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ORIGINAL PAPER

Balance-of-payments-constrained growth model: an application to the Kazakhstan's economy

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Abstract
In this paper we analyze whether the long-term economic growth of Kazakhstan is subject to macroeconomic constraints. The balance-of-payments-constrained growth (BPCG) models predict that a country's growth rate can be approximated through the ratio of growth rates of exports to the income elasticity of demand for imports. We apply the BPCG model to Kazakhstan's quarterly data—a typical emerging economy with a low trade to GDP ratio. To estimate the trade parameters we use Johansen's cointegration technique. Vector error correction model is employed to analyze the short-run adjustments of income elasticities. The results demonstrate that the average growth rate estimated by the BPCG hypothesis projects around 2% long-run economic growth for Kazakhstan and current economic growth is aggregate demand constrained.

Keywords Balance of payments · Income elasticity · Kazakhstan

JEL Classification O47 · F32 · F43

1 Introduction

The balance-of-payments-constrained growth model by Thirlwall (1979), originally was developed as an instrument to study the constraint imposed by the need to generate foreign exchange for developing countries, provides an explanation of demand-side structural economic barriers that can limit economic growth. There is now a growing literature that provides support and extends both theoretical and empirical

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propositions that aggregate demand plays a key role in determining growth in the long run. According to this framework, Setterfield (2003) outlines that the accumulation and allocation of productive capacity in terms of capital and labor is determined by demand, which ultimately sets the limit to economic growth to which potential output (supply) can adapt.

According to the hypothesis of "balance-of-payments constrained (BPCG) growth", given that relative prices are stable in the long run (real exchange rates are constant or have minor variations) and trade must be balanced, there is a very robust approximation between the growth rate of output and the ratio of the income elasticity of demand for a country's exports to the income elasticity of the country's imports times the rate of world income growth. This outcome later became known as Thirlwall's Law. The ratio determines the balance-of-payments-constrained growth rate based on the assumptions that balance of payments equilibrium on current account is preserved and the real terms of trade remain unchanged. Thirlwall and Hussain (1982) summarize that the actual experience of advanced economies proves the validity of original Thirlwall's Law. As a consequence, differences in growth performances between countries are linked to the relative strength of their balance of payments position.

Thus, in the long run, when the actual growth is faster than the BPCG growth rate, it leads to a significant worsening of the current-account balance, which puts additional pressure on the exchange rate and the financial system. Practical evidence demonstrate that flexible exchange rate effectively facilitate short-run adjustments, whereas in the long-run, the adjustment process occurs through slower growth to rebalance the current account. As a result, the long-term constraint, derived from the BPCG growth rate is not influenced by the price elasticities. The primary factors are income elasticities for country's exports and imports, which reflect the country's competitiveness of a country's goods relative to alternatives on the world market. Therefore, it is largely real income (and employment) that adjusts to preserve the balance of payments equilibrium.

The estimates on different income elasticities of demand for imports and exports essentially demonstrate the non-price features of goods, and thus, the structure of production of the economy (Thirlwall, 1997). Consequently, different sectoral income elasticities form different sectoral demand growth, which are reflected in the structure of production and the changes in the rate of growth of countries. In our paper Kazakhstan serves as an example of a commodity exporting (primarily oil extraction), small open economy, which cannot absorb foreign exchange rapidly and efficiently.

The growth rate of Kazakhstan since its independence in 1991 has demonstrated a very dynamic rise and today is among the world's upper middle income group of countries by World Bank classification. At the same time, the structure of the economy has concentrated on heavy exploitation of natural resources, primarily of oil reserves, and thus, lacks an adequate level of sector-wise development of manufacturing and other value-creating industries. This paper aims to study the macroeconomic performance of Kazakhstan since 2005Q1 till 2019Q2 and explains the path of its growth rate using the Thirlwall's balance-of-payments-constrained growth model.

After the collapse of the Soviet Union in 1991, Kazakhstan's economy experienced all the difficulties of transition from state planned organization into a capitalistic one. Hyperinflation of the early years, overall disintegration of trade and production links within the post-Soviet countries, and the recent Asian and Russian economic crises in the 90s have led to a sort of "lost decade" phenomenon. It is with the start of 2000s and emerging super cycle of commodities, has paved the path for a rapid economic recovery and growth. Thus, we investigate the period of the last 18 years of robust economic development, during which we can observe a certain composition of sectoral structure of the economy. In this paper, we embark to study whether the Kazakhstan's growth rate is balance-of-payments constrained?

We use quarterly data of main macroeconomic variables of Kazakhstan, obtained from the Committee of Statistics of Kazakhstan. Following the theoretical predictions and after studying the time-series characteristics of export and import functions, our investigation specifically focuses on two parts: one analyzing the "weak" form of the BPCG hypothesis and the other studying its "strong" form. We use Johansen's cointegration technique and establish a stable long-run relationship between Kazakhstan's real imports, real GDP, and real effective exchange rate. Then, the cointegrating vector was embedded in a Vector Error Correction Model (VECM) to analyze the short-run adjustments of income elasticities.

The rest of the paper is structured as follows. Section 2 presents a broad overview of both theoretical and practical studies testing and extending the Thirlwall's Law. Section 3 introduces the balance-of-payments-constrained growth model. In Sect. 4 we present the empirical investigation of Kazakhstan's growth rate based on our model. Section 5 presents our findings and the final section concludes.

2 Literature review

In his seminal work, Thirlwall (1979) exploited earlier findings or large inter-country variation in income elasticities to explain long-run growth rate differences between countries. Therefore, the author states that the dominant constraint on demand is the external constraint. If a growing country runs into balance-of-payments problems before it reaches its short-run capacity, then domestic demand must be reduced. As a result, resources remain underutilized. Technological progress is curtailed, and the country's competitiveness suffers, deteriorating its balance-of-payments position (Razmi, 2005).

By contrast, if a country is able to increase demand without running balance-of-payments deficits, the pressure originating from demand may raise the capacity growth rate through investment, technological progress, and increased factor supply. Thus, as Thirlwall (1979, p.49) concludes: "while a country cannot grow faster than its balance of payments equilibrium growth rate for very long, unless it can finance an ever-growing deficit, there is little stopping a country growing slower and accumulating large surpluses."

Thirlwall finally obtained the balance-of-payments-constrained growth rate, which is a dynamic version of the static Harrod trade multiplier. Thirlwall and Hussain (1982) extended the model to analyze the working mechanism of developing

countries that run current account deficits for prolonged periods. As a result, the growth of capital flows dynamics appears as an additional constraint on the long-term growth in their model. However, McCombie and Roberts (2002) show that taking into account a reasonable assumption regarding the sustainability of net foreign capital inflows as a ratio of national income, the presence of capital flows would not contribute to the loosening of the balance-of-payments constraint. It does not necessarily imply that a sharp increase in capital inflows may facilitate the growth rate higher than the BPCG rate in the short-run.

The hypothesis that the growth is limited by the balance-of-payments constraint is especially plausible for developing countries due to their inability to borrow in their own domestic currency (Razmi, 2015). This specification of emerging economies was well recognized and investigated, but the constraint itself need not come from world demand at given relative prices. For instance, the traditional structuralist approach rationalized the case, where growth in the Global South is constrained by capital, then Southern terms of trade may adjust to satisfy the constraint. On the other hand, investment in the tradable sector at given world prices and aggregate demand might generate the exports required to finance increased imports and output. One of the main consequences, however, is that domestic growth is a positive function of global growth.

An extensive number of work has been conducted to test for Thirlwall's law in both country-and region-specific studies. For instance, a single-country case study investigation include Atesoglu (1997), Hieke (1997), Leon-Ledesma (1999), Moreno-Brid (1999), Razmi (2005) and Jeon (2009). At the same time, country group studies were carried out by Thirlwall and Hussain (1982), Christopoulos and Tsionas (2003), Alonso and Garcimartín (1998), Ansari et al. (2000), Bairam (1997), Bértola et al. (2002), Perraton (2010) and Bagnai (2010). In general, most of the studies have results that support the validity of the law. McCombie (1997) summarizes the conclusions from earlier empirical studies, and Thirlwall (2012) provides a comprehensive survey on how well the BOPC growth model fits the experience of many countries.

The experience of the Asian newly industrialized economies (NIEs) shows that they have not experienced particularly high productivity growth, while growth mainly was generated by high rates of factor accumulation (Young, 1995). The reliance on import of capital goods in NIEs, allows rationalizing the Thirlwall's hypothesis as growth being dependent on import capacity, especially in emerging markets. In addition, the imports of capital goods are central to developing countries' growth, with limited possibilities for substituting domestic production for imports of capital goods (Marquez, 1985). Thus, incorporating imports into aggregate production function models of growth demonstrates that external demand may essentially constrain the economic growth (Ziesemer, 1995).

In addition, the price and income elasticities of exports and imports are considered to depend on the country's pattern of specialization. In this approach, aggregate income elasticities are the weighted averages of the income elasticities of exports and imports from each sector, where the weights are the sectors' shares in exports and imports, respectively. Araujo and Lima (2007) identified this approach as Multi-Sectoral Thirlwall's Law, and emphasized the fact that even at the presence

of constant world income elasticities and growth rates, a country can still raise its long-term growth rate by favorably changing the sectoral composition of its external trade. For instance, Gouvêa and Lima (2010) show empirical evidence of how elasticities vary as a result of changes in export patterns.

The contribution of this paper to the existing literature is threefold. First, in this paper we aim to enlarge the empirical testing of Thirlwall's Law using Kazakhstan's quarterly data - a typical emerging economy. Thus, we estimate country's exports and imports demand functions for Kazakhstan and report the figures on income elasticity for exports and imports, which have not been investigated in the recent studies. Second, we test both the "strong" and "weak" form of the hypothesis. The weak form treats exports as deterministic, non-stochastic variable, whereas the strong form treats exports as a stochastic variable determined by the relative prices and expenditures. Lastly, we employ the Johansen cointegration procedure, which allows us to evaluate a multivariate system of equations using variables that are assumed to be jointly endogenous, thus minimizing possible simultaneity problems.

3 Kazakhstan's economy and the balance of payments

Following the break up of the Soviet Union, Kazakhstan has experienced a significant shrinkage in overall economic activity during the first few years after gaining its independence in 1991. The real GDP per capita around the early 1990s was about 4000 US dollars. At the same time, it was endowed with one of the largest natural resource bases in the region, and by the end of that decade started to heavily exploit them, mainly of crude oil and natural gas, non-ferrous metals and grain. This period also coincided with commodities super-cycle (Fig. 1), which skyrocketed the national income of Kazakhstan from the beginning of 2000s. However,

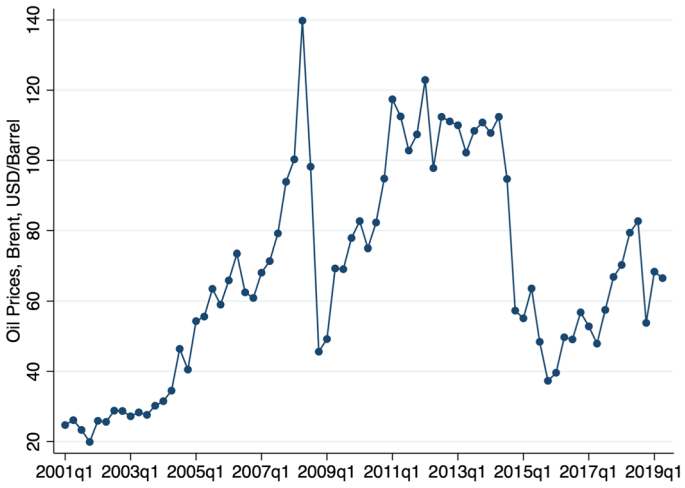

Fig. 1 Oil prices, Brent: 2001Q1–2019Q1. Source: Committee of Statistics of Kazakhstan

borrowing from the literature featuring the "Dutch disease" externality of excessive capital flows, the growth in this period cannot be explained by consistent increases in aggregate demand.

The growth rate of GDP has been consistently around 10% a year during the first half of 2000s, and the GDP per capita doubled reaching about 8000 US dollars in real terms around 2007. Then, Kazakhstan as a part of global economy, has been severely affected by the Great Financial Crisis of 2008–2009, its growth has been interrupted and the economic development pace began to slow down. After a rapid decline in economic activity, the country has entered a phase of moderate-to-high economic growth with average GDP being around 5% and steadily declining. However, the positive trend allowed the country to continue increasing its national income and today, the GDP per capita in Kazakhstan is around 11,000 US dollars.

The most recent macroeconomic developments in Kazakhstan has shown the increased fragility of the economy to arising balance of payments difficulties. After the dramatic fall of oil prices in 2015–2016 (Fig. 1), and a subsequent shrinkage in export revenues (see Fig. 2), being unable to defend a fixed parity because of external constraints, the National Bank of Kazakhstan has effectively switched from the fixed exchange rate regime to the floating exchange rate regime of its national currency in August of 2015. Interestingly, Razmi (2005) notes that in the short-run, income variable was not found to adjust significantly to disequilibria. To the extent that the income is prone to greater inertia, real imports were to adjust rather rapidly. The pattern of adjustment of import prices and volumes may indicate policies collectively described as "import compression". Another possible evidence of this pattern is a large proportion of intermediate and capital goods in the composition of total imports in a developing country.

In line with the IMF (2022) definition, current account (*CA*) shows flows of goods, services, primary income, and secondary income between resident and

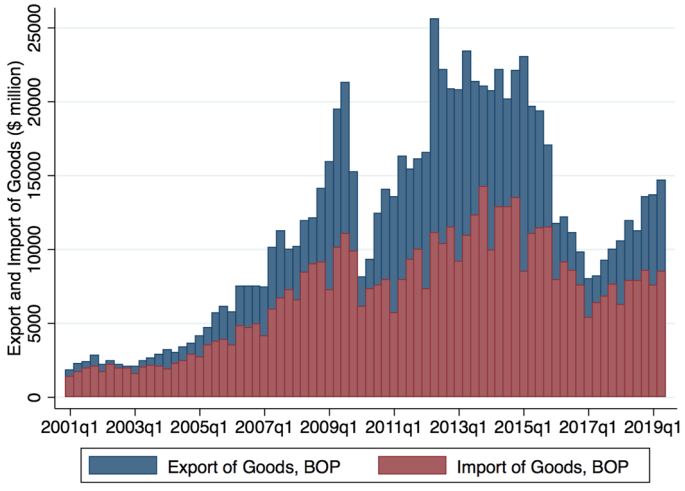

Fig. 2 Export and import of goods, BOP: 2001Q1–2019Q2. Source: National Bank of Kazakhstan

nonresidents (Fig. 3). The CA balance shows the difference between the sum of exports and income receivable and the sum of imports and income payable (exports and imports refer to both goods and services, while income refers to both primary and secondary income). At the same time, the capital account (*KA*) shows credit and debit entries for non-produced non-financial assets and capital transfers between residents and nonresidents. It records acquisitions and disposals of non-produced non-financial assets as well as capital transfers, that is, the provision of resources for capital purposes by one party without anything of economic value being supplied as a direct return to that party.

According to the NBK (2020) report on the Balance of Payments, an improvement in the BOP originates mainly from a reduction in primary incomes deficit and an increase in trade balance. The balance of payments statistics for the year 2020 has recorded a deficit of 6.3 billion US dollars. This compares to a current account deficit of about 7.3 billion US dollars in 2019. The official export of goods and services in the balance-of-payments accounted for 46.7 billion US dollars, which is a 19.7% decrease compared to 2019 (Fig. 2). The oil and gas value in the total official export of goods amounts to 50.5% of total official exports, which is a 29.4% decrease compared to 2019. The decline primarily reflects a fall in contract prices as well as a cut in physical volumes of oil and gas in that period. Exports of non-ferrous metals increased by 0.8% due to larger physical amounts exported. At the same time, the export value of ferrous metals has shown a decline of 8.9%, mainly due to a decline in both of prices and quantities of goods sent abroad. Exports of grain gained 1.1.% in value over the last year.

Official imports of goods and services decreased by 9.6%, compared to 2019, and accounted for about 36.2 billion US dollars (Fig. 2). Imports of consumer goods is the only category, which did not experience a decline among all the other import categories. Particularly, the investment goods category fell by 10.1%, while

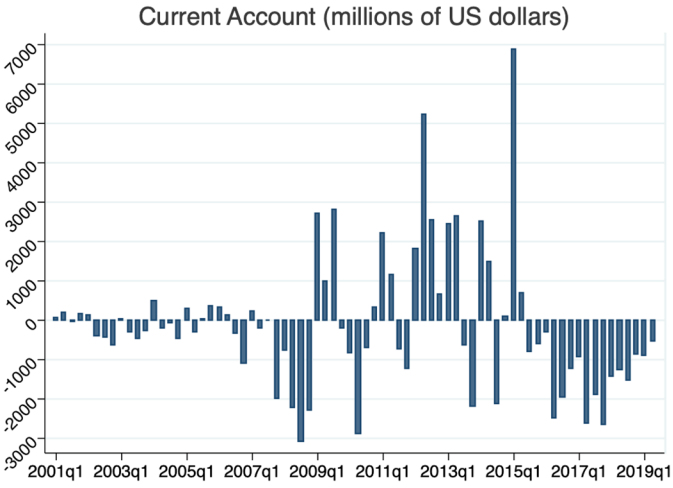

Fig. 3 Current account, BOP: 2001Q1–2019Q2. Source: National Bank of Kazakhstan

intermediate goods consumption decreased by 13.1 percent. Imports of consumption goods increased by 18.2%, with food-related imports increased by 2.9% and non-food related items increasing by 27.1% in annual terms.

The deficit in the balance of primary incomes in 2020 accounted for 14.9 billion US dollars, which is a 34.4% decrease compared to the same period last year. Mainly the loss accrues from the decline in dividends of foreign direct investors. Payments of investment income to non-residents declined by about 11.6% and measure up to 5.7 billion US dollars. The earning of non-residents from direct investments decreased to 1.9 billion US dollars in 2020. The balance of secondary incomes shows a surplus of 1.2 billion US dollars.

Next, according to IMF (2022) definition, the Financial Account (*FA*) account records transactions that involve financial assets and liabilities and that take place between residents and nonresidents. The FA indicates the functional categories, sectors, instruments, and maturities used for net international financing transactions. The overall balance on the FA is called net lending/net borrowing. Net lending means that, in net terms, the economy supplies funds to the rest of the world, taking into account acquisition and disposal of financial assets and incurrence and repayment of liabilities.

The net inflow in the financial account (the difference between net changes in external assets and net change in external liabilities) was equal to 15.3 billion US dollars in 2020, whereas it was 1.6 billion US dollars net outflow in 2019 (Fig. 4). A significant increase in external assets has resulted in a considerable net capital inflow.

The net capital inflow of foreign direct investment has amounted to 5.9 billion US dollars in 2020 and was mainly due to a decrease in assets and an increase in liabilities of residents. At the same time, gross inflow of foreign direct investment to Kazakhstan fell by 29.8% in 2020 relative to the 2019 and was equal to 17.1 billion

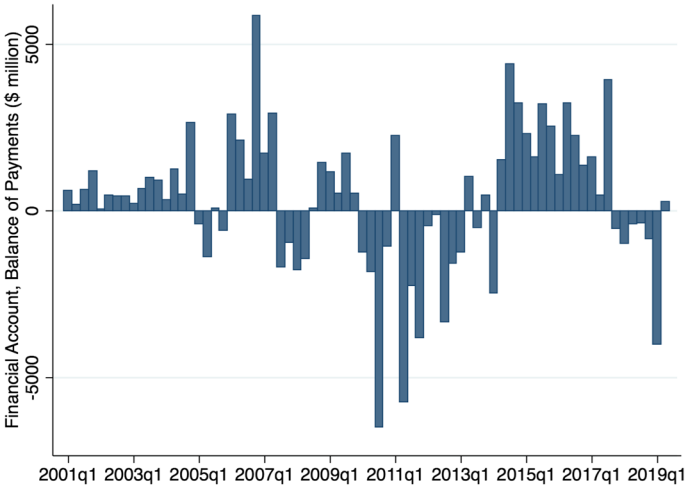

Fig. 4 Financial account, balance of payments: 2001Q1–2019Q2. Source: National Bank of Kazakhstan

US dollars. More than half of the gross FDI inflow of funds (37.8%) went into extraction of crude oil and natural gas industry. Comparatively, metallurgy industry received about 2.5 billion US dollars (14.7% decrease), and the wholesale, retail and vehicles repair industries in total obtained about 2.5 billion dollars (14.9%).

Sectoral analysis by the type of residency shows that the largest net capital outflows were recorded in the "General government provision" section (8202 million US dollars), banking sector (2113 million US dollars), and other sectors (4587 million US dollars). By the types of investment, foreign direct investment and medium- to long-term portfolio investment are the largest contributors to net capital inflows, whereas short-term portfolio investments accounted for net outflow of funds from Kazakhstan.

The net inflow in portfolio investment was equal to 7.7 billion US dollars in 2020 (5.1 billion US dollars), mainly due to an increase in external assets by residents. Financial assets in portfolio investment have decreased by 6.7 billion US dollars, and principally consist from foreign securities in the portfolio of the National Fund, banking and other sectors.

Net capital inflow/outflow by the private sector includes all transactions by the private sector registered in financial account as well as transaction that have not been classified in the balance of payments (errors and omissions part). The net capital inflow by the private sector in 2020 was about 3.17 billion US dollars. As of January 1, 2021 (Fig. 5), international reserves of the National Bank amounted to 35.6 billion US dollars, which covers about 9.7 months' worth of Kazakhstan's imports of goods and services.

Described patterns of the balance of payments configuration are useful to study the natural resource-economic growth nexus within transition economies in general due to their similar structure, and is applicable to the experiences of the CIS countries in particular. Especially, taking into account that post-Soviet countries share

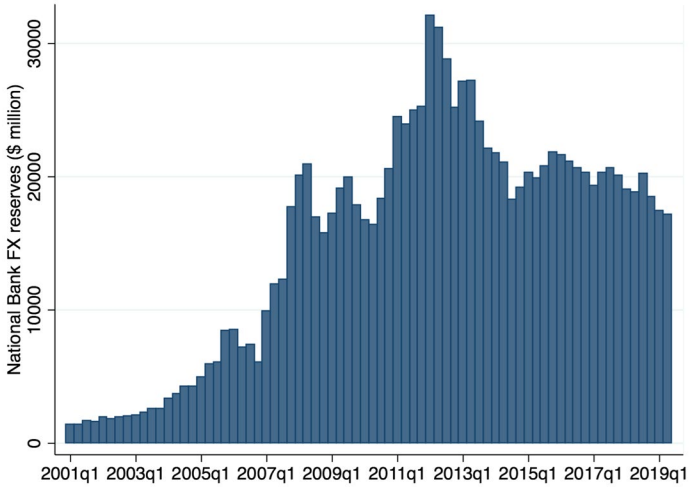

Fig. 5 National Bank Reserves: 2001Q1–2019Q2. Source: National Bank of Kazakhstan

common economic, social and institutional backgrounds with sufficiently industrialized bases, that likely to shape development paths of the regions' resource-rich countries in some comparable ways (Horvath & Zeynalov, 2016). Thus, for instance, Kronenberg (2004) documents that natural resources are negatively related to economic growth and argues that corruption is an obstacle to transforming natural resource endowments into higher economic growth. Esanov et al. (2001) demonstrate that having generated income from natural resources sector reduced the incentive to reform in transition countries during the 1990s. Pomfret (2012) offers an extensive discussion of natural resource management in Central Asian countries and Azerbaijan and find that natural resource management is far from optimal and that the interactions among natural resources, ownership and institutional quality are complex.

Brunnschweiler (2009) tested the impact of oil reserves on economic growth in transition countries (including former Soviet countries and countries from Central and Eastern Europe) and found that oil reserves had a positive effect on economic growth over the 1996–2006 period. At the same time, however, the study reports that oil reserves have a positive relationship with low democracy index scores, high levels of corruption and low human capital formation. In addition, Alexeev and Conrad (2011) discuss the relationship between point-source natural resources and economic growth in transition countries and conclude that natural resources do not represent an obstacle to economic growth in transition economies. Oskenbayev et al. (2013) provide case study for Kazakhstan and document natural resource curse only for point-source resources when institutional quality is low. In a larger study of former Soviet Union states, Anceschi (2011) highlights the point that whether countries experience the natural resources curse is highly dependent on the ownership structures and the prevailing fiscal regimes.

4 Model

The starting point in our study is balance-of-payments accounting identity:

$$Pd_tX_t + F_t = Pf_tE_tM_t, \tag{1}$$

where X is the quantity of exports; M is the quantity of imports; F is the value of net capital receipts in domestic currency, with $F > 0$ ($F < 0$) measuring net capital inflows (outflows); Pd is the domestic price level; Pf is the foreign price level; E is the nominal exchange rate; and t is a time index. By taking natural logarithms and differentiating with respect to time, we obtain a dynamic version of (1):

$$\theta(p_{dt} + x_t) + (1 - \theta)f_t = p_{ft} + e_t + m_t, \tag{2}$$

where the lowercase letters denote the rates of growth of the variables, and θ and $(1 - \theta)$ indicate the shares of exports and capital flows in total foreign currency receipts.

The export and import demand functions are assumed to be multiplicative with constant elasticities:

$$M_t = A\left(\frac{Pf_t E_t}{P_{dt}}\right)^{\Psi} Y_t^{\pi} \tag{3}$$

$$X_t = B\left(\frac{P_{dt}}{Pf_t E_t}\right)^{\eta} Z_t^{\varepsilon}, \tag{4}$$

where Y is the real output of the country; Z is the world real income; π and ε are, respectively, the income elasticities of imports and exports; Ψ is the price elasticity of imports ($\Psi < 0$); and η is the price elasticity of exports ($\eta < 0$). Meanwhile, A and B are constants capturing other effects. Taking growth rates of the variables in Eqs. (3) and (4), we obtain:

$$m_t = \Psi(p_{ft} + e_t - p_d t) + \pi y_t \tag{5}$$

$$x_t = \eta(p_{dt} - p_f t - e_t) + \varepsilon z_t \tag{6}$$

Then, we substitute (5) and (6) into (2) and solving for the BOPC growth rate, y_{bp}^*, we arrive at:

$$y_{bp}^* = \frac{(\theta\eta + \Psi + 1)(p_d t - p_f t - e_t) + \theta\varepsilon z_t + (1-\theta)(f_t - pd_t)}{\pi}. \tag{7}$$

If we assume that the real exchange rate is stable in the long-run, so relative prices in a common currency remain unchanged, this implies that $(p_{dt} - p_{ft} - e_t) = 0$, and that there is no net debt in the long run ($\theta = 1$), Eq. (7) can be simplified to the level of the original Thirlwall's Law:

$$y_{bp}^* = \left(\frac{\varepsilon z_t}{\pi}\right) \tag{8}$$

or

$$y_{bp}^* = \left(\frac{x_t}{\pi}\right). \tag{9}$$

Therefore, we can otherwise restate the Thirlwall's model the following way: The long-run BPCG rate equals the rate of growth of exports divided by the income elasticity for imports.

There are "weak" and "strong" forms of the BPCG hypothesis. The "weak" corresponds to Eq. (9), whereas the latter corresponds to Eq. (8), depending on whether the price effects are included or not. The weak form treats exports as a deterministic, non-stochastic variable. Whereas the strong form estimates the export equation separately, treating exports as a stochastic variable determined by relative prices and a scale variable.

Traditionally, studies of the BPCG model have tested one of the last two equations. This assumes that variations in the terms of trade are either insignificant or that elasticity pessimism holds.

5 Empirical analysis

Balance-of-payments-constrained growth rate is a concept of the long-run nature, and empirical investigations consistently consider it to be constant over time. However, the Eqs. (8) and (9) suggest that even short-run fluctuations of parameters can lead the value of y_{bopc} to change over time. Furthermore, the long-run value of y_{bopc} will also be time-varying if the income elasticities of demand for exports and imports are subject to periodically change. Sectoral composition of production and resource endowment of the economy shape non-price competitive characteristics of the parameters: the income elasticity of demand for exports and imports. This proposition is relevant for developing economies, and for Kazakhstan in particular, if the economy has experienced deep structural changes towards diversified manufacturing of higher value added industries. For the purpose of initial establishing of the BPCG growth rate and taking into account that the primary product production accounts for about 70% of all exports, this paper assumes a relatively stable income elasticity of demand for imports.

5.1 Data

We use quarterly data on Kazakhstan's main macroeconomic variables from the Committee of Statistics of Kazakhstan, IMF Financial Statistics, and the National Bank of Kazakhstan. We exploit the statistics on real GDP of both Kazakhstan and Russia (GDP_t) and ($GDPRU_t$) respectively, real value of exports (EX_t), real value of imports (IM_t), real effective exchange rate ($REER$), and their annual growth rates. The time period investigated in our study is from 2005Q1 to 2019Q2. The prefix LN before any of these variable names denotes the log value of that variable, whereas the prefix D denotes the first-differenced value of that variable.

A country's REER is to reflect not only its price competitiveness vis-a-vis the importing country but also its price competitiveness versus other competing developing countries-exports to the same receiving country. Thus, the current REER measure includes thirty eight countries basket with the weights based on the proportion of Kazakhstan's exports with all the present trade partners (Figs. 6, 7, 8, 9).

Following Razmi (2005), in the first step we establish the order of integration of each variable. In the second step, the presence of one or more stationary linear combinations or cointegrating vectors among the variables is explored. Thus, Augmented Dickey-Fuller (ADF) tests found that all series have a unit root in levels. Furthermore, the tests show that the first difference in logs of our main macroeconomic series are stationary. They also identified a possible deterministic trend for all the series in the model.

5.2 Test of the "weak" form

We use the cointegration test developed by Johansen (1988). Johansen's procedure is vector aggressive (VAR)-based, consists of a maximum likelihood ratio test, and has

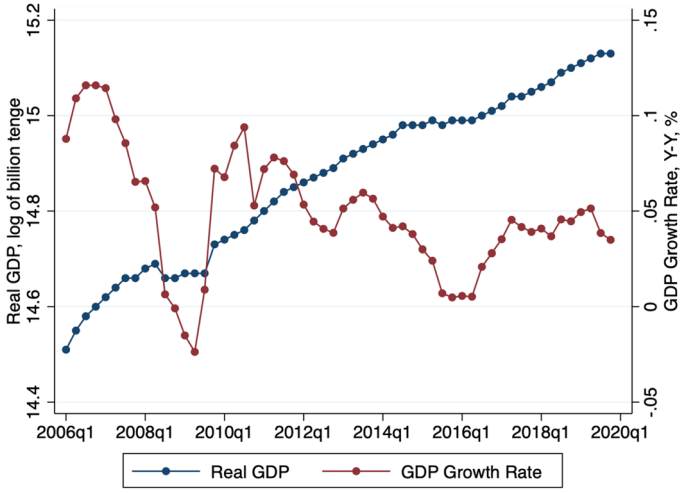

Fig. 6 Real GDP, 2005Q1–2019Q4. The blue lines represents the path of the key variables in "log-levels" on the left scale. The red lines show the "growth rates" of the corresponding data series on the right scale (colour figure online)

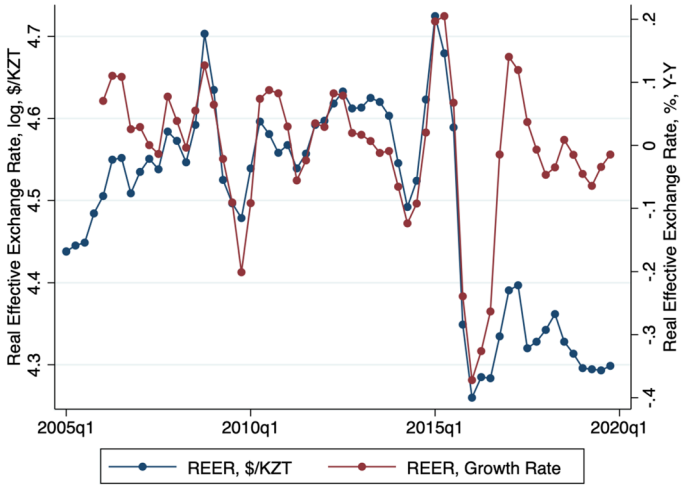

Fig. 7 REER, 2005Q1–2019Q4. The blue lines represent the path of the key variables in "log-levels" on the left scale. The red lines show the "growth rates" of the corresponding data series on the right scale (colour figure online)

the advantage that it jointly models several endogenous variables in a VAR framework. At the same time, it provides a reparametrization that is flexible to allow for asymmetric short-run reactions to fluctuations in domestic and foreign price variables while simultaneously imposing long-run homogeneity. As you can see from the Table 1, you see that the maximum rank is one, which means that we reject null

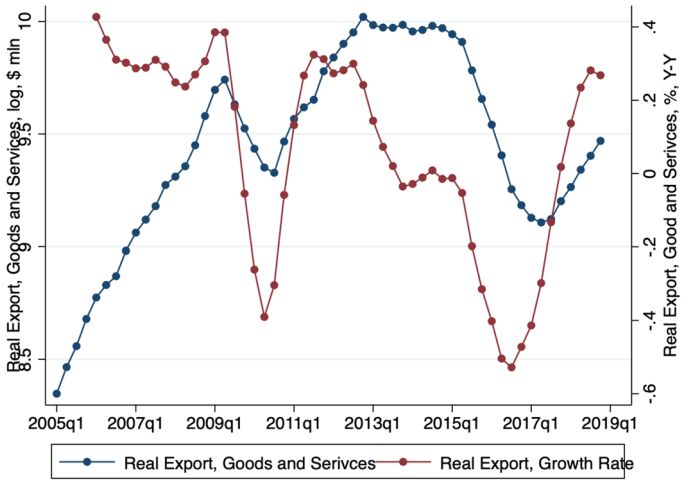

Fig. 8 Real exports, 2005Q1-2019Q1. The blue lines represent the path of the key variables in "log-levels" on the left scale. The red lines show the "growth rates" of the corresponding data series on the right scale (colour figure online)

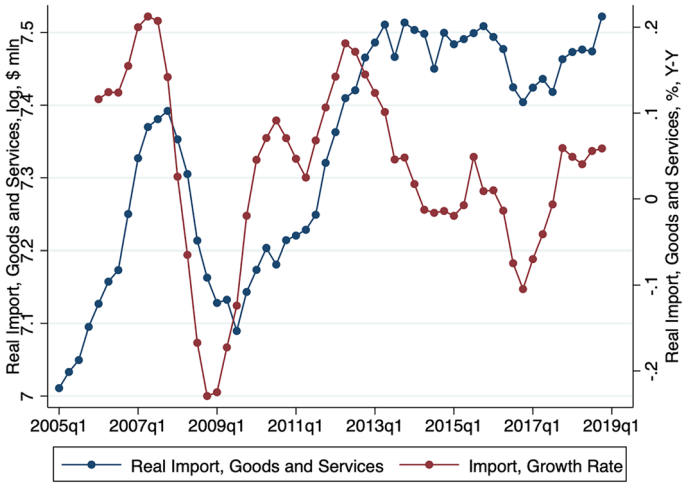

Fig. 9 Real imports, 2005Q1-2019Q1. The blue lines represent the path of the key variables in "log-levels" on the left scale. The red lines show the "growth rates" of the corresponding data series on the right scale (colour figure online)

hypothesis and establish that there is at least one cointegration between the variables of interest. Based on Akaike information criterion (AIC), Schwartz and Hannan–Quinn information criterion (HQIC), we have selected a lag length of 5 for each of the variable of interest in levels.

The results of the restricted/parsimonious Johansen cointegration test normalized on the real import term are presented in Table 2. The coefficients of all variables are

Table 1 Johansen tests for cointegration

Trend: constant			Number of obs = 58		
Sample: 2005Q1-2019Q2			Lags=5		
Maximum rank	Parms	LL	Eigenvalue	Max statistics	5% critical value
0	48	512.78886		41.8115	29.68
1	53	520.83385	0.21635	14.9193*	15.41
2	56	524.22246	0.09759	2.8386	3.76
3	57	524.34909	0.00383		

* denotes rejection of the hypothesis at the 0.05 level

Table 2 VECM estimation of import equation

Cointegrating equation	CointEq1		
$LNIM_{t-1}$	1.000		
LNY_{t-1}	− 1.638 [0.25]		
$LNREER_{t-1}$	− 0.674 [0.48]		
C	10.243		
Error Correction	$D(LNIM_{t-1})$	$D(LNY_{t-1})$	$D(REER_{t-1})$
CointEq1	− 0.027 [0.02]	0.021 [0.00]	− 0.030 [0.04]
$D(LNIM_{t-1})$	0.478 [0.13]	0.170 [0.05]	− 0.146 [0.24]
$D(LNY_{t-1})$	0.096 [0.37]	0.184 [0.13]	0.935 [0.65]
$D(LNREER_{t-1})$	− 0.089 [0.08]	− 0.065 [0.03]	0.375 [0.15]
$D(LNIM_{t-2})$	0.321 [0.03]	0.005 [0.05]	0.040 [0.64]
$D(LNY_{t-2})$	0.279 [0.00]	− 0.676 [0.00]	− 0.278 [0.60]
$D(LNREER_{t-2})$	− 0.021 [0.93]	− 0.098 [0.76]	0.375 [0.04]
$D(LNIM_{t-3})$	− 0.181 [0.25]	0.001 [0.99]	0.037 [0.64]
$D(LNY_{t-3})$	− 0.054 [0.50]	− 0.538 [0.00]	0.031 [0.47]
$D(LNREER_{t-3})$	0.218 [0.39]	− 0.143 [0.71]	− 0.170 [0.15]
C	0.009 [0.01]	− 0.004 [0.00]	− 0.011 [0.18]
N	66		
R^2	0.469	0.779	0.334

significant at the 5% level. Also, the estimated parameters have expected signs. The coefficient of Kazakhstan's real GDP term indicates that this variable does not adjust significantly to short-run deviations from the equilibrium, which also indicates weak exogeneity.

The elements of the cointegrating vector can be expressed as follows:

$$IM_t = 10.23 + 1.6GDP_t + 0.67REER_t. \tag{10}$$

The magnitude and signs of the short-run adjustment parameters also remained roughly unchanged. The coefficients of two adjusting error correction terms are significant at 5% level. Considering the import values, one of the explanations could be a "compression of imports" following the current account deficits. This requires substantial government interventions to regulate the balance of external accounts. Also, the error correction coefficient is statistically significant and has an expected sign, which provides additional support for cointegration between the key macroeconomic variables. At the same time, the short-run dynamic adjustments parameters are insignificant, which signifies that the conventional determinants of imports did not produce large effects in the short-run.

5.3 Test of the "strong" form

Now we consider the BPCG model in its strong form. For this purpose, we need to estimate the export demand function. Initial specifications did not produce adequate results, thus we decided to substitute the world GDP growth with key (Kazakhstani) exporting markets. Since the largest trade partner of Kazakhstan is Russian Federation, we use it as a proxy for world growth rate. This way we expect it to capture the world demand for tradables better than world income growth. Since a large proportion of exports to third countries goes through Russia, and errors in the data can include the export to other countries as an export (re-export) to Russian Federation, the measure of elasticity is likely to be overestimated.

Again, from the Table 3, the maximum rank is one, which means that we reject null hypothesis and establish that there is at least one cointegration between the variables of interest. The Akaike information criterion (AIC), SIC and Hannan–Quinn information criterion (HQIC), suggested a lag length of 5 for each of the variable of interest in levels.

Table 4 presents estimates of the restricted VECM on export demand function. Similarly with the import function procedure, we report the first three lags of each cointegrating equations, which properly describes the Kazakhstan's export demand function over the time period. The estimated long-run income elasticity of

Table 3 Johansen tests for cointegration

Trend: constant			Number of obs = 58		
Sample: 2005Q1-2019Q2			Lags = 5		
Maximum rank	Parms	LL	Eigenvalue	Max statistics	5% critical value
0	51	528.83173		41.4439	34.55
1	56	544.84581	0.38447	9.4158*	23.46
2	59	547.94261	0.08957	3.2222	6.40
3	60	549.5537	0.04765		

* denotes rejection of the hypothesis at the 0.05 level

Table 4 VECM estimation of export equation

Cointegrating equation	CointEq1		
$LNEX_{t-1}$	1.000		
$LNYRU_{t-1}$	− 3.678 [0.13]		
$LNREER_{t-1}$	− 3.053 [0.22]		
C	38.837		
Error correction	$D(LNEX_{t-1})$	$D(LNYRU_{t-1})$	$D(REER_{t-1})$
CointEq1	− 0.043 [0.07]	0.021 [0.01]	0.249 [0.08]
$D(LNEX_{t-1})$	− 0.011 [0.02]	0.744 [0.08]	0.059 [0.3]
$D(LNYRU_{t-1})$	0.096 [0.37]	0.184 [0.13]	0.935 [0.65]
$D(LNREER_{t-1})$	0.186 [0.15]	− 0.389 [0.66]	0.802 [0.22]
$D(LNIM_{t-2})$	− 0.216 [0.106]	0.299 [0.314]	0.093 [0.460]
$D(LNYRU_{t-2})$	− 0.234 [0.000]	− 0.416 [0.000]	− 0.037 [0.455]
$D(LNREER_{t-2})$	− 0.385 [0.007]	− 0.470 [0.141]	0.004 [0.974]
$D(LNIM_{t-3})$	0.014 [0.896]	1.650 [0.000]	− 0.166 [0.179]
$D(LNYRU_{t-3})$	0.112 [0.006]	0.065 [0.587]	− 0.078 [0.104]
$D(LNREER_{t-3})$	0.114 [0.308]	1.085 [0.001]	− 0.002 [0.988]
C	.009 [0.01]	− 0.004 [0.00]	− 0.011 [0.189]
N	66		
R^2	0.827	0.547	0.527

demand for exports is 3.67, and the elements of the cointegrating relationship can be expressed as follows:

$$EX_t = 38.84 + 3.67GDPRU_t + 3.05EER_t. \tag{11}$$

The signs of the coefficients are consistent with findings in the related literature. As a result, Kazakhstan's exports increases with the rise of Russian incomes, but at a relatively higher rate. Since both countries are remarkably specialized in the extraction of crude oil and other natural resources, it might suggest a synchronization of two economies, especially considering that the export destination for Kazakhstan as well as for Russia is Europe. In other words, to a degree, an increase in Russian GDP growth rate should be closely correlated with an increase of incomes in Kazakhstan. We also acknowledge that the possible overestimation of income elasticity for exports might suggest the time-varying nature of the parameter. In particular, large fluctuations in a super-cycle of commodities prices might lead to the failure of capturing significant variations in the behavior of income elasticity. In addition, due to a relatively low trade to GDP ratio, and very limited number of trade countries, we decided to choose Russian growth rate as the proxy for the external world's demand for Kazakhstan's economy. It might raise certain concerns regarding the application

of the given theory, but using the world's GDP growth would only be of a symbolic nature, and would produce any meaningful results.

In addition, Bairam (1997) argues that although the income elasticities of import demand are independent from the level of development of a country, those of export demand are not. Razmi (2005) found that subperiod analysis provides some support to Bairam's findings. He also explains that a study by Senhadji and Montenegro (1998) reported significant and correctly signed parameters for the income elasticity of Indian imports. At the same time, the authors could not find valid estimates for India's export. Therefore Bairam (1997) has concluded that the assessment of the BPCG rate should be based on the weak form hypothesis. In our study, we also suggest mostly relying on "weak" form, since the export destinations and the structure of exporting goods might be subject to unclear interpretations of external demand markets for a particular country.

Figure 10 demonstrates visual dynamics of both the actual GDP growth in Kazakhstan and the weak form of balance-of-payments-constrained growth rate obtained in this paper. The BPCG rate was calculated from Eqs. (7) and (9) by substituting our estimates of income elasticities. Considering the weak form only, the BPCG hypothesis predicted around 2% long-run growth, which is consistently and significantly smaller that the actual average growth rate over the entire period of 2001Q1 and 2018Q4.

The Kazakhstani economy grew at a rate higher than the one hypothesized by the BPCG theory, but slowly converging to the latter. This finding might prove the point that Kazakhstan's growth was constrained on the demand side by the balance of payments. At the same time, BPCG hypothesis allows for a country's actual growth pace get faster as well as slower than the rate predicted by the BPCG constraint. Another supporting point for the BPCG hypothesis is that in years when two

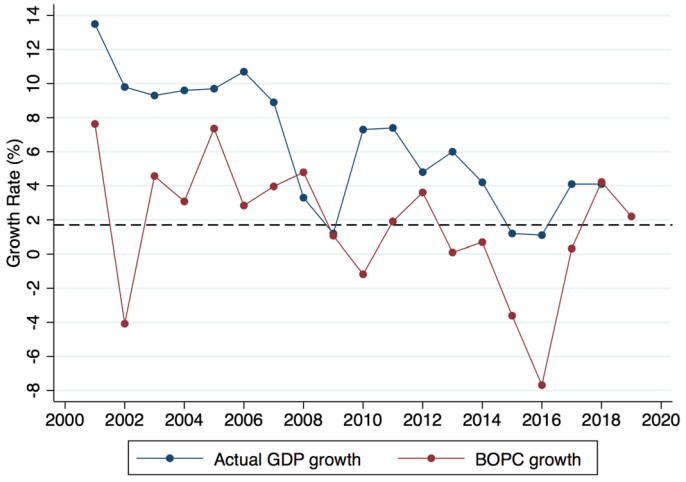

Fig. 10 Actual GDP growth rate and BOPC growth rate (weak form). Source: National Bank of Kazakhstan

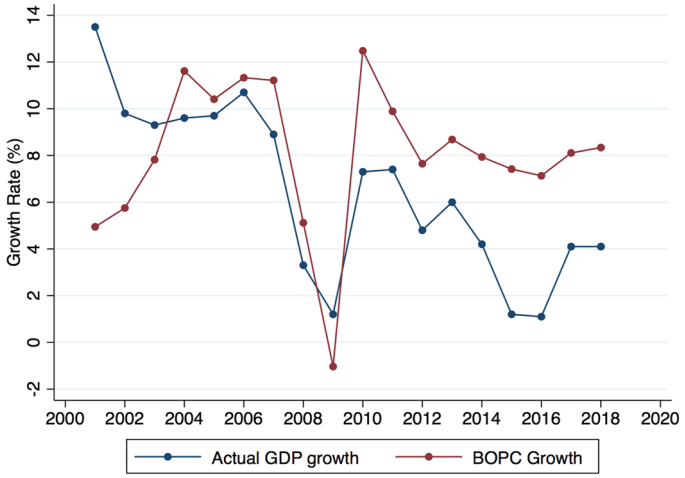

Fig. 11 Actual GDP growth rate and BOPC growth rate (strong form). Source: National Bank of Kazakhstan

growth rates coincided, such that the actual growth was slower than the BPCG rate, Kazakhstan was accumulating the most of international reserves. These periods are favorable to jump start the foreign-exchange-intensive, technology-importing sectors and enlarge the productive capacity of the economy.

Figure 11 shows a "strong" form dynamics of BPCG rate in comparison to the actual growth rate path over the same period. Now we observe that the BPCG rate is above the actual GDP growth rate, which suggests about existence of a room for greater economic expansion after 2008. However, as we mentioned above, oil-exporting countries are probably subject to a stricter guideline rules for estimating the BPCG rate using the "strong" form. It might result through an increase of excessive capital inflows, especially in times of high oil prices, which leads to specific distortions of export-import income elasticities, their dynamics, and the balance-of-payments temporary stabilization periods. Thus, we recommend to concentrate on the "weak" form estimation of the BPCG-rate for commodity-exporting emerging economy such as Kazakhstan.

Figure 12 demonstrates line graphs of the residuals from the cointegrating relationships of import and export functions, which supports our claims for stationarity. In addition, it is interesting to note that the residuals on import function exhibit rather stable behavior over the entire period, while export function tends to reduce the volatility towards the end of the time frame. The auto- and cross-residual correlograms of the parsimonious VECM and tests for normality of residuals and first-order autocorrelation did not reveal any problems.

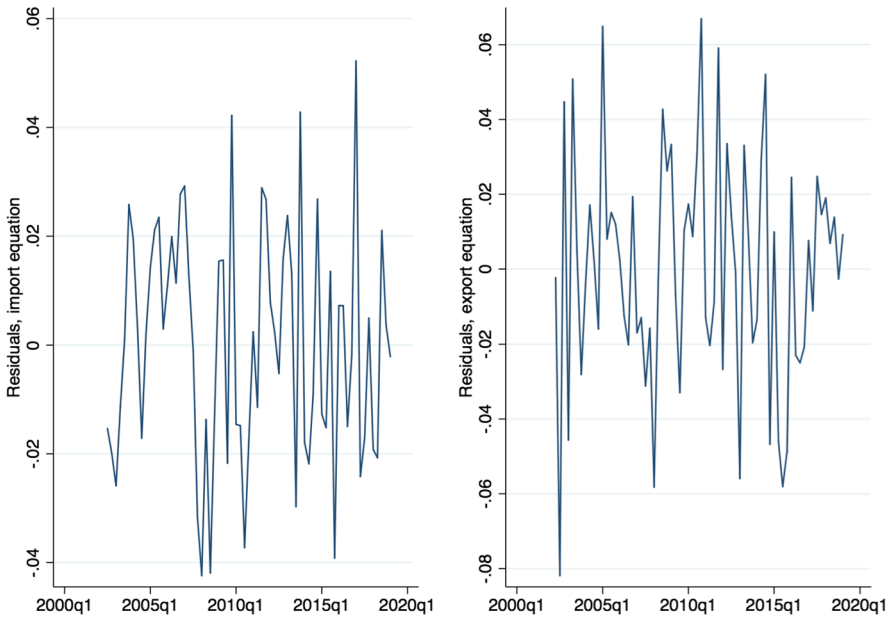

Fig. 12 Residuals of the first cointegrating relationship on import and export functions. Source: National Bank of Kazakhstan

6 Conclusion

In this paper we have explored whether the balance-of-payments-constrained hypothesis is valid for the case of Kazakhstan, a small open economy with a heavy proportion of primary goods production industries. For this purpose, we have obtained quarterly macroeconomic data for the 2005Q1-2019Q2 period. Following the theoretical predictions and after studying the time-series characteristics of export and import functions, our investigation specifically focuses on two parts: one analyzing the weak form of the BPCG hypothesis and the other studying the strong form. Considering the weak form, and using Johansen's cointegration technique, we have established a stable long-run relationship between Kazakhstan's real imports, real GDP, and real effective exchange rate. Then, the cointegrating vector was embedded in a Vector Error Correction Model (VECM) to find the patterns of the relationship. The estimated value of the long-run income elasticity of demand for imports is equal to 1.67, which is also consistent with a number of empirical papers in developing countries.

However, following the procedure of the framework, the average BCPG rate (weak form) was computed to be about 2%, which is significantly lower than the current average GDP growth rate of Kazakhstan's economy (4.5% in 2019). However, it does not weaken the rationality of the model, which originated as a long-run concept. Moreover, we found that income is the largest component determining the balance-of-payments-constraint, which in turn supports the theoretical foundations of the BCPG hypothesis. Moreover, real imports adjust relatively rapidly that

inversely adds to the previous point, but also highlights the primary importance of exports and foreign exchange accumulation, especially for developing countries with "soft" domestic currencies.

Analyzing the strong form of the model, we exploited the same Johansen's cointegration method to test for the presence of a long-run relationship between the Kazakhstan's export volume, world economic growth, and the real effective exchange rate. We found a long-run linear relationship between the $I(1)$ variables. Again, the cointegrating relationship was embedded in a VECM. Since the largest trