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Openness and isolation: The trade performance of the former Soviet Central Asian countries

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ABSTRACT

Previous studies divide the former Soviet Central Asian countries (CACs) into "more open" (Kazakhstan, Kyrgyzstan) and "more isolationist" (Tajikistan, Turkmenistan and Uzbekistan) depending on their trade-to-GDP ratio. We investigate this by gravity analysis measuring contributions of country-specific properties and networking factors in 185 bilateral CACs trade flows over the period 1995–2011. Our findings suggest that while all CACs have experienced growing trade over the period, they show considerable variety in initial conditions and transition reforms. The more isolationist countries have mostly relied on fortuitous factors such as hikes in natural resource prices to boost their trade, whereas the more open, reform-minded states have achieved considerable trade growth through reducing trade costs. Being an open or isolationist economy has resulted, respectively, in more or less suitable environment for business and investment.
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1. Introduction

While much of the literature on post-Soviet transition has focused on the experiences of the countries in Central and Eastern Europe and the Russian Federation, the Central Asian countries (CACs) have received relatively less attention[2]. There is no study focusing on the trade determinants and performance of CACs, even though it has been recognised that there is a strong correlation between success in transition from plan to market and foreign trade performance (Kaminski, Wang, & Winters, 1996). In addition, the international business (IB) literature has not paid enough attention to the developments in Central Asia after the disintegration of the Soviet Union and there is no study focusing on the business environment in CACs and their trade performance[3].

Much of the existing (economics) literature has tended to treat the CACs as a relatively homogenous region. However, after more than two decades of independence, important differences are emerging. In terms of trade performance, the trade/GDP ratio over the period 1995–2011 is much higher for Kazakhstan and Kyrgyzstan (38% on average) than for Tajikistan, Uzbekistan, and Turkmenistan (26% in average). This ranking also corresponds to that in the 2013 World Bank "Doing Business" report, which reflects the ease of doing business, tax collection, investor protection, access to credit, trading across borders, corruption, economic freedom, and competitiveness. Kazakhstan (49th out of 183 countries) is the highest ranking CAC, followed by Kyrgyzstan (70), Tajikistan (141), and Uzbekistan (154) while Turkmenistan is not ranked at all. This perhaps illustrates the close ties between trade openness and overall politico-economic reforms.

The standard transition literature emphasises a combination of initial conditions and the reform policies adopted during the transition period (Falcetti, Lysenko, & Sanfey, 2005 present a good review). Both initial conditions and, especially, reform policies vary substantially. Trade performance clearly reflects, in part, initial conditions, such as resource abundance, geography, transport infrastructure, specialisation, colonial ties, and so on (Elbourgh-Woytek, 2003; Grigoriou, 2007; Levy, 2007; Pomfret, 2011; Sinitsina, 2012; Suvankulov & Guc, 2012) as well as national business culture (Buck, Filatotchev, Demina, & Wright, 2000; Dow & Karunaratna, 2006; Wu, Li, & Samsell, 2012) or corporate

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[1] The paper draws heavily on Arman Mazhikeyev's doctoral research; nevertheless, the authors' contributions to this paper are equal.

[2] Some notable exceptions are Rumer (1995, 2000a, 200b), Pomfret (2000, 2003), Burghart and Sabonis-Helf (2004), Starr (2004), Hausmann, Hwang, and Rodrik (2005), Dowling and Wignaraja (2005, 2006), and UNDP (2005) which focus on general economic development and political issues.

[3] The IB literature has a few examples of papers on disintegration and rebuilding of networks between former Soviet republics (e.g., Davis et al., 1996), but these papers are now rather old. Pittman (2013) covers Central Asia, but from the limited perspective of transport system restructuring.

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governance (Filatotchev, Wright, Uhlenbruck, Tihanyi, & Hoskisson, 2003). These are quite heterogeneous, as we discuss below. However, there is also a strong contrast in terms of reforms enacted since the mid-1990s, as measured by the EBRD transition indicators (Stark & Ahrens, 2012). It is not easy to disentangle the effects of varied initial conditions from those of ongoing reforms, and this is made even harder by a changing global and regional environment which impacts the different players to varied degrees (Levy, 2007).

In the paper, we develop an IB-inspired theoretical framework to motivate hypotheses and investigate which factors are more important for each individual CAC by measuring the proportional share of country-specific properties and networking factors in bilateral trade flows. We do this by utilizing the gravity concept (e.g., Head, Mayer, & Ries, 2010; Zwinkels & Beugelsdijk, 2010), which explains bilateral trade in terms of country "masses" (country properties) and "distances" (networking). From the previous literature in the field, we would anticipate that these countries are all relatively isolated from the rest of the World. However, Pomfret (2010) has indicated that some of these countries have started engaging in serious reforms, while others are much slower—we will be seeking evidence in support of this. We therefore expect that these countries are more heterogeneous than the previous literature has recognised. In addition to documenting this heterogeneity, we would identify factors impacting trade, and link policy reform to trade performance and business development.

In terms of the detailed econometric work, by taking a ratio of the ratios of bilateral trade, we can separate country-specific from networking (bilateral) factors. Our analysis of 185 CACs bilateral trade observations, based on a 37 country panel covering the 1995–2011 period shows that: (i) networking factors explain 50% or more of changes in Kazakhstan's and Kyrgyzstan's trade flows and 5–14% of changes in Turkmenistan's, Uzbekistan's and Tajikistan's trade; (ii) 75% of changes in the 185 bilateral CACs' trade flows are mainly explained by country specific properties, i.e., monadic driven trade; (iii) 25% of the 185 bilateral CACs' trade flows are explained by networking (bilateral) factors such as transport costs, combined with landlockedness and RTAs, i.e., dyadic driven trade; (iv) open CACs are more sensitive to global and regional shocks compared to isolationist CACs.

2. Context, theory and hypotheses

2.1. The CACs context

All the CACs became independent in 1991. Similarities in initial conditions reflect their history, geographic closeness and cultures. CACs populations originate from the same Turkic tribes. Historically, all were colonised by Tsarist Russia and belonged to the Soviet Union for over 70 years. All geographically landlocked, CACs differ in terms of neighbours, land sizes and landscape, size of population, endowment of natural resources, and historic production specialisation. Kazakhstan possesses the largest territory, borders with Russia and China and has relatively better rail and road connections left from Soviet times. It is well endowed with oil, coal, metals and agricultural land. By contrast, Kyrgyzstan and Tajikistan are mountainous, smaller in size and population and have mountain borders with China and Afghanistan. Uzbekistan has a relatively large population, possesses substantial natural gas reserves and good conditions for cotton production. Turkmenistan is much more sparsely populated, but well-endowed with natural gas.

Pomfret (2005) among others concludes that transition reforms proceeded faster in Kyrgyzstan and Kazakhstan and slower in Tajikistan, Uzbekistan and Turkmenistan. EBRD transition indicators show a similar ranking in terms of privatisation and price liberalisation—policies which are an important stage of ongoing transition reforms (Barlow & Radulescu, 2005; Stark & Ahrens, 2012). Although Uzbekistan did well with price liberalisation in the mid-1990s, it kept enterprises under state control and has been slow with other reforms. Gas-rich Turkmenistan has been reluctant to make substantial changes in its economy, although after the death of the president Nyazov in 2006 the country has begun to liberalise. Tajikistan went through a civil war (1992–1997) and since then has been slow to implement reforms.

The CACs faced huge trade and production hardships with the Soviet collapse and subsequent hyperinflation in 1991–1996. Within a year of independence trade with Russia fell tenfold (Sinitsina, 2012). Later, in 1998–1999, the CACs were hit by the Russian financial crisis. Despite these circumstances, countries were already beginning to diverge in terms of international integration—particularly, though not exclusively with Russia. Already by 1998 Kazakhstan, Kyrgyzstan and Tajikistan had joined several major RTAs with Russia, including the CISFTA in 1994, EurAsEc and SCO in 1996 while Uzbekistan and Turkmenistan were only observers (see Appendix). The CACs' trade with Russia was damaged substantially by the 1998 crisis, especially those countries which had engaged in integration (Westin, 1999). The more isolationist Turkmenistan and Uzbekistan had less exposure. The period 2000–2007 was more fruitful as world prices for the CACs' primary export goods (oil, gas, cotton) accelerated and volumes of trade and FDI inflows, mainly from China and Europe, increased. The main beneficiaries were the more open economies, but Uzbekistan and Turkmenistan also benefited from a global boom and increasing global gas demand, negotiating with China and Iran to reduce their dependence on the Russian market. The 2008 crisis had both direct and indirect effects on the CACs' trade and economic wellbeing. The exposure of Kazakhstan's banks to the global financial crisis spread to Tajikistan and Kyrgyzstan. Uzbekistan and Turkmenistan which had more limited financial links with the other CACs, Russia and rest of the world where originally less affected by the crisis.

2.2. Theory and hypotheses

2.2.1. A game tree of openness and trade: Actors and interactions

The degree of openness or isolation of an economy can be seen as the outcome of the interaction of decisions of a number of actors in response to their environment and to each other. The principle *actors* in any economy constitute consumers/voters, government, MNEs and local firms: however, we should also note that the specific post-Soviet environment tends to include important roles for ethnic (particularly Russian) minorities and for the politically-connected oligarchs who rose during and just after the fall of Communism. Broadly speaking, Fig. 1 shows a game tree outlining the interactions of these actors.

Trade *policy* is set by the governments, and may take the form of multilateral liberalisation or regional integration (the latter being increasingly favoured by the intended development of the Eurasian Union). Governments also set the regulatory environment governing trade and FDI, and have influence on the legal environment, as well as influencing the quality of transport linkages and border efficiency. The presence of multinational agreements and RTAs shows that governments interact with one another: particularly their neighbours (and the rest of the world).

At the same time, however, the *trade performance* of an economy depends upon the decisions of other actors (at micro level), notably firms. If the larger local firms and MNEs respond to liberalisation by expanding trade greatly, then the country will see an increase in competition and specialisation gains from trade, in turn benefiting consumers. The more elastic is firms' response, the less will be the 'beggar-my-neighbour' incentive of a country to

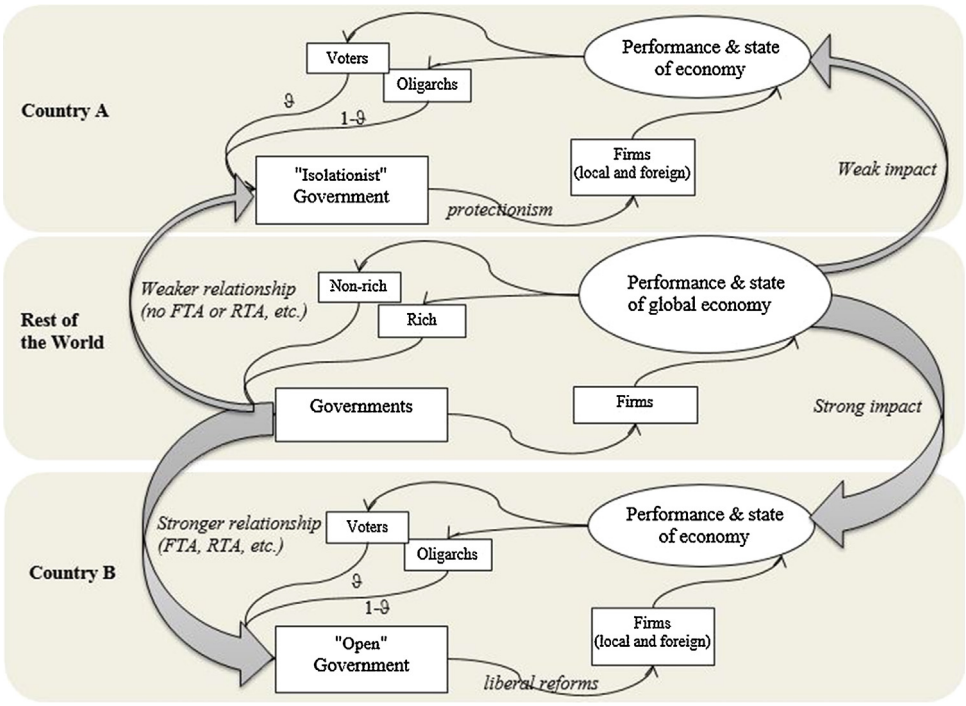


Fig. 1. A game tree of openness and trade: actors and interactions.

protect its economy for terms-of-trade reasons (Edwards, 2010). Firms' responses will, of course, reflect remoteness and transport networks, as well as 'psychic' distance as demonstrated by Dow and Karunaratna (2006). Limao and Venables (2001) find that trade performance is affected by high overland transport costs of goods. Historic business networks (Rauch & Trindade, 2002) and their collapse and re-emergence (Davis, Patterson, & Grazin, 1996) and colonial ties (Head et al., 2010)[4] also play an important role. To the extent that MNEs drive the trade response, their liability of foreignness (Zaheer, 1995, 2002) can be an important factor as well. However, Yildiz and Fey (2012) argue that in transition (and emerging) countries the liability of foreignness is relatively less important due to ability of NMEs to bypass local suppliers, customers' favourable stereotypes and curb of appeal brought by the MNEs, and possibly host governments' desire for FDI and foreign technology (e.g., Bevan, Estrin, & Meyer, 2004).

Depending upon the response of firms, there will be gains in income (perhaps with offsetting losses in security) to voters (in Fig. 1, defined as theta which will increase). However, in countries of limited democracy with powerful oligarchs, the lobbying power of the latter is also crucial: if oligarchs' power is based in exporting industries (such as through the control of natural resources), they may favour trade expansion, while if they control import-competing industries they will resist growth in trade or FDI (in Fig. 1, (1-theta) will increase).

In line with standard political economy bargaining theory, we can see the decision-making by government as reflecting the relative bargaining weights of voters and oligarchs, which will be dependent on the political and institutional makeup of the country.

2.2.2. The actors in the CACs

2.2.2.1. Governments. A recent IMF Survey (IMF, 2012) finds a strong correlation between political regime and trade policies of the CACs. While all countries have relatively authoritarian regimes, there are still considerable differences in political systems. Kyrgyzstan and Kazakhstan are somewhat more liberal compared to Tajikistan, Turkmenistan and Uzbekistan. Kaser (1998) and Luong and Weinthal (2002) link CACs' economic performance to variation in political regimes, as Kazakhstan is characterised as "populist with soft autocracy", Kyrgyzstan as "dualist with electoral democracy", and Uzbekistan, Tajikistan and Turkmenistan as "centralist with hard autocracy". Reflecting this, economic liberalisation of each CAC is at different stages. There are many other related country-specific features (majority and minority population make up, liberalisation level, FDI level and so on) that affect CACs trade performance. Some CACs (Turkmenistan, Uzbekistan and Tajikistan) have a higher level of government intervention and state control in their economies compared to others (Kyrgyzstan and Kazakhstan) where the economy is more liberal and relatively more influenced by regional or global economic conditions.

2.2.2.2. Firms. According to Pomfret (2010), Turkmenistan, Uzbekistan and Tajikistan, relative to Kazakhstan and Kyrgyzstan, are among the slowest of the transition economies to reform, with firms facing less competition and softer budget constraints compared to Russia, let alone the EU Accession states. Nevertheless, the CACs, like other transition countries, have experienced radical transformations in their political and business landscapes due to the wave of deregulation and liberalisation of their economies after the dissolution of the Soviet Union (Hoskisson, Eden, Lau, & Wright, 2000; Filatotchev et al., 2003). These dramatic economic and political changes affecting CACs firms can be seen as regulatory punctuations leading to radical environmental change (Haveman, Russo, & Meyer, 2001; Perez-Batres & Eden, 2008). Firms' strategic responses to radical environmental change are an important factor for the aggregate trade performance of CACs.

To better understand firm responses to regulatory punctuations in the CACs, we find useful insights in the IB literature on liability of foreignness, and particularly the extension to this concept by Perez-Batres and Eden (2008) who introduced the parallel concept of "liability of localness". Eden and Miller's (2004) definition of

[4] Acharya et al. (2011) assert the impact of colonial ties between former Soviet countries on current trade patterns.

liability of foreignness focuses on the socio-political and relational hazards associated with "being a stranger in a strange land". Similar to liability of foreignness facing potential MNE incomers (e.g., Zaheer & Mosakowski, 1997; Eden & Miller, 2004), the ongoing transition reforms are producing a degree of 'liability of localness' (Perez-Batres & Eden, 2008), with local firms less familiar with operating in a globalised and marketised environment. Thus, liability of localness is about the added costs faced by local firms, adjusting to "now" being different from "then"; the competitive landscape facing the firms has shifted markedly, necessitating new strategies for survival. Local firms need to learn the 'rules of the game' under liberalisation (Dunning, 2003; Miller & Pisani, 2007).

Perez-Batres and Eden (2008) demonstrate that emerging market firms with international experience in developed countries can better interpret their home market evolving institutions which in turn lessens the emerging market firms' liability of localness. In a related analysis D'Aveni and Macmillan (1990) show that under strenuous situations, such as regulatory punctuations, firms focusing their attention on the external environment outperformed those focusing their attention on the internal aspects of the business. Their argument rests on the notion that most internal aspects of the business are not necessarily aligned with the new business landscape and need to change. Alternatively, firms that focus on the internal aspects of their business, during strenuous situations, may be operating under the assumptions of past cognitive, normative, or regulatory structures. Given the prevailing privatisation methods in CACs such as buyouts by local managers and "give-away" deals (Filatotchev et al., 2003) many firms with incumbent managers have focused their attention on the internal aspects of the business thus facing high liability of localness.

Furthermore, under uncertain political and economic conditions such as after the dissolution of the Soviet Union, many CACs firms would have not necessarily understood their new institutional environment and this misconception (Scott, 1997) has hindered their ability to function. According to March (1988), the greater the uncertainty, the more likely organisations are to engage in exchange relations with those with whom they have transacted in the past and with those of similar status. Thus, in the CACs, given that many firms were trading or had closer organisational links with firms from other Soviet Union countries, especially Russia, it is likely that trade patterns after political independence and market liberalisation will remain strongly associated with the former Soviet Union countries, and in particular Russia. Such an assertion is also in line with Dow and Karunaratna's (2006) concept of 'psychic' distance stimuli.

In summary, the implication for our theoretical framework is that the liability of localness produces a position where oligarchs and state-actors in industries opening to foreign competition may lose. In turn, the weakness of local firms – the liability of localness – increases the profit-shifting motives for protectionism (Bagwell & Staiger, 2012), and also increases the risks of protectionist lobbying by oligarchs.

2.2.2.3. Voters and the role of minorities. Although Russian-speaking minorities have shrunk considerably since 1989, estimates from 2007 suggest that there were still 4 million ethnic Russians in Kazakhstan (25% of the population) and 500,000 (or about 10% of the population) in Kyrgyzstan. By contrast, the formerly sizeable Russian populations in Uzbekistan, Tajikistan and Turkmenistan have shrunk to less than 3% of the population (Peyrouse, 2008). Given that the role of language ties is often emphasised as a driver of trade (Dow & Karunaratna, 2006), it is likely that Russian minorities will stimulate policy towards openness—at least in the form of RTAs with Russia (and Belarus). This is magnified by the increasing foreign policy assertiveness of Russia vis *a* vis ethnic Russians beyond its borders[5]. Ethnic composition and pressure from Russia may both explain why Kazakhstan and Kyrgyzstan are more open – yet more biased towards Russia – in trade than other CACs.

2.2.2.4. The environment and specificities of CACs. The CACs are large in area, though sparsely populated, and are all landlocked. This reduces trade potential, compared to countries with sea ports. Raballand (2003) emphasises the variation in the effect of landlockedness in each CAC. Adding to this are issues of transport infrastructure and logistics services in the CACs (Grigoriou, 2007). Reduced trade potential also reduces the potential benefits to a country from trade liberalisation. Again, Kazakhstan, which has industrialised border areas closer to the Russian Urals, may have more trade potential than countries further to the South.

Resource endowment has an important influence on trade performance. Auty (2001), World Bank (2002), Pomfret (2004), Felipe, Kumar, Abdon, and Bacate (2012) all point out that there is a strong correlation between the resource abundance and trade performance of the CACs. Turkmenistan and Kazakhstan can be viewed as much richer in resources than the other CACs; while this has a clear effect on trade outcome (the recovery in resource prices from 2000 boosted these economies), the effect upon policy is harder to determine, since Kazakhstan is relatively open and Turkmenistan isolationist.

Historical environment also affects current performance by government and firms. The role of inter-firm networking is explored in Davis et al. (1996) for the case of decline and re-emergence of Soviet era ties in Estonia—but similar networking factors apply to Central Asia. Historically poor governance may make effective trade reforms difficult. Tai and Lee (2009) emphasise bureaucratic barriers to trade: investors spend 20% (in Kazakhstan and Kyrgyzstan) and 48% (in Tajikistan, Turkmenistan, and Uzbekistan) of their time to deal with unnecessary bureaucracy. Using the 2010 World Bank Governance Indicators (WGI), Magilevskii (2012) points out the heterogeneity of governance efficiency; out of 230 countries, Kazakhstan ranks 138, Kyrgyzstan 171, Tajikistan 187, Uzbekistan 199, and Turkmenistan 201. The importance of governance environment for trade is also emphasised by Wu et al. (2012).

2.2.3. Hypotheses: Expectations and feedback in the openness game

Non-government actors will affect government policy via three routes. The first is through direct feedback: the various players will support or oppose reform depending upon their perceived self-interest: their influence will depend upon the political reality and bargaining power. The second is through expectations (affected by uncertainty), as in any forward-looking game expected gains will determine the nature and degree of lobbying. The third is the interaction of different lobbies across countries, given that the benefits of trade liberalisation are usually greater when the countries act concertedly.

The history of post-Communist transition countries' reform process is also important in determining whether a country is likely to engage in further liberalisation. Based on EBRD data, Barlow and Radulescu (2005) find, for example, that reform is more likely to continue and spread to other areas in economies where there is early privatisation of small business. This may well feed back through differences in the lobbying balance within the economies.

[5] http://wwweurasiareview.com/06082014-post-crimea-central-asian-fear-putins-stick-analysis/.

Table 1
CACs exports, imports and internal trade.

	1995–1999	2000–2003	2004–2007	2008–2011
Total Exports (in bln U.S. dollars)				
Kazakhstan	21.9	29.0	64.0	103.4
Kyrgyzstan	1.3	1.5	2.2	2.6
Tajikistan	0.9	0.8	1.7	2.2
Turkmenistan	4.5	5.9	14.1	18.9
Uzbekistan	5.7	4.9	11.9	19.8
Total Imports (in bln U.S. dollars)				
Kazakhstan	22.3	28.4	66.6	93.4
Kyrgyzstan	1.3	1.4	2.5	2.6
Tajikistan	0.9	0.8	1.9	2.4
Turkmenistan	4.5	5.6	14.4	28.1
Uzbekistan	5.7	4.7	13.7	22.0
Total Internal trade (in bln U.S. dollars)				
Kazakhstan	20.2	23.4	73.7	135.5
Kyrgyzstan	1.6	1.5	3.1	5.1
Tajikistan	1.0	1.2	3.0	5.8
Turkmenistan	3.6	7.7	20.0	32.2
Uzbekistan	14.2	11.1	18.3	38.8

Source: IMF World Economic Outlook Database (2013).

Trade outcomes (the relative size and changes in trade for each CAC) can be seen in Table 1. Crucially, observed trade in all CACs has recovered sharply in the period since 1998. The common factor is that incomes in the Central Asian region grew sharply, spurred by growing demand from its main export market (Russia) and, in resource-rich countries, by rising mineral prices. While Kyrgyzstan may have seen lower export growth than, say, Turkmenistan, this difference can be explained by the fact that the latter is a major gas exporter, at a time when fossil fuel demand was buoyant, while the former is resource-poor.

Clearly, observed changes in trade volumes reflect the complex interactions represented in the openness game tree: the key role of gravity analysis that follows is in decomposing and quantitatively explaining the outcomes depicted in Table 1. Following on the discussion in our theory section and to help interpret in a structured way our gravity analysis results we formulate four empirical hypotheses:

H1. The observed recovery in trade volume (outcome measures of global integration) is not necessarily driven by falling trade costs (policy measure), but partially reflects other country specific or environmental factors.

H2. Networking (bilateral) factors have strongly boosted trade in the more open CACs, whereas the more isolationist countries' trade has grown in spite of, rather than because of, trade policy.

H3. The countries which have opted for stronger regional integration with other CIS states are also more open towards the Rest of the World (RoW) than the isolationist CACs.

H4. Cyclical fluctuations in the trade of the more open CACs are more closely linked to those of the RoW while isolationist CACs' trade is only weakly affected by cyclical fluctuations in the RoW economies.

If trade reforms can be seen as part of an overall reform process, then we would anticipate that the more reforming countries are reducing the liability on foreign firms doing business, but the trade-off is that the liability on local firms is increased. However, this may in turn spur reforms among local firms, increasing their ability to export. This dynamic process is consistent with the more macroeconomic-level predictions in H2. The ability to export more to the RoW in H3 again reflects the effects of trade reforms within the CIS, and Kazakhstan and Kirgizstan, prompting restructuring of local firms, overcoming their liability for exporting.

3. Methodology and data

3.1. The gravity concept

We utilise the gravity model of trade (GMT), a modified form of Newton's gravity equation, this predicts bilateral trade flows based on economic sizes and geographic distance of two trading countries (Zwinkels & Beugelsdijk, 2010). The GMT has been proven to be consistent with empirical findings, and to which have been added theoretical foundations (Anderson & Van Wincoop, 2003; Bergstrand, 1989; Deardorff, 1998; Eaton & Kortum, 2002; Chaney, 2008; Helpman, Melitz, & Rubinstrein, 2008). We start with Anderson and van Wincoop's (Anderson & Van Wincoop, 2003) theory-based GMT which takes the following form:

$$x_{ij} = \frac{y_i y_j}{y_w}\left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma}, \quad (1)$$

where x_{ij} is nominal exports from country i to country j, y_i and y_j are economic sizes of country i and j, respectively, y_w is world economic size, t_{ij} is trade cost, P_i and P_j are the respective price indices, and σ is the elasticity of substitution.[6,7]

World economic size equals the sum of nominal incomes of all countries j, $y_w = \sum_j y_j$. Theoretically, the economic size of country i (y_i) is equal to the gross consumption of goods (produced in country i) by country j at a price (p_{ij}) that differs from j's domestic price level by the inclusion of a trade cost (t_{ij}):

$$y_i = \sum_j c_{ij} p_{ij} \quad (2)$$

Country j's economic size (y_i) is calculated analogously. It is common practice in a gravity analysis to weight the economic size using the nominal GDP of the country.

The central contribution of Anderson and Van Wincoop (2003) is the concept of multilateral resistance to trade (MRT). The outward trade resistance, P_i and inward trade resistance, P_j are price indices that take into account the weighted aggregate values of observable traded costs across all possible export partners of i and import partners of j, respectively, and take the form of CES unit cost functions:

$$P_i = \left(\sum_j P_j^{\sigma-1}\theta_j t_{ij}^{1-\sigma}\right)^{1/1-\sigma}, \quad (3)$$

$$P_j = \left(\sum_i P_i^{\sigma-1}\theta_i t_{ij}^{1-\sigma}\right)^{1/1-\sigma} \quad (4)$$

While MRT terms are not directly observable, gravity studies provide methods to proxy them[8].

[6] Note that Eq. (1) follows Anderson and Van Wincoop (2003) in assuming imports and exports have a proportional effect on bilateral trade; however, this assumption can easily be relaxed, as we do later in our estimated equations.

[7] The elasticity of substitution should be larger than one, $\sigma > 1$, but exact values may change as preferences and trade opportunities change. The debates over precise level of elasticity of substitution have been ongoing for quit long, and it seems there is still no consensus what it should be like. For example, some papers use relatively low σ; for example Backus, Kehoe, and Kydland (1994) use 1.5 and Coeurdacier, Kolmann, and Martin (2007) use 0.6–2. Other papers use relatively high σ; for example, Hummels (2001) at around 9 and Romalis (2007) chooses 11. However, since Eaton and Kortum (2002) and Anderson and Van Wincoop (2004), many trade papers tend to pick value somewhere between 5-10, although some papers have estimated it instead.

[8] Anderson and Van Wincoop (2003) proposed an iterative procedure to estimate MRT terms based on non-linear least squares but because of its complexity it was overshadowed by simpler proxies such as "remoteness" or fixed effect dummies.

Anderson and Van Wincoop (2003) assume that trade costs, t_{ij}, are symmetric, and of "iceberg" form (Samuelson, 1952):

$$t_{ij} = \sum_{m=1} \left(z_{ij}^{m}\right)^{\gamma_m}, \tag{5}$$

where z_{ij}^{m} is a function of bilateral trade barriers (transport cost, tariffs, quotas etc.) and the parameter γ_m. The geographic distance between trading countries i and j can serve as proxy of transport cost.

3.2. The gravity decomposition

The GMT is a simple model with strong predictive power, and has been extensively used for empirical studies since its first implementation by Tinbergen (1962). Researchers have developed extension and decomposition techniques to allow the GMT to measure overall trade costs (Anderson & Van Wincoop, 2004; Jacks, Meissner, & Novy, 2009; Head et al., 2010) or unobservable MTRs (Anderson & Van Wincoop, 2003; Baier & Bergstrand, 2009).

We make use of a gravity consistent extension of the AvW procedure called the "tetrad" method (see Head et al., 2010). This allows us to capture time varying bilateral effects (for instance, caused by changes in tariffs or non-tariff measures) on trade volumes by eliminating (by division) all importer, exporter, and global (time) effects as well as fixed bilateral effects (such as distance or colonial ties). In addition to exporter i and importer j countries, we need to take another two countries, one as reference exporter l and another as reference importer k. So by taking a "tetrad" of Eq. (1) with ij, ik, lj, and lk sets and denoting it as $\beth$, it can be represented as

$$\beth_{(il)(jk)} = \frac{x_{ij}/x_{ik}}{x_{lj}/x_{lk}}, \tag{6}$$

which then through elimination of monadic $\left(y_i y_j / y_w (P_i P_j)^{1-\sigma}\right)$ and fixed dyadic terms $(\tilde{t}_{ij})$ can be reduced to "tetrad" of φs:

$$\beth_{(il)(jk)} = \frac{\varphi_{ij}/\varphi_{ik}}{\varphi_{lj}/\varphi_{lk}} = \tilde{\varphi}_{ijt} \tag{7}$$

where $\tilde{\varphi}_{ijt} = (t_{ij})^{1-\sigma}$ is an overall measure of observable and unobservable trade-cost factors. Although $\tilde{\varphi}_{ijt}$ s contain elasticity of substitution (σ), no assumption about the level of elasticity needs to be imposed which is crucially important since exogenously introduced level of elasticity is always questionable.

Unlike traditional fixed effect methods, the tetrad approach allows for time-varying changes in relative trade costs across different country pairs. For example, Head et al. (2010) analyse the time varying effect of independence on trade between a metropolis (coloniser), colony, and siblings (other colonies), to capture the effect of other relevant bilateral factors (changes in RTA, GATT membership, and currency rates). Romalis (2007) used the approach to evaluate the effect of NAFTA tariffs on trade flows among USA, Mexico, and Canada. Our purpose is to decompose the GMT into two parts:

$$x_{ij} = D_{ij} M_{i,j}, \tag{8}$$

where the dyad, D_{ij}, stand for varying overall trade measure powered by trade elasticity, $1-\sigma$. The dyad represents the country-pair-specific (ij) networking or trade cost component of trade:

$$D_{ij} = \varphi_{ij}. \tag{9}$$

The monad, $M_{i,j}$, is the combination of the country specific components for each country in the pair ij: economic size and MRT. This is derived by eliminating D_{ij} from Eq. (1):(10)$M_{i,j} = \frac{y_i y_j}{\sum_j y_j (P_i P_j)^{1-\sigma}}$.

3.3. Data

Our bilateral trade panel contains 37 countries over the period 1995–2011[9]. The selection of countries was based on volume of trade with the CACs region. Sadly, data on 1989–1992 period are either missing or if reported are unreliable; these problems also apply to the data for the period till 1994 which is characterised by hyperinflation. Consequently, our study starts from 1995.

Bilateral trade flows and tariff rates for the 1995–2011 period, in 2007 US dollars were obtained from WITS (www.wits.org). This contains both the COMTRADE and TRAINS bilateral databases, both of which contain some of the necessary data, as COMTRADE covers only WTO members, while TRAINS covers all the CACs, but aggregates the EU into one single region. The other issue was that one third of all trade data for some countries was missing or unreported; consequently we had to use interpolation which allowed reduction of missing trade data from 1/3 to 1/5.

GDP levels were obtained from the IMF International Financial Statistics database (www.imf.org), while geographic distances between capital cities of the countries and standard gravity dummies for colonisation, common language, and common border were obtained from CEPII (www.cepii.fr). Additional binomial dummies for landlockedness and RTA membership were also included. Summary statistics, description of variables and correlation matrixes are reported in Tables 2 and 3, respectively.

3.4. The estimation model

We estimate a set of log-linear models. First, we consider a standard OLS model with fixed effect dummies:

$$\ln x_{ijt} = a_0 + a_1 \ln y_{it} + a_2 \ln y_{jt} + a_3 \ln t_{ijt} + a_4 I_{it} + a_5 I_{jt} + a_6 I_t + \varepsilon_{ijt}, \tag{11}$$

where a_0 is constant, y_{it} and y_{jt} are proxied with nominal GDP levels of exporter i and importer j country respectively, $a_3 = 1-\sigma$ is trade elasticity, ε_{ijt} is error term; I_{it} is exporter-year, I_{jt} is importer-year, and I_t represents year binary dummies to proxy P_{it}, P_{jt}, and y_w, respectively, for theoretical consistency. Our trade costs take the following form:

$$\ln t_{ijt} = b_1 \ \ln \ \mathrm{dist}_{ij} + b_2 \ln(1+\mathrm{trf}_{ijt}) + b_3 \ \mathrm{lang}_{ij} + b_4 \ \mathrm{col}_{ij} + b_5 \ \mathrm{bord}_{ij} + b_6 \ \mathrm{llock}_i + b_7 \ \mathrm{llock}_{ij} + b_8 \ \mathrm{RTA}_{it} + b_9 \ \mathrm{RTA}_{ijt} + u_{ijt}. \tag{12}$$

In Eq. (12), the geographic distance (dist) proxy for transport cost, trf[10] stands for border cost, and further binomial dummies capture effects of historic (common language and colony), geographic (sharing borders, one and both landlocked), and economic linkages (one and both in RTA) effects on trade cost; u is error term. In the equation time constant variables, unlike time variant ones, have no time subscript.

As previously mentioned, the derived values from tetrading – the dyads – stand for time-varying bilateral factors, which can be

[9] The 37 countries considered are Algeria, Austria, Azerbaijan, Belarus, China, Croatia, Finland, France, Georgia, Germany, Greece, Hungary, India, Iran, Italy, Japan, Kazakhstan, Korea, Kyrgyzstan, Lithuania, Moldova, Netherlands, Norway, Poland, Romania, Russian Federation, Saudi Arabia, Spain, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, United Arab Emirates, United Kingdom, United States, and Uzbekistan.

[10] Taking log of 1+trf is necessary to account for the cases with zero tariffs in our data.

Table 2
Descriptive statistics for the variables ($n = 23{,}274$).

Variable	Description	Min	Max	Mean	s.d.
yr	Year	1995	2011	2003	4.899
x_{ijt}	Exports, in billions of US dollars	0	1038090	971.21	14862.54
y_{it}	GDP of exporter, in billions of US dollars	0.569	28062	972.01	2345.5
y_{jt}	GDP of importer, in billions of US dollars	0.569	28062	972.01	2345.5
$dist_{ij}$	Geographic distance, in km	69.04	11763.9	3512.8	2578.6
trf_{ijt}	Effectively applied tariffs, in percentages	0	121.04	3.4594	5.6896
$bord_{ij}$	Dummy for common border between I and j is 1, otherwise 0	0	1	0.078	0.2695
$lang_{ij}$	Dummy for common language between I and j is 1, otherwise 0	0	1	0.0394	0.1946
col_{ij}	Dummy for common colonial history between I and j is 1, otherwise 0	0	1	0.0321	0.1763
$llock_i$	Dummy for landlocked I is 1, otherwise 0	0	1	0.4558	0.4980
$llock_{ij}$	Dummy for both landlocked I and j is 1, otherwise 0	0	1	0.1234	0.3289
RTA_{it}	Dummy for RTA membership of I only is 1, otherwise 0	0	1	0.3389	0.4733
RTA_{ijt}	Dummy for both, I and j, are members of the same RTA is 1, otherwise 0	0	1	0.0467	0.2111
Rad_i	Radius of I from (0,0) geographic coordinate	3.6427	17.33361	10.268	3.8370
Rad_j	Radius of j from (0,0) geographic coordinate	3.6427	17.33361	10.268	3.8370

Table 3
Correlation matrix ($n = 19{,}522$).

		1	2	3	4	5	6	7	8	9	10	11	12
1	$\ln x_{ijt}$	1.0											
2	$\ln y_{it}$	0.5730	1										
3	$\ln y_{jt}$	0.4894	0.0403	1									
4	$\ln dist_{ij}$	−0.2440	0.1238	0.1976	1								
5	$\ln(1 + trf_{ijt})$	−0.2336	0.0065	−0.0756	0.3634	1							
6	$bord_{ij}$	0.1384	−0.0216	−0.0321	−0.3260	−0.0424	1						
7	$lanf_{ij}$	0.1033	0.0371	0.0171	−0.0467	0.0185	0.2751	1					
8	col_{ij}	0.1316	0.0430	0.0462	−0.0728	0.0080	0.2487	0.2890	1				
9	$llock_i$	−0.3106	−0.1963	−0.1413	0.0387	0.0270	−0.0132	−0.0204	124	1			
10	$llock_{ij}$	−0.1508	−0.2738	−0.2843	−0.1872	−0.1147	0.0979	0.0544	−0.0683	−0.3117	1		
11	RTA_{it}	−0.3697	−0.2484	−0.2212	0.1035	0.1569	0.0276	−0.1166	−0.0399	0.3831	0.1292	1	
12	RTA_{ijt}	−0.0264	−0.1897	−0.2136	−0.1406	−0.0587	0.1613	0.1734	0.2310	−0.0861	0.4211	−0.1427	1

expressed as:

$$\ln x_{ijt} = d_0 + d_1 \ln y_{it} + d_2 \ln y_{jt} + d_3 \ln \tilde{\varphi}_{ijt} + d_4 I_{it} + d_5 I_{jt} + d_6 I_t + \varepsilon_{ijt}, \quad (13)$$

where

$$\ln \tilde{\varphi}_{ijt} = c_0 + c_1 \ \ln \ dist_{ij} + c_2 \ln(1 + trf_{ijt}) + c_3 \ lang_{ij} + c_4 \ col_{ij} + c_5 \ bord_{ij} + c_6 \ llock_i + c_7 \ llock_{ij} + c_8 \ RTA_{it} + c_9 \ RTA_{ijt} + u_{ijt}. \quad (14)$$

Feenstra (2004) states that fixed effects models are the most reliable and simple method to estimate gravity of trade flows. The fixed effect dummies proxy the omitted MRT terms effect. If the interest is as in our case to estimate coefficients of time-invariant variables (such as distance) then Dummy Variable Least Squares (DVLS) method which works the same way as fixed effects model is appropriate to use[11].

Potentially, DVLS estimates could suffer from serial correlation, non-stationarity and endogeneity. Moreover, DVLS does not take into account zero trade values where it is unknown whether these are true zeroes or unreported values. In any case zero trade values should not be neglected, especially when 1/5 of our observations are zeroes. Experts suggest re-estimating the GMT using other estimators that handle these issues such as TSLS (Two Stage Least Squares) to control for endogeneity bias (Egger, Larch, Staub, & Winkelmann, 2011), DVLS (with AR option) – for autocorrelation issue (Martin, Anderson, & Pham, 2009), PPML (Poisson Pseudo Maximum Likelihood) estimator – for inclusion of zero trade values, and FDE (First Differencing) estimator – for stationarity of variables as discussed by Zwinkels and Beugelsdijk (2010). Following the relevant literature we run tests for non-stationarity and co-integration and report the results in Table 4 which shows that some variables (GDPs and RTAs) are non-stationary in levels but stationary in first differences. Furthermore, there seems to be no issues with cointegration of variables.

[11] The fixed effect estimator drops all the variables that are constant over time like distances, therefore, including fixed effect dummies produces the same results as the fixed effect estimator but also estimates coefficients for constant variables.

4. Estimation results

4.1. Gravity model results

Results are presented in Table 5, where control variables are categorised into country-specific factors (importer and exporter GDP), time-invariant bilateral (networking) factors (distance, landlockedness, shared common borders, common language, and common historical coloniser), and time-variant bilateral factors (tariff rates, participation in RTA). The estimates in columns 1 to 5 are obtained using (1) Dummy Variable Least Squares (DVLS) with the STATA's *robust* and *cluster* option, (2) DVLS with AR option, (3) Two Stage Least Squares (TSLS), (4) Poisson Pseudo Maximum Likelihood (PPML) estimator, and (5) First Differencing (FDE) estimator respectively.

Regarding signs, estimated coefficients across different estimators show a logical relationship between the explained variable and explanatory variables and agree with correlation matrix results (Table 3); trade is positively associated with both exporter and importer GDPs as well as with the dummies for a common language, and with the countries being members of the same RTA, while in contrast, distance, landlockedness, and tariff rates are negatively correlated with trade. However, we observe some sign disagreements of coefficients (depending on estimator in use) such as unexpected signs of tariff and colony variables in PPML column.

Table 4
Non-stationarity and cointegration test results.

(a) Phillips–Perron non-stationarity test

		Statistic	*p*-Value	Statistic	*p*-Value
	$\ln x_{ijt}$	Level		Difference	
P	Inverse chi-squared (2610)	6495.4	0	2.18e+04	0
Z	Inverse normal	−17.1	0	−95.4	0
L*	Inverse logit t(6234)	−29.1	0	−162.7	0
Pm	Modified inverse chi-squared	53.4	0	265.2	0
	$\ln y_{it}$	Level		Difference	
P	Inverse chi-squared (2738)	1439.1	1	5220.6	0
Z	Inverse normal	21.3	1	−25.3	0
L*	Inverse logit t(6664)	19.2	1	−26.9	0
Pm	Modified inverse chi-squared	−17.5	1	33.5	0
	$\ln y_{jt}$	Level		Difference	
P	Inverse chi-squared (2738)	1439.1	1	5220.6	0
Z	Inverse normal	21.3	1	−25.3	0
L*	Inverse logit t(6664)	19.2	1	−26.9	0
Pm	Modified inverse chi-squared	−17.5	1	33.5	0
	$\ln(1+\mathrm{trf}_{ijt})$	Level		Difference	
P	Inverse chi-squared (2738)	6777.9	0	2.72e+04	0
Z	Inverse normal	−25.1	0	−127.4	0
L*	Inverse logit t(5994)	−37.1	0	−215.5	0
Pm	Modified inverse chi-squared	54.6	0	330.7	0
	RTA_{it}	Level		Difference	
P	Inverse chi-squared (2738)	283.7	1	3795.4	0
Z	Inverse normal	11.8	1	−46.9	0
L*	Inverse logit t(2039)	10.7	1	−51.7	0
Pm	Modified inverse chi-squared	−33.1	1	14.2	0
	RTA_{ijt}	Level		Difference	
P	Inverse chi-squared (2738)	209.4	1	3631.5	0
Z	Inverse normal	13.7	1	−46.7	0
L*	Inverse logit t(1834)	12.4	1	−52.2	0
Pm	Modified inverse chi-squared	−34.1	1	12.1	0

(b) Westerlund ECM cointegration test

$\mathbf{x_{ijt}/y_{it}/\ln y_{jt}/RTA_{it}/RTA_{ijt}}$	Statistic	*Z*-value	*p*-Value
Gt	−1.155	50.005	1
Ga	2.997	77.040	1
Pa	11.493	101.502	1

Note: In (a) null hypothesis is variable is non-stationary, and in (b) null hypothesis is no cointegration.

Table 5
Gravity regression estimates.

Estimation method	DVLS (1)	DVLS(AR) (2)	PPML (3)	TSLS (4)	FDE (5)
Dependent variable: $\mathbf{lnx_{ijt}}$					
Country specific terms					
Constant	10.49 (1.205)***	12.48 (0.84)***	20.23 (1.135)***	5.87 (0.421)***	0.16 (0.036)***
$\ln y_{jt}$	0.78 (0.046)***	0.69 (0.028)***	0.55 (0.043)***	0.62 (0.012)***	0.39 (0.17)*
$\ln y_{it}$	0.14 (0.038)***	0.07 (0.013)***	0.41 (0.04)***	0.26 (0.009)***	0.07 (0.025)**
Time invariant bilateral terms					
lndist_{ij}	−1.67 (0.092)***	−1.68 (0.05)***	−2.19 (0.1)***	−1.04 (0.053)***	
bord_{ij}	−0.29 (0.160)***	−0.33 (0.143)*	−1.16 (0.189)***	0.44 (0.2)*	
lang_{ij}	0.40 (0.213)	0.43 (0.187)*	0.64 (0.334)	0.54 (0.314)	
col_{ij}	0.48 (0.286)	0.49 (0.212)*	−0.63 (0.252)*	0.63 (0.767)	
lock_{i}	−1.25 (0.446)**	−1.88 (0.347)***	−3.72 (0.371)***	−1.5 (0.108)***	
lock_{ij}	−1.02 (1.874)	−2.24 (0.691)**	−5.24 (0.703)***	−1.55 (0.756)***	
Time variant bilateral terms					
$\ln(1+\mathrm{trf}_{ijt})$	−3.65 (0.518)***	−2.55 (0.163)***	0.44 (2.284)	−3.83 (0.175)***	−1.99 (0.372)***
RTA_{it}	−0.01 (0.046)	−0.02 (0.024)	−1.12 (0.32)***	0.03 (0.03)	−0.04 (0.025)
RTA_{ijt}	0.41 (0.047)***	0.35 (0.026)***	1.64 (0.189)***	0.42 (0.024)***	0.20 (0.027)***
Observations	19,522	19,522	23,273	19,522	18,079
Adj. R-squared	0.82	0.82	0.59	0.64	

Note: Robust standard errors are in parentheses. Significance levels are *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Common border is found in many gravity papers to have positive correlation to trade, but only TSLS column confirms it in the CACs case.

Regarding magnitudes, estimated coefficients across all estimators are similar which enables us to confirm a range of predictions. DVLS and DVLS (AR) coefficients are more similar compared to TSLS or PPML ones, indicating that serial correlation is not a severe issue (as expected for short time-series panel). Controlling for endogeneity changes some coefficients slightly (GDPs, distance, and border), but inclusion of zero trade values produces even more change in coefficients for most variables. This is notable from the number of observations in the DVLS and TSLS cases (19,522) and in the PPML case (23,273). Inclusion of more observations indeed gives more precise estimates, and in fact we

Table 6
Tetrad regression estimates.

Estimation method	DVLS (1)	DVLS(AR) (2)	PPML (3)	TSLS (4)
(a) Dependent variable: $\ln x_{ijt}$				
$\ln y_{jt}$	0.32 (0.013)***	0.67 (0.019)***		0.04 (0.004)***
$\ln y_{it}$	0.23 (0.012)***	0.07 (0.008)***		0.03 (0.002)***
$\ln\tilde{\varphi}_{ijt}$	0.98 (0.002)***			0.95 (0.007)***
(b) Dependent variable: $\ln\tilde{\varphi}_{ijt}$				
$\ln dist_{ij}$	*−1.65 (0.09)***	*−1.66 (0.051)***	*−2.06 (0.104)***	*−0.68 (0.081)***
$bord_{ij}$	*−0.27 (0.161)*	*−0.30 (0.145)**	*−1.13 (0.183)***	*0.8 (0.285)***
$lang_{ij}$	*0.39 (0.213)*	*0.43 (0.19)**	*0.6 (0.33)*	*0.92 (0.372)**
col_{ij}	*0.49 (0.286)*	*0.52 (0.216)**	*0.57 (0.243)**	*0.95 (0.408)**
$llock_i$	*−6.36 (0.322)***	*−6.39 (0.298)***	*−6.88 (0.241)***	*−2.51 (0.145)***
$llock_{ij}$	*−11.27 (0.613)***	*−11.29 (0.592)***	*−11.72 (0.446)***	*−3.49 (0.227)***
$\ln(1+trf_{ijt})$.	*−4.28 (0.532)***	*−2.94 (0.174)***	*−3.32 (2.359)*	*−7.39 (0.215)***
RTA_{it}	*−0.01 (0.048)*	*−0.02 (0.025)*	*−0.95 (0.168)***	*0.14 (0.025)***
RTA_{ijt}	*0.47 (0.05)***	*0.38 (0.027)***	*1.62 (0.149)***	*0.86 (0.026)***
Constant	*8.21 (0.972)***	*8.37 (0.712)***	*13.04 (0.956)***	*−7.01 (0.659)***
Observations	16.426	16.426	19,166	16,426
Adj. *R*-squared	0.82	0.81		0.31

Note: Robust standard errors are in parentheses. Significance levels are *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

observe quite a significant change in coefficient values. Despite the improvements in estimates due to inclusion of zero trades it is hard to rely on PPML as its goodness of fit is only 59% and lower than the other estimators' fit of 81–82%. FDE compared with DVLS provides coefficients almost twice smaller—a regularity, which has been pointed out in Zwinkels and Beugelsdijk (2010).

Based on Eqs. (13) and (14) gravity variables are re-estimated and reported in Table 6. Comparing the country specific coefficients in Table 6 (part a) and Table 5 confirm that importer GDP is more important than the exporter's, however, DVLS (AR) provides more similar values that are in line with GDP coefficients presented in Table 5. In Table 6 (part b) dependent variable is a product of a tetrad which is regressed over gravity trade cost variables. Coefficient signs and magnitudes are quite similar to ones in Table 5 while coefficients for some variables such as landlockedness are significant and quite high, at least for estimates from DVLS, DVLS (AR) and PPML, while TSLS values fall well in line with gravity estimates. Estimated coefficients by both the gravity and tetrad models can be grouped into two categories according to their economic and statistical significance.

4.1.1. Variables which are both statistically and economically significant: Tariffs, distance and landlockedness

A 10% increase in distance leads to a 16–22% decrease in trade. Similar results are obtained by Suvankulov and Guc (2012). Usually gravity studies estimate distance coefficient equal to one but the geographic distance is indeed important factor when we talk about CACs trade. The huge distance of CACs from the major trade centres creates a big obstacle for their goods to be competitive in world markets. The effect is exacerbated further by the fact that CACs are landlocked having no direct access to sea corridors. A 13–35% or 10–51% trade drops when one (exporter or importer) or both traders are landlocked respectively. Except for the PPML results in Table 5, we find that tariffs are statistically and economically significant as an increase in tariff rate by 1% causes about 1.9–3.8% reduction in trade.

4.1.2. Variables which are only statistically (but not economically) significant: RTA membership, GDP levels and common border

To reduce trading costs CACs join RTAs which is beneficial only to those who are in the same RTA. A pair of countries joining a RTA leads to 5–16% trade increase, while if only one country is a RTA member trade drops by 0.6–17%. A 10% increase of exporter's GDP increase trade by 0.6–4.8%, while 10% importer's GDP increase leads to 3.9–7.8% increase in trade meaning that importer's GDP is twice as important in the case of CACs. This finding makes sense when we consider the fact that overland transportation costs in trade with CACs are very high and these are passed to importers (Anderson & Van Wincoop, 2004). In contrast to other gravity studies, a common border negatively affects trade—trade drops by 0.3–1%. This might be explained by the fact that we considering trade of landlocked countries which have to pay extra costs associated with crossing territories of neighbouring (landlocked) countries in order to export or import goods.

4.2. Gravity decomposition results

There are 185 (5 CACs by 37 partners) country pair trade relations decomposed into monadic (country-specific) and dyadic (networking) components. By plotting these over the period 1995–2011, we can observe changes in the trade flows and bilateral relations over time. For simplicity trade and dyads obtained only by DVLS estimator and using France and Germany as reference importer and export respectively are reported. We find that in 17 years of independence each CAC improved its trade with all countries in the pool (37 countries including intra-trade) and country-specific and networking factors increased their influence. The changes vary from country pair to country pair though, but it is still feasible to categorise results into two groups as follows.

4.2.1. Monadic-driven bilateral trade

In this group of country pairs, a gap appears between trade flow and bilateral trade component (dyad) which becomes wider over time. This happens because the slope of growing trade flows is greater than that of the dyadic component. 136 country-pair relationships (or about 75% of all bilateral trade) fall into this category. The example of country-pair trade dominated by monadic factors is shown in Fig. 2 (plot 1).

4.2.2. Dyadic-driven bilateral trade

In this group of country pairs trade is increasing at the same rate as dyadic costs do while monadic component is constant over time. 49 (or about 25%) country-pair relationships fall into this category. The example of dyadic driven country-pair trade is shown in Fig. 2 (plot 2).

The aggregate dyadic and monadic component shares in bilateral trade of each CAC are reported in Table 7 and show remarkable heterogeneity in trade behaviour. Detailed information on all 185 country pairs is reported in Mazhikeyev, Edwards, and Rizov (2014). Comparing our estimates of dyads (networking effects) with results from the alternative method offered in Novy (2013), which assumes trade elasticity equal to 8, produced similar

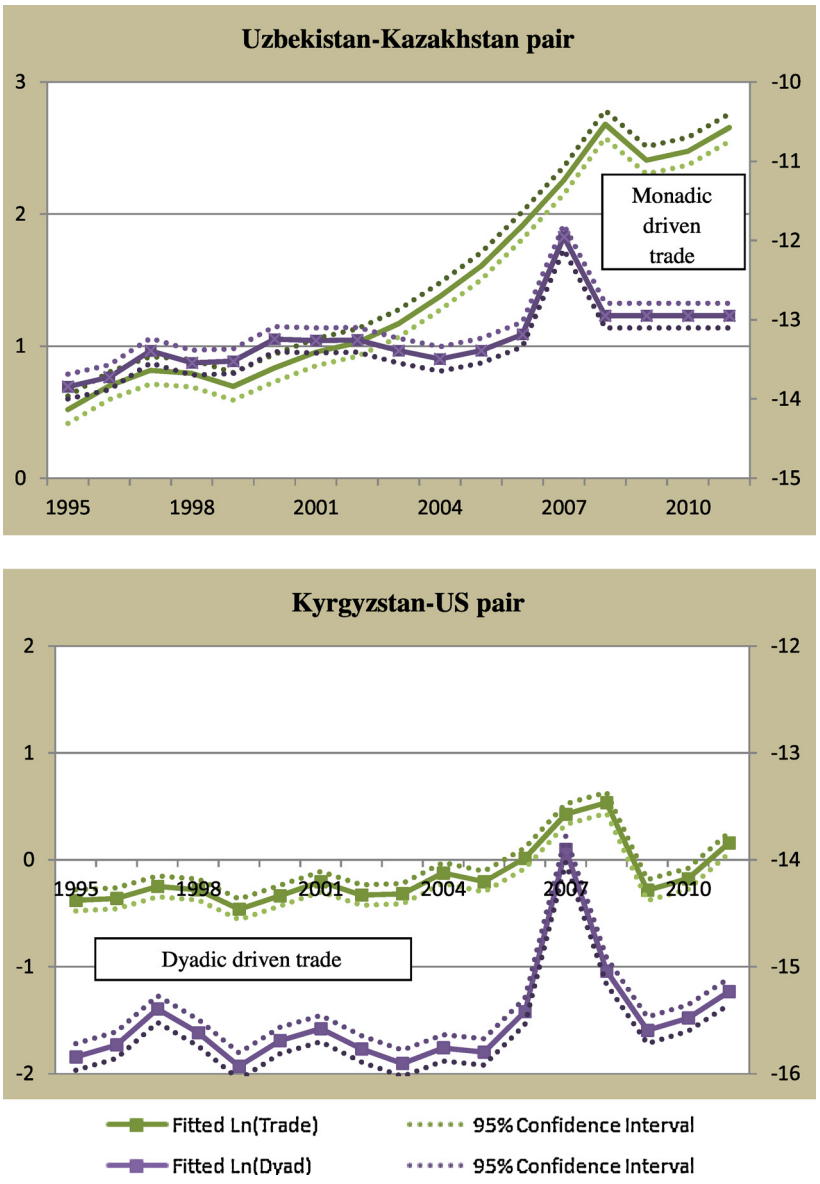


Fig. 2. Illustrative examples of Monadic-driven and Dyadic-driven trade.

Table 7
Summary of dyadic and monadic driven trade.

Country pair trade of	Dyadic driven (%)	Monadic driven (%)
Kazakhstan	58	42
Kyrgyzstan	50	50
Tajikistan	8	92
Turkmenistan	4	96
Uzbekistan	4	96

dynamic changes in dyads and overall trade costs over time. This similarity confirms that tetrading can be successfully employed for decomposition analysis in the case of CACs.

5. Discussion and conclusions

Our study confirms the four hypotheses set out in Section 2. First of all, while all CACs have experienced growing trade since the end of the 1998 Russian crisis, this does not mean that the countries are homogeneous. In fact, while they share aspects of culture, history and landlockedness, the CACs show considerable variety in initial conditions (size, population, resource base, specialisation). Moreover, in terms of transitional reforms, there is a considerable divergence between Kazakhstan and Kyrgyzstan, in the reformist camp, and the other CACs. Reform in terms of trade tends to be strongly correlated with other transitional reforms such as privatisation and enterprise restructuring linking at theoretical level to the liability of localness concept that we tried to utilise in explaining the micro (firm) level drives of trade performance.

Secondly, we note that trade has grown considerably in all countries, reflecting the rise in Russian and regional incomes (following stabilisation and oil/gas price recovery). Oil and gas exporters have particularly benefited. However, the evidence is that the more isolationist states have simply relied on these, possibly fortuitous factors to boost their trade, whereas the more reform-minded states have achieved considerable trade growth through reducing trade costs. Hence, the growth and fluctuations in trade of the "more isolationist" economies Turkmenistan, Tajikistan and Uzbekistan are driven by changes over time in monadic variables (primarily GDP) while trade partnerships of "more open" economies Kazakhstan and Kyrgyzstan are driven

roughly equally by dyadic variables (changes in trade costs) as well as monadic variables.

We re-emphasise that our findings summarised above are subject to some data limitations and caveats associated with the estimation methods used. Next we discuss implications of our results for business strategy and government policy.

5.1. Globalisation vs. regionalisation

In the era of globalisation, countries build more trade connections that raise income and welfare. However, there are also some negative implications: not just in terms of trade diversion where integration is regional, but also in terms of vulnerability to shocks. For example, during the 1998 Russian crisis The Euromoney Risk Ranking for Russia went up from 78 (in December 1997) to 129 (in September 1998). Observing this situation, Fitch IBCA lowered Russian International Credit Rating from B+ to CCC−. As a result, Russian interest rates increased from 3% to 6%. This had a strong impact upon the CACs, both through monadic effects (GDP in a major export market reduced), and through trade costs (since access to finance is important for trade). Kazakhstan, with a common border with Russia, was more exposed than Tajikistan and Kyrgyzstan, and was hit by the crisis harder (Westin, 1999), although even the isolationist CACs were dependent on Russia as the primary export market for their gas, as dictated by pipeline routes. Financial shortages reduced CACs-Russia trade in both directions by 40%. Furthermore, the debt-to-GDP ratio, in early 1999, rose more sharply for small open CACs, Kyrgyzstan (54%) and Tajikistan (90%), and less for large and more diversified Kazakhstan (17%) while for isolationist Turkmenistan (1.7%) and Uzbekistan (−4.4%) the effect was negligible (Pastor & Damjanovic, 2001).

In support of Hypothesis 4 the current fall in the global price of oil, and the effects of Western sanctions on Russia will have heterogeneous effects on these countries. Paradoxically, the countries which have reformed trade more, Kazakhstan and Kyrgyzstan, are more tied in the short-medium term to fluctuations in the Russian economy, and their currencies are already showing evidence of spillover of the current Russian crisis.

5.2. Transport links and RTAs

The CACs' location in the heart of Eurasia is strategically important but imposes a disadvantage in trade. Overland transport costs of goods average $1380/1000 km, almost 10 times higher than by sea ($190/1000 km) raising trade costs by 60% as found by Limao and Venables (2001). According to the Vinokurov, Dzhadraliyev, and Shcherbanin (2009) CACs main trade flows go in three main directions: (i) to Russia and Europe via the Trans-Asian-Railway (Tashkent/Bishkek–Dushanbe–Almaty–Moscow/Kiev) or TRACECA (Bishkek–Tashkent–Almaty–Aktau–Baku–Batumi); (ii) to Iran, Turkey, and Saudi Arabia via the Central-Railway (Almaty/Bishkek–Tashkent–Ashkhabat–Turkmenbashi–Tehran–Istanbul); (iii) to China and Asian-Pacific Region via the East-Trans-Asian-Railway (Tashkent–Bishkek/Dushanbe–Dostyk–Lianyungang). Leamer and Levinsohn (1994) rightly assert that "distance matters and it matters a lot"; since 90% of CACs trade is by rail the assertion is particularly relevant for the CACs case.

Raballand (2003) found that the trade of landlocked Former Soviet Union countries fell by 80% compared to coastal ones during 1995–1999. Landlocked CACs had to negotiate with bordering coastal states, as well as other landlocked states controlling routes (Grigoriou, 2007). For example, Uzbekistan is virtually surrounded by other landlocked countries. Trade barriers imposed by (coastal) Russia to landlocked CACs were very high (Djankov & Freud, 2002). Even though Uzbekistan, Kyrgyzstan and Tajikistan share a border with coastal China, trade is impeded by the Himalaya-Tibet massif, and the only convenient geographic corridor to China is the Djunghar Gate of Kazakhstan. Note that the infrastructure and rail roads to China were built during the Soviet era mostly with strategic considerations (Grigoriou, 2007), and partly reflect poor Soviet-Chinese relations since the late 1950s. Furthermore, Pittman (2013) finds that reforms to the monopolistic freight railways in the Former Soviet Union have slowed to a halt over time, and that even the more reform-minded countries (the Baltics, Russia and Kazakhstan) have not followed the path of Western railway modernisation.

While our study finds RTA membership to be only weakly economically significant, RTAs potentially allow CACs to lessen transport and transit costs as well as to improve regional transport infrastructure and create transport corridors. However, the complexity of regional trade partnerships often creates additional obstacles. Moreover, most of the regional RTAs have had relatively little practical importance (Acharya, Crawford, Maliszewska, & Renard, 2011). The major exception is the Eurasian Custom Union (EACU) which unifies the external tariffs of Kazakhstan, Russia and Belarus. Magilevskii (2012) demonstrates the EACU effect by pointing out that the trade turnover between Kazakhstan and Russia increased by 28% between 2010 and 2011, while for the same period growth rate of trade between the Customs Union of Belarus, Kazakhstan and the Russian Federation and the other CACs is 19%. Kyrgyzstan is likely to join the EACU next year and Tajikistan is currently negotiating its membership. However, Kassenova (2012) reports that despite the EACU formation, Kazakhstan still faces high Russian NTBs. Furthermore, there are serious questions outstanding, especially for those CACs reluctant to reform, like Turkmenistan and Uzbekistan, who are not showing any sign of interest in the EACU.

5.3. Other important factors of trade

Other factors of importance are the conditions of access and use of CACs' transport infrastructure (Grigoriou, 2007), CACs access to sea ports (Kulipanova, 2012), transit systems in the region (Raballand, 2003). Trade barriers, indeed, are reaching beyond the transport and border costs, and as mentioned in Anderson and Van Wincoop (2004) also include policy costs (tariff and non-tariff like quotas), cost of information and currency exchange, finance, distribution costs and trade costs associated with unobservable barriers linked to cultural and historic ties. Indeed, trade costs as estimated in our gravity formulation will include any costs of business regulation and corruption. Evans (1999) suggest that political systems, differences in education, production, market and industrial structure should be considered as primary factors of trade. Dow and Karunaratna (2006) examine 37 different studies to identify main 'psychic' distance factors. They find that culture, language, education level, religion, time zone, industrial development, and political systems are most common factors used in trade studies. Of these factors, the latter two are likely to be most relevant for the CACs. Inherited from Soviet days the main industries and infrastructure in CACs are quite outdated, but the energy rich CACs (Kazakhstan, Uzbekistan and Turkmenistan) using oil and gas revenues have been able to modernise their industries, while Tajikistan and Kyrgyzstan developed their agrarian sectors. Regarding the political system, the IMF (2012) finds that relatively liberal (more accurately less authoritarian) political systems (like in Kyrgyzstan, compared to Turkmenistan and Uzbekistan) are linked to less restrictive trade regimes.

To conclude: we find a relationship between being an open/isolationist country and having dyadic/monadic driven trade with other countries. Open CACs' (Kazakhstan and Kyrgyzstan) trade performance is mostly explained by time varying bilateral factors

while the trade performance of isolationist CACs (Tajikistan, Turkmenistan and Uzbekistan) is affected mostly by country-specific properties. The IB literature on liability of localness versus foreignness has particular relevance to CACs, because of their past Soviet ties. Under the Soviet system, trade and other economic reforms which would place local enterprises at a liability, were avoided. The price was greatly reduced incentive to innovate or to develop products saleable on world markets. Our hypotheses and gravity evidence show that those CACs which are now reforming are achieving an increasing ability to export to markets more widely than simply the former Soviet countries, even though Russia remains the primary trade partner in many cases. A possible implication is that, at least in industries where Russian businesses themselves have reformed, the process of integration into an Eurasian bloc may not necessarily be damaging to export performance with the rest of the world. However, some countries may fear loss of sovereignty (Dragneva & Wolczuk, 2013) or look for alternative alliances to the East or the South. Clearly, the ongoing CACs integration processes and their international business implications present an interesting case for future research.

Appendix. Main Central Asia RTAs (in chronological order)

- 1991—Central Asian Commonwealth (CAC) with five members (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) was established; the organisation merged with the EurAsEC in 2006.
- 1994—Commonwealth of Independent States Free Trade Agreement (CISFTA) was created covering all the CIS countries, although by 2009, only eight of its members (Kazakhstan, Russia, Belarus, Kyrgyzstan, Tajikistan, Armenia, Moldova, and Ukraine) remained, with the other CIS countries (Azerbaijan, Uzbekistan and Turkmenistan) becoming observers.
- 1996—Eurasian Economic Community (EurAsEC) was established by Kazakhstan, Russia and Belarus. In 2001, these three countries as well as Kyrgyzstan and Tajikistan signed a treaty to organise a common system of water and energy use. Uzbekistan withdrew from the organisation.
- 1996—Shanghai Cooperation Organization (SCO) was formed among China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and further in 2001 Uzbekistan joined the group as well.
- 1998—Ukraine and Kyrgyzstan joined the WTO (as did Russia in 2012).
- 2010—Eurasian Customs Union (EACU) was established between Kazakhstan, Russia and Belarus, which is intended to be the first step towards forming "Common Economic Space", a common supranational system of trade and tariffs connecting all CIS countries.

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