relative cost of air travel, giving rise to uneven changes in bilateral trade costs over time. By using these uneven changes in bilateral trade costs within individual country-partner pairs, we difference out any time-invariant unobserved heterogeneity, such as physical geography and institutions.

Instrumental Variables Specification We now introduce our baseline regression specification connecting political and economic interests. In general, a country’s political alignment towards a trade partner could depend on both the sensitivity (elasticity) of its welfare to productivity growth in that partner and the sign and magnitude of the productivity growth. We use our theoretically-consistent measures of the sensitivity of importer welfare to productivity growth in each exporter (U_{nit}^{IO}) from Section 2.3 above. We control separately for the sign and magnitude of exporter productivity growth using exporter-year fixed effects, exploiting the property that productivity growth is common across trade partners. We also control separately for importer-year fixed effects, which capture importer expenditure and price indexes, and other macro shocks that are common across trade partners. In particular, we consider the following second-stage regression specification relating bilateral political alignment (A_{nit}) to bilateral welfare exposure (U_{nit}^{IO}) for importer n and exporter i at time t :

$$A_{nit} = \beta U_{nit}^{IO} + \vartheta_{ni}^A + \eta_{nt}^A + \mu_{it}^A + \epsilon_{nit}^A, \quad (14)$$

where ϑ_{ni}^A is an importer-exporter fixed effect that captures time-invariant unobserved heterogeneity; η_{nt}^A and μ_{it}^A are importer-year and exporter-year fixed effects; and ϵ_{nit}^A is a stochastic error. We expect countries that benefit more from a partner’s productivity growth (more positive or less negative welfare exposure U_{nit}^{IO}) to be more politically aligned with that partner (higher A_{nit}). We report standard errors clustered by country-partner pair to allow for serial correlation in the error term over time.

In Column (1) of Table 2, we report the results of estimating this relationship using OLS for our baseline κ -score measure of bilateral political alignment. We find a positive and statistically significant coefficient on welfare exposure (β). Therefore, countries whose welfare is more sensitive to productivity growth in a trade partner are more politically aligned with that trade partner, after controlling for the sign and size of the productivity growth using our exporter-year fixed effects. But the interpretation of this relationship is subject to the concerns discussed above. First, unobserved positive shocks to bilateral political alignment in the error term (ϵ_{nit}^A) could raise bilateral trade and hence raise welfare exposure (U_{nit}^{IO}), thereby introducing a positive correlation between welfare exposure and the error term, and inducing an upward bias in the estimated

coefficient (β). Second, political alignment is likely to be determined by secular forces that are relatively slow moving compared to bilateral trade flows, which are subject to higher-frequency idiosyncratic shocks. These idiosyncratic shocks imply that observed bilateral trade flows need not perfectly capture long-run trade relationships. Therefore, even if these idiosyncratic shocks are independently distributed, they could act like classical measurement error in attenuating the estimated coefficient (β) towards zero.

As a first step to addressing these challenges, we construct an instrument for welfare exposure, which uses its strong correlation with the expenditure share in our input-output model (\mathbf{S}_{nit}^{IO}), and the strong relationship between this expenditure share (\mathbf{S}_{nit}^{IO}) and geography. In particular, we consider the following gravity equation specification:

$$\ln \mathbf{S}_{nit}^{IO} = \gamma_a [\ln (\text{airdist}_{ni}) \times \text{trend}_t] + \gamma_s [\ln (\text{seadist}_{ni}) \times \text{trend}_t] + \vartheta_{ni}^S + \eta_{nt}^S + \mu_{it}^S + \epsilon_{nit}^S, \quad (15)$$

where airdist_{ni} is the population-weighted average of the great circle distances between the largest cities within countries; seadist_{ni} is the least-cost path by sea between the leading ports of each country, for all bilateral pairs of countries that are connected by sea; the main effects of both distance measures and any time-invariant unobserved heterogeneity are captured by the country-partner fixed effect (ϑ_{ni}^S); the interactions of these log distance measures with time trends (trend_t) capture secular changes over time in the relative importance of air and sea distance in determining trade flows with improvements in the technology of air travel; the importer-year (η_{nt}^S) and exporter-year (μ_{it}^S) fixed effects control for changes over time in country income and price indexes and macro shocks; and ϵ_{nit}^S is a stochastic error.

Our first instrument uses the fitted values ($\hat{\mathbf{S}}_{nit}^{IO}$) from the gravity equation (15) to instrument welfare exposure, in order to abstract from the impact of idiosyncratic shocks to bilateral trade (ϵ_{nit}^S). We begin by replicating [Feyrer \(2019\)](#) and estimating the log linear gravity equation (15) for the aggregate value of bilateral trade (X_{nit}) using OLS. We find a positive and statistically significant coefficient on the interaction between log sea distance and the time trend (sea distance becomes less important in determining bilateral trade over time), and a negative and statistically significant coefficient on the interaction between log air distance and the time trend (air distance becomes more important in determining bilateral trade over time).¹⁸

We next estimate the gravity equation (15) for the input-output expenditure share (\mathbf{S}_{nit}^{IO}) using the Poisson Pseudo-Maximum Likelihood (PPML) estimator of [Santos Silva and Teneyro \(2006\)](#), which allows for zero bilateral trade flows. Using the estimated parameters, we generate fitted values for the expenditure share ($\hat{\mathbf{S}}_{nit}^{IO}$), and use these fitted values as our instrument for welfare

¹⁸We find estimated coefficients (standard errors) of 0.0051 (0.0026) for the interaction between log sea distance and the time trend and -0.0165 (0.0027) for the interaction between log air distance and the time trend.

exposure (U_{nit}^{IO}) in the second-stage regression (14). As reported in Column (2) of Table 2, we continue to find a positive and statistically significant coefficient on welfare exposure (β), which increases in magnitude relative to Column (1).

Table 2: Political and Economic Friends

	(1)	(2)	(3)	(4)	(5)
	A_{nit}^{κ}	A_{nit}^{κ}	A_{nit}^{κ}	A_{nit}^{κ}	A_{nit}^{κ}
U_{nit}^{IO}	24.20*** (3.824)	585.0*** (69.33)	546.5*** (60.78)	661.8*** (61.00)	640.5*** (57.38)
Estimation	OLS	IV	IV	IV	IV
Observations	653,214	480,452	480,452	653,214	653,214
R-squared	0.646	—	—	—	—
First-stage F-statistic	—	18.36	65.62	166.16	86.75

Note: Panel of exporter-importer-year observations from 1970-2012; all specifications include exporter-importer, exporter-year and importer-year fixed effects; A_{nit}^{κ} is the κ -score measure of the bilateral similarity of countries' votes in the UNGA; U_{nit}^{IO} is welfare exposure from our input-output specification; Column (2) instruments welfare exposure with the fitted values from the gravity equation (15); Column (3) directly instruments welfare exposure with interactions between (i) a linear time trend and log sea distance and (ii) a linear time trend and log air distance using equation (16); Column (4) directly instruments welfare exposure with the interaction between a linear time trend and log air distance; Column (5) directly instruments welfare exposure with interactions between linear and quadratic time trends and log air distance; the number of observations in Columns (2)-(3) is smaller than in the other columns, because sea distance is missing for country-partner pairs that do not have a sea connection; first-stage F-statistic is a test of the statistical significance of the excluded exogenous variables in the first-stage regression; the second-stage R-squared is not reported for the IV specifications, because it does not have a meaningful interpretation; standard errors in parentheses are clustered by exporter-importer pair; *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level.

This increase in the estimated coefficient from Columns (1) to (2) is consistent with the attenuation bias from idiosyncratic shocks to bilateral trade dominating the upward simultaneity bias from a positive correlation between shocks to bilateral political alignment and trade in Column (1). Once we eliminate the impact of these idiosyncratic shocks by instrumenting welfare exposure with the fitted values from the gravity equation (15), the estimated coefficient on welfare exposure increases. These estimates in Column (2) imply that a one standard deviation increase in welfare exposure predicted by our instruments leads to a 0.77 standard deviation increase in bilateral political alignment. Therefore, the relationship between bilateral political alignment and welfare exposure is not only statistically but also economically significant. As reported at the bottom of Column (2), we find that the fitted expenditure shares (\hat{S}_{nit}^{IO}) are a powerful instrument for welfare exposure, with a first-stage F-statistic above the conventional threshold of 10.

Although our first instrument addresses this concern about idiosyncratic shocks to bilateral trade, other challenges remain. First, the fitted values for the expenditure share (\hat{S}_{nit}^{IO}) from the gravity equation (15) include the time-varying exporter-year and importer-year fixed effects. In principle, shocks to political alignment could affect these exporter-year and importer-year fixed

effects, which capture endogenous variables such as expenditure and price indexes. Although our second-stage equation for bilateral political alignment (14) also includes exporter-year and importer-year fixed effects, these do not perfectly control for these variables from the gravity equation (15), because the second-stage equation (14) is linear, whereas the gravity equation (15) is log linear. Second, the conventional two-stage least squares standard errors in Column (2) do not take into account that our instrument for welfare exposure (\widehat{S}_{nit}^{IO}) is itself generated in a prior regression (Pagan 1984).

To address both of these issues, we consider the following first-stage regression specification, in which we directly instrument welfare exposure using our interactions between the log distance measures and time trends:

$$\begin{aligned} U_{nit}^{IO} = & \gamma_a [\ln(\text{airdist}_{ni}) \times \text{trend}_t] + \gamma_s [\ln(\text{seadist}_{ni}) \times \text{trend}_t] \\ & + \vartheta_{ni}^U + \eta_{nt}^U + \mu_{it}^U + \epsilon_{nit}^U, \end{aligned} \quad (16)$$

where all variables are defined in the same way as above.

Both the first and second-stage regressions (equations (16) and (14), respectively) include country-partner, exporter-year and importer-year fixed effects. Therefore, this specification controls for time-invariant unobserved heterogeneity, and time-varying shocks that are common across trade partners for each exporter and importer. The coefficient of interest (β) is identified solely from differential changes in bilateral trade costs over time for country-partner pairs with different values for air and sea distance. As reported in Column (3) of Table 2, we continue to find a positive and statistically significant coefficient on welfare exposure (β), which is of around the same magnitude as in Column (2). We find that the interactions between air and sea distance and the time trends are powerful instruments for welfare exposure, with a first-stage F-Statistic above the conventional threshold of 10, as reported at the bottom of the column.

Finally, we report a number of further specification checks. First, sea distance is missing for country-partner pairs without a sea connection. Therefore, we consider a specification in which we drop the sea distance interaction, which substantially increases the number of observations. In this specification, the interaction between air distance and the time trend is our sole instrument, and captures the net impact of changes in the technology for air travel on bilateral trade costs at long versus short distances between countries. As reported in Column (4) of Table 2, we continue to find a positive and statistically significant coefficient on welfare exposure (β), which increases somewhat relative to Columns (2)-(3). We find a larger first-stage F-statistic in this more parsimonious specification with a single instrument, as shown at the bottom of the column.

Second, we explored allowing for richer functional forms for the change in bilateral trade costs at long versus short distances between countries. We augmented our interaction between a linear trend and log air distance in the first-stage regression from Column (4) with an interaction

between a quadratic trend and log air distance. As reported in Column (5) of Table 2, we find a similar estimated coefficient on welfare exposure (β), which suggests that there is little additional information in this higher-order term, consistent with our estimates capturing a secular improvement in transportation technology over time. The first-stage F-statistic falls somewhat when we add this higher-order interaction, but remains above the conventional threshold of 10. As a further robustness check, we replaced our interaction between a linear trend and log air distance in Column (4) with (i) interactions between year dummies and log air distance; (ii) interactions between five-year period dummies and log air distance; (iii) interactions between ten-year period dummies and log air distance. Across all of these specifications, we find a similar positive and statistically significant coefficient on welfare exposure (β).¹⁹ We use the linear trend interacted with log air distance as our baseline specification, in order to focus on differences in secular trends in bilateral trade costs between long and short bilateral distances.

Taken together, the results of this section provide evidence that secular increases in bilateral welfare exposure predicted by our instrument induce increased bilateral political alignment between countries as captured by the κ -score measure of voting similarity in the UNGA. In the remainder of this section, we show that the same pattern holds across a wide range of measures of political similarity, including measures of the bilateral distance in foreign policy ideal points, strategic rivalries, and formal alliances. For each of these measures of bilateral political alignment, we demonstrate the robustness of our results across a wide range of different specifications.

Alternative Measures of Voting Similarity in the UNGA In our empirical results above, we focused on the κ -score as our baseline measure of the bilateral similarity of countries' UNGA voting, because it controls for the empirical frequency with which each country votes yes, no or abstain. Nevertheless, we now show in Table 3 that we find the same pattern of results using other measures of bilateral political alignment based on the UNGA voting data.

In the top panel, we report the results of estimating equation (14) using OLS. In the bottom panel, we report the results of estimating the same specification using two-stage least squares, instrumenting welfare exposure with our interaction between a linear trend and log air distance. In Column (1) of the top and bottom panels, we reproduce our baseline results using the κ -score (from Columns (1) and (4) of Table 2). In Columns (2) and (3) of Table 3, we estimate the same specification using the S -score and π -score measures of bilateral political alignment, respectively. Again we find that increases in bilateral welfare exposure raise bilateral political alignment between countries. In Column (4), we estimate the same specification using our measure of the difference in countries' ideal points based on the UNGA voting data. Consistent with the pre-

¹⁹For example, using interactions between five-year period dummies and log air distance, we find an estimated coefficient (standard error) on welfare exposure of 594.56 (49.24).

vious columns, we find that increases in bilateral welfare exposure reduce the bilateral distance between countries' foreign policy ideal points. Again our instrument has power in the first-stage regressions, with first-stage F statistics above the conventional threshold of 10 in all columns.

Table 3: Political and Economic Friends (Alternative Measures of Bilateral Political Alignment)

Panel A: OLS								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A_{nit}^{κ}	A_{nit}^S	A_{nit}^{π}	A_{nit}^{ideal}	A_{nit}^{κ}	A_{nit}^S	A_{nit}^{π}	A_{nit}^{ideal}
U_{nit}^{IO}	24.20*** (3.824)	12.01*** (2.099)	25.77*** (4.085)	-28.59*** (8.524)	23.49*** (4.553)	11.15*** (2.451)	24.45*** (4.879)	-27.45*** (9.611)
S_{nit}^{SSM}					0.0628 (0.274)	0.0760 (0.133)	0.118 (0.295)	-0.104 (0.466)
N	653,214	653,214	653,214	623,586	653,214	653,214	653,214	623,586
r2	0.646	0.872	0.709	0.833	0.646	0.872	0.709	0.833
Panel B: IV								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A_{nit}^{κ}	A_{nit}^S	A_{nit}^{π}	A_{nit}^{ideal}	A_{nit}^{κ}	A_{nit}^S	A_{nit}^{π}	A_{nit}^{ideal}
U_{nit}^{IO}	661.8*** (61.00)	353.2*** (32.98)	701.7*** (65.27)	-652.4*** (104.1)	1699.4*** (332.0)	908.0*** (178.6)	1800.8*** (352.7)	-1699.4*** (419.3)
S_{nit}^{SSM}					-83.47*** (22.18)	-44.63*** (11.92)	-88.43*** (23.54)	83.87*** (25.76)
N	653,214	653,214	653,214	623,586	653,214	653,214	653,214	623,586
First-stage F	166.2	166.2	166.2	140.7	27.47	27.47	27.47	23.34

Note: Panel of exporter-importer-year observations from 1970-2012; all specifications include exporter-importer, exporter-year and importer-year fixed effects; Column (1) of Panel A corresponds to Column (1) of Table 2; Column (1) of Panel B corresponds to Column (5) of Table 2; A_{nit}^{κ} , A_{nit}^S and A_{nit}^{π} are the κ -score, S -score and π -score measures of the bilateral similarity of countries' votes in the UNGA, respectively; A_{nit}^{ideal} is the bilateral difference in countries' ideal points from the UNGA voting data; U_{nit}^{IO} is welfare exposure from our input-output specification; S_{nit}^{SSM} is the share of each exporter in the aggregate expenditure of each importer (the expenditure share in the single-sector model); Panel A reports OLS estimates; Panel B reports IV estimates, in which welfare exposure is instrumented with the interaction between a linear time trend and log air distance; first-stage F-statistic is a test of the statistical significance of the excluded exogenous variables in the first-stage regression; the second-stage R-squared is not reported for these IV specifications, because it does not have a meaningful interpretation; standard errors in parentheses are clustered by exporter-importer pair; *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level.

In Columns (5)-(8), we show that our measure of welfare exposure is not simply proxying for bilateral trade between countries. When we augment our regression specification with the aggregate share of importer expenditure on each exporter (S_{nit}^{SSM}), we continue to find the same pattern of results for welfare exposure.²⁰ In the OLS specification in the top panel, the estimated coefficient on welfare exposure remains of a similar magnitude, while that on the aggregate

²⁰We find a similar pattern of results if we instead include the log value of aggregate bilateral trade as a control.

import share is statistically insignificant. In the IV specification in the bottom panel, the estimated coefficient on welfare exposure remains of the same sign and increases in absolute magnitude. In contrast, the estimated coefficient on the aggregate import share has the opposite sign and is statistically significant, which likely reflects the fact that the aggregate import share itself is endogenous. We nevertheless report this specification to show that our estimates for welfare exposure are not simply capturing bilateral trade between countries, which is consistent with the discussion in Section 4.1, where we noted that our exposure measures are not completely captured by simpler measures of trading relationships between countries.

Alternative Measures of Bilateral Political Alignment While we have so far considered measures of bilateral political alignment based on UNGA voting data, we now demonstrate the robustness of our results to the use of alternative measures of bilateral political alignment.

In Table 4, we estimate the same regression specification (14) using our measures of strategic rivalry, which capture the contemporary perceptions of policy-makers as to whether two countries regard each other as competitors, sources of threats or enemies. Columns (1)-(4) present the OLS estimates, while Columns (5)-(8) contain the IV estimates. Whether we consider all strategic rivalries (Columns (1) and (5)), positional strategic rivalries (Columns (2) and (6)), spatial strategic rivalries (Columns (3) and (7)) or ideological strategic rivalries (Columns (4) and (8)), we find the same pattern of results. In all cases, we find a negative and statistically significant relationship between the propensity with which countries are strategic rivals and bilateral welfare exposure. Consistent with the UNGA voting results, when we instrument bilateral welfare exposure with our interaction between a linear trend and bilateral distance, we find an even stronger relationship, with an increase in the absolute magnitude of the estimated coefficient. Again we find that our instrument has power in the first-stage regression, as indicated by the first-stage F-statistic.

Table 4: Political and Economic Friends (Strategic Rivalries Specification)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A_{nit}^{Any}	A_{nit}^{Pos}	A_{nit}^{Spa}	A_{nit}^{Id}	A_{nit}^{Any}	A_{nit}^{Pos}	A_{nit}^{Spa}	A_{nit}^{Id}
U_{nit}^{IO}	-3.234*** (1.100)	-0.851*** (0.325)	-1.191*** (0.446)	-1.912** (0.975)	-104.5*** (22.72)	-50.50*** (14.31)	-71.91*** (18.17)	-52.30*** (14.63)
Estimation	OLS	OLS	OLS	OLS	IV	IV	IV	IV
N	788,396	788,396	788,396	788,396	779,664	779,664	779,664	779,664
R-squared	0.791	0.837	0.807	0.729	—	—	—	—
First-stage F	—	—	—	—	164.2	164.2	164.2	164.2

Note: Panel of exporter-importer-year observations from 1970-2012; all specifications include exporter-importer, exporter-year and importer-year fixed effects; A_{nit}^{Any} , A_{nit}^{Pos} and A_{nit}^{Spa} and A_{nit}^{Id} are indicator variables for any, positional, spatial and ideological strategic rivalries, respectively; U_{nit}^{IO} is welfare exposure from our input-output specification; Columns (1)-(4) report OLS estimates; Columns (5)-(8) report IV estimates, in which welfare exposure is instrumented with the interaction between a linear time trend and log air distance; first-stage F-statistic is a test of the statistical significance of the excluded exogenous variables in the first-stage regression; the second-stage R-squared is not reported for the IV specifications, because it does not have a meaningful interpretation; standard errors in parentheses are clustered by exporter-importer pair; *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level.

In Table 5, we re-estimate this regression specification (14) using our measures of formal alliances between countries. The top panel reports the OLS estimates, while the bottom panel gives the IV estimates. We find the same pattern of results for any alliances (Column (1)), mutual defense pacts (Column (2)), non-aggression treaties (Column (4)) and ententes (Column (5)). Consistent with the UNGA voting results, we find a positive and statistically significant relationship between the frequency with which countries form alliances and bilateral welfare exposure. When we instrument bilateral welfare exposure with our interaction between a linear trend and bilateral distance, we again find that this relationship strengthens, with an increase in the absolute magnitude of the estimated coefficient. The only exception is for neutrality pacts, where the estimated coefficient is statistically insignificant in the OLS specification, but becomes positive and statistically significant in the IV specification. This pattern of results could reflect the fact that neutrality decisions are more tied to multilateral considerations (with all of a country's neighbors) rather than bilateral considerations (with one of a country's neighbors). Again we find that our instrument has power in the first-stage regression, as shown by the first-stage F-statistic.

Table 5: Political and Economic Friends (Formal Alliances Specification)

Panel A: OLS					
	(1)	(2)	(3)	(4)	(5)
	A_{nit}^{AllAny}	A_{nit}^{AllDef}	A_{nit}^{AllNeu}	A_{nit}^{AllNon}	A_{nit}^{AllEnt}
U_{nit}^{IO}	4.518*** (1.200)	2.994** (1.257)	0.986 (0.969)	3.734*** (1.448)	3.949*** (1.147)
N	788,396	788,396	788,396	788,396	788,396
R-squared	0.899	0.902	0.564	0.897	0.908
Panel B: IV					
	(1)	(2)	(3)	(4)	(5)
	A_{nit}^{AllAny}	A_{nit}^{AllDef}	A_{nit}^{AllNeu}	A_{nit}^{AllNon}	A_{nit}^{AllEnt}
U_{nit}^{IO}	803.0*** (74.43)	798.0*** (73.30)	35.98*** (12.38)	603.3*** (60.20)	550.7*** (54.30)
N	779,664	779,664	779,664	779,664	779,664
First-stage F	164.2	164.2	164.2	164.2	164.2

Note: Panel of exporter-importer-year observations from 1970-2012; all specifications include exporter-importer, exporter-year and importer-year fixed effects; A_{nit}^{AllAny} , A_{nit}^{AllDef} , A_{nit}^{AllNeu} , A_{nit}^{AllNon} , and A_{nit}^{AllEnt} are indicator variables for any, defense, neutrality, non-aggression and entente formal alliances, respectively; U_{nit}^{IO} is welfare exposure from our input-output specification; Panel A reports OLS estimates; Panel B reports IV estimates, in which welfare exposure is instrumented with the interaction between a linear time trend and log air distance; first-stage F-statistic is a test of the statistical significance of the excluded exogenous variables in the first-stage regression; the second-stage R-squared is not reported for the IV specifications, because it does not have a meaningful interpretation; standard errors in parentheses are clustered by exporter-importer pair; *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level.

Long-Differences Specification In our empirical results so far, we have used an exporter-importer-year panel, which allows us to include exporter-importer fixed effects to control for time-invariant unobserved heterogeneity, and exporter-year and importer-year fixed effects to control for the sign and magnitude of productivity growth and time-varying factors that are common across trade partners for each exporter and importer. Although this panel data specification focuses on changes in bilateral political alignment and welfare exposure within country-partner pairs, it uses deviations each year from the country-partner time mean, and one concern could be that bilateral political alignment changes over longer-time horizons. Our IV specification addresses this concern, by using an interaction between a linear trend and distance as our instrument, which implies that we exploit variation from differences in linear trends within country-partner pairs between long versus short bilateral distances. As a further robustness check to address this concern, Section G of the online appendix reports a long-differences specification using five-year differences. In this specification, we difference out the exporter-importer fixed effects, and again include exporter-year and importer-year fixed effects to control for the sign and magnitude of productivity growth and time-varying factors that are common across trade

partners for each exporter and importer. Again in both our OLS and IV estimates, we find that increases in bilateral welfare exposure raise bilateral political alignment, confirming the results of our baseline panel data specification here.

Summary As a country becomes more economically exposed to productivity growth in a trade partner, we find that it becomes more politically aligned with that trade partner. We find this pattern of results using quite different approaches to measuring political alignment: (i) United Nations voting data; (ii) the perceptions of contemporary policy-makers about strategic rivalries; and (iii) formal alliances between nations. We find this relationship after controlling for unobserved time-invariant heterogeneity that is specific to each country-partner pair (e.g. geographical location and institutions) and time-varying factors that are specific to each exporter and importer and common across trade partners. Our estimates therefore focus on changes in bilateral political alignment and bilateral welfare exposure within individual country-partner pairs. We demonstrate that this relationship holds whether we use all of the observed variation in bilateral welfare exposure (in our OLS specification) or the differential changes in welfare exposure between long and short bilateral distances because of improvements in the technology of air travel (in our IV specification). Therefore, whether we consider China’s emergence into the global economy as a natural experiment (previous section) or exogenous variation from the improvement in the technology of air travel (this section), we find that increases in economic friendship lead to increases in political friendship between countries.

5 Specification Checks

In this section, we report additional specification checks on our economic exposure measures. In Subsection 5.1, we report an overidentification check on these measures, in which we show that they are systematically related to separate data on preferential trade agreements (PTAs) that were not used in their estimation. In Subsection 5.2, we report a specification check, in which we examine the potential role for non-linearities, by comparing the predictions of our linearization to the full non-linear model solution. We show that our exposure measures provide a good approximation to the full non-linear model solution for empirically-realistic shocks, including cumulative changes in productivity over our sample period of more than forty years.

5.1 Preferential Trade Agreements (PTAs)

We use separate data on PTAs to provide an overidentification check on our economic exposure measures. We first examine the determinants of PTAs: If our exposure measures correctly capture gains from economic integration, we would expect them to predict self-selection into PTAs. We

next examine the effects of PTAs: If our exposure measures correctly capture economic interdependence between countries, we would expect to observe systematic changes in these measures following the formation of PTAs.

In Section H.1.1 of the online appendix, we estimate a selection model for the decision to form a PTA. We show that initial income and welfare exposure to reductions in bilateral trade costs in 1970 are predictive of the subsequent formation of PTAs from 1971-2012. We show that this result is robust to controlling for simpler measures of trading relationships between countries, such as initial bilateral trade or aggregate expenditure shares in 1970, or geographical distance. In Section H.1.2 of the online appendix, we use an event-study specification to provide evidence on the effects of PTAs. We show that our exposure measures successfully detect increases in economic interdependence between member countries following the formation of PTAs. We find this pattern of results whether we use exposure to productivity growth or bilateral trade cost reductions, and after controlling for simpler measures of trading relationships between countries. We demonstrate that these results hold across a range of different event-study specifications, including those that allow for variable timing of the treatment and treatment heterogeneity.

Therefore, we find that our exposure measures have predictive power for separate data on PTAs not used in their estimation, both in terms of predicting selection into future PTAs, and in terms of detecting the impact of these future PTAs in increasing economic interdependence between countries.

5.2 Non-linearities

In Section 2, we derived our measures of the sensitivity of country income and welfare to foreign productivity growth from a linearization of the class of international trade models with a constant trade elasticity. We now report a specification check in which we examine the potential role for non-linearities by comparing the predictions of our linearization to those of the full non-linear model solution. To build intuition, we first compare the two approaches in our baseline single-sector model, before implementing this comparison for our quantitative specification with multiple sectors and input-output linkages. We focus largely on the quality of our approximation to the full non-linear model solution for productivity shocks that are the subject of our empirical application. For completeness, we also report some results comparing the quality of our approximation for trade cost shocks.

5.2.1 Single-Sector Model

As discussed above, a first key advantage of our representation of the first-order general equilibrium effect of productivity shocks in terms of the expenditure share (S), income share (T) and cross-substitution (M) matrices is that it can be used to provide an analytical characterization

of the quality of the first-order approximation to the full non-linear model solution in terms of these observed matrices.

In Section H.2.1 of the online appendix, we show that the difference between the predictions of our linearization and the full non-linear model solution for the impact of productivity shocks corresponds to the difference between the log of a weighted mean and a weighted mean of logs. This difference corresponds to the second and higher-order terms in a Taylor-series expansion around the initial equilibrium. We show that this difference is necessarily equal to zero in the two limiting cases of autarky ($t_{nn} \rightarrow 1$ and $s_{nn} \rightarrow 1$ for all n) and free trade ($t_{in} \rightarrow \bar{t}_i$ and $s_{ni} \rightarrow \bar{s}_i$ for all n, i). More generally, in Propositions A.2-A.6 in Section H.2.2 of the online appendix, we use this Taylor-series expansion to derive analytical global bounds of the absolute magnitude of the second and higher-order terms in terms of the observed expenditure share (\mathbf{S}), income share (\mathbf{T}) and cross-substitution (\mathbf{M}) matrices. Given these observed trade matrices and a central value for the trade elasticity of $\theta = 5$, we show that the global approximation errors for the absolute magnitude of the second and higher-order terms are less than 0.62 percent of the variance of productivity shocks for income exposure, and less than 0.33 percent of the variance of productivity shocks for welfare exposure.

At first glance, these results appear to contrast with the findings in Baqaee and Farhi (2019) that second-order terms can be large in response to economic shocks. However, our results are derived for the influential class of trade models with a single constant trade elasticity, whereas the Baqaee and Farhi (2019) results are derived for a general network economy and illustrated using the example of a nested constant elasticity of substitution (CES) economy. It is precisely the presence of the multiple CES nests with different elasticities of substitution in this example that generates the large second-order terms, whereas in specifications with a single elasticity of substitution, these second-order terms remain small.

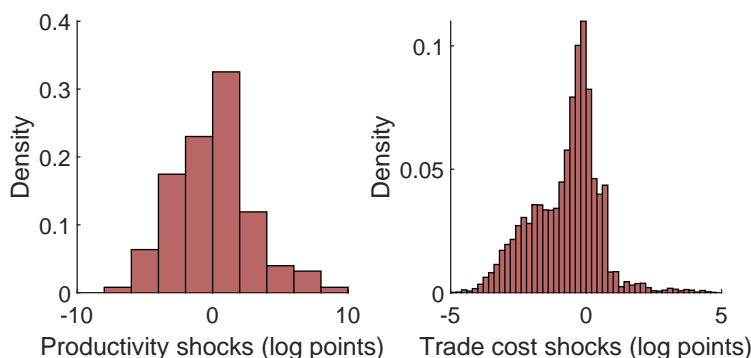
5.2.2 Multiple Sectors and Input-Output Linkages

A second key advantage of our representation of the first-order general equilibrium effect of productivity shocks in terms of the expenditure share (\mathbf{S}), income share (\mathbf{T}) and cross-substitution (\mathbf{M}) matrices is that this same representation holds across a wide range of trade models, after making appropriate changes to the elements of these matrices. We now implement this comparison of our linearization and the full non-linear model solution for our state of the art quantitative specification with multiple sectors and input-output linkages.

Empirical Distributions of Productivity and Trade Cost Shocks We begin by recovering empirical distributions of productivity and trade cost shocks that we use to compare the predictions of the two approaches. Since we undertake counterfactuals for productivity and trade cost

shocks that are common across sectors, we recover these empirical distributions of shocks from our single-sector model, as discussed in Section H.2.4 of the online appendix. In Figure 7, we display histograms of the resulting log changes in relative productivity (left panel) and trade costs (right panel) for our sample period as a whole, based on our central value of the trade elasticity of $\theta = 5$. We normalize both variables to have a mean of zero in logs. The distribution of productivity shocks is across countries, while the distribution of trade cost shocks is across country-partner pairs. Over this period of more than forty years, which includes double-digit annual growth for some countries such as China, we find large changes in both relative productivity and trade costs. Relative changes in productivity span close to 20 log points (from -9 to 10 log points), while relative changes in trade costs span 10 log points (from -5 to 5 log points). Therefore, although we could undertake counterfactuals in the non-linear model using any distributions of productivity and trade cost shocks, these empirical distributions provide ample variation to examine the importance of non-linearities.

Figure 7: Empirical Distributions of Productivity and Trade Cost Shocks from 1970-2012



Note: Empirical distributions (histograms) of log productivity shocks (left panel) and log trade cost shocks (right panel) from 1970-2012; productivity and trade cost shocks recovered from inverting the single-sector model, as shown in Section H.2.4 of the online appendix. Both log productivity and trade costs shocks are normalized to have a mean of zero, so that the figure shows shocks to relative productivity and relative trade costs.

Productivity and Trade Cost Shocks We use these empirical distributions of productivity and trade cost shock to undertake counterfactuals in the non-linear model with multiple sectors and input-output linkages. In particular, we compare the predictions of conventional exact-hat algebra counterfactuals in the non-linear model to the predictions of our linearization, which can be recovered by multiplying our exposure measures by the size of the productivity or trade cost shock. We begin by undertaking this comparison for our central value of the trade elasticity of $\theta = 5$. We vary the magnitude of the productivity shocks by taking weighted averages of the vector of empirical shocks from 1970-2012 in Figure 7 and a vector of ones that corresponds to

no shocks ($\hat{z}_i = z'_i/z_i = 1$). Similarly, we vary the magnitude of the trade cost shocks by taking weighted averages of the matrix of empirical shocks from 1970-2012 in Figure 7 and the identity matrix that again corresponds to no shocks ($\hat{\tau}_{ni} = \tau'_{ni}/\tau_{ni} = 1$). As we vary the weights on the empirical shocks from zero to one, we smoothly change the magnitude of the productivity and trade cost shocks from no shocks to the full empirical magnitude of the shocks. For each size of productivity and trade cost shocks, we compute the correlation coefficient across countries between the log counterfactual changes in welfare predicted by the non-linear model and those predicted by our linearization.

Figure 8: Correlations Between the Non-Linear and Linear Counterfactual Predictions for Log Changes in Welfare for Different Magnitudes of the Productivity and Trade Cost Shocks



Note: Left panel shows results for productivity shocks and right panel shows results for trade cost shocks using the empirical distributions of these shocks from Figure 7 above; vertical axis shows the correlation across countries between the non-linear and linear counterfactual predictions for log changes in welfare; horizontal axis varies the magnitude of the shocks by varying the weights on the empirical shocks (α) and no shocks ($1 - \alpha$) from zero to one, where no shocks corresponds to $z'_i/z_i = 1$ and $\tau'_{ni}/\tau_{ni} = 1$. Therefore, a value of zero on the horizontal axis corresponds to no shocks, while a value of the one on the horizontal axis corresponds to the full empirical value of shocks from 1970-2012 from Figure 7 above.

In Figure 8, we display these correlations between the welfare predictions of the non-linear model and our linearization (vertical axis) against the weight on the empirical shocks (horizontal axis). The left and right panels show these correlations for productivity and trade cost shocks, respectively. Larger weights on the empirical shocks on the horizontal axis correspond to bigger shocks. Regardless of the magnitude of the productivity shocks that we consider, we find a correlation in the left panel that is visibly indistinguishable from one, at least up to the (large) empirical value of the shocks from Figure 7 above. Even though this specification incorporates rich input-output linkages, the production technology is Cobb-Douglas and there is a single elasticity of substitution across the goods supplied by different countries, which ensures that the absolute magnitude of the second-order and higher terms remains small. For trade cost shocks up to around half as large as the empirical shocks, we also find a correlation close to one in the

right panel. As we increase the magnitude of the trade cost shocks towards the (large) empirical value of the shocks, we find that the correlation begins to fall, but it remains above 0.5 for most of the interval, and is always positive and statistically significant at conventional levels.²¹ Even for large trade cost shocks for which the correlation falls, we find that this decline is driven by a few countries, and that for most countries the linear and non-linear predictions for the log changes in welfare are close, as shown in Section H.2.6 of the online appendix.

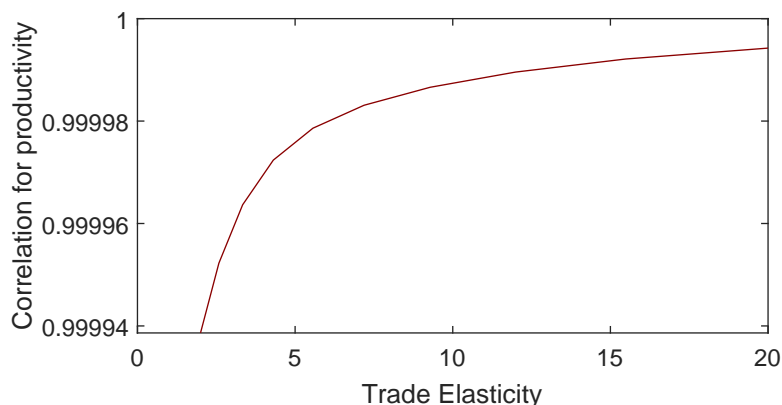
Robustness to Alternative Trade Elasticities ($\theta \in [2, 20]$) So far, we have established a strong correlation between the linear and non-linear predictions for the productivity shocks that are the subject of our empirical application using a central trade elasticity of $\theta = 5$. We now demonstrate the robustness this result to the assumption of alternative values for the trade elasticity from 2 to 20, which spans the empirically-relevant range.²² We use the full empirical magnitude of productivity shocks at the right-most point on the horizontal axis in Figure 8 with a weight of one. We hold the empirical distribution of productivity shocks constant and compute the correlation between the linear and non-linear predictions for log changes in welfare in response to these productivity shocks for alternative values of the trade elasticity. Across the entire of this empirically-relevant range of trade elasticities, we find a correlation close to one. As we increase the trade elasticity, the correlation between the linear and non-linear predictions increases, because for larger trade elasticities smaller changes in the endogenous variables are required to restore equilibrium in the model in response to the productivity shocks.

Therefore, for the sensitivity of country welfare to productivity shocks that is the subject of our empirical application, our exposure measures closely approximate the full non-linear model solution for empirically-realistic shocks across the entire range of empirically-relevant values for the trade elasticity from 2 to 20, even when we consider cumulative changes in productivity over our sample period of more than forty years. An advantage of our linearization relative to the full non-linear model solution is that our exposure measures can be computed from observed trade data alone, thereby avoiding the challenge of measuring counterfactual shocks that influenced country behavior but did not occur.

²¹Whereas productivity shocks are common across all trade partners, trade shocks are bilateral, which results in a three-tensor rather than a matrix representation (see Section D.1 of the online appendix). Our friend-enemy representation reduces this three-tensor down to a matrix using the observed trade shares, which contributes to the lower correlation between the non-linear and linear predictions for large changes in trade costs.

²²Eaton and Kortum (2002) reports estimates of the trade elasticity ranging from 2 to 12; Costinot and Rodríguez-Clare (2014) assumes a central value of 5; and Simonovska and Waugh (2014) estimates a value of 4.

Figure 9: Correlations Between the Non-Linear and Linear Counterfactual Predictions for Log Changes in Welfare in Response to Productivity Shocks for Trade Elasticities from 2 to 20



Note: Vertical axis shows the correlation across countries between the linear and non-linear counterfactual predictions for log changes in welfare in response to the full empirical magnitude of productivity shocks from 1970-2012 from Figure 7 above; horizontal axis shows the trade elasticity (θ).

6 Conclusions

To what extent do nations' economic interests influence their political behavior? We provide new evidence on this question using network measures of the sensitivity of welfare in one country to productivity growth in another country. We propose a bilateral friends-and-enemies matrix representation of the first-order general equilibrium effect of productivity growth in one country on welfare in another: One country is a friend [enemy] for income or welfare in another country if its productivity growth raises [reduces] the income or welfare of the other country.

Our exposure measures have a number of advantages for studying the relationship between political behavior and economic interests. First, they correspond exactly to the *sensitivity* of country welfare with respect to foreign productivity growth in the class of constant elasticity trade models. Second, they use only data on observed trade flows, which avoids the challenge of measuring counterfactual shocks that influenced country behavior but did not in fact occur. Third, we recover the entire bilateral network of country income and welfare exposure to productivity growth, which allows us to use techniques from the networks literature to characterize the role of countries' positions in the network in influencing the effects of productivity growth. Fourth, we show that the same representation of our exposure measures in terms expenditure share, income share and cross-substitution matrices holds across a wide range of trade models, including specifications with multiple sectors and input-output linkages, with appropriate changes to the elements of these matrices. Finally, we show that our representation can be used to provide an analytical characterization of the quality of the first-order approximation to the full non-linear model solution in terms of these observed matrices.

We combine our economic exposure measures with data on bilateral political alignment that capture softer forms of political power beyond military conflict. We use two sources of exogenous variation to provide evidence on the relationship between countries' political behavior and their economic interests. First, following China's market-orientated reforms in 1978, we show that other countries realign politically towards China and away from the United States. We show that this political realignment is greater in countries that experience larger increases in welfare exposure to China relative to the United States, consistent with the idea that economic interests shape political behavior. To further strengthen the evidence in support of this relationship, we use our network measure of countries' initial hub scores in 1980 shortly after China's liberalization. We show that the countries with the highest *initial* levels of exposure to productivity growth in *any* nation experience the largest political realignment towards China relative to the United States, consistent with these countries being the most vulnerable to the change in relative welfare exposure following China's emergence into the global economy.

Second, we make use of the large-scale reduction in the cost of air travel that occurred over our sample period, which reduced bilateral trade costs for some exporter-importer pairs by more than for others. By exploiting this variation in trade costs over time within exporter-importer pairs, we control for a host of time-invariant factors that are specific to individual pairs of countries (e.g. geographical location, institutions, legal origin, common language etc.). We also include exporter-year and importer-year fixed effects, which control for the sign and absolute magnitude of actual or expected exporter productivity growth, as well as policy changes that are common to all trade partners and macro shocks. Using these differential changes in relative trade costs within exporter-importer pairs, we again find that increases in bilateral welfare exposure raise bilateral political alignment. We show that these results are robust across a range of econometric specifications (including panel and long-differences regressions) and measures of bilateral political alignment (including UN voting, strategic rivalries and formal alliances).

Therefore, using these two quite different sources of quasi-experimental variation, we find the same pattern of results, where as a country becomes more economically dependent on a trade partner, it realigns politically towards that trade partner.

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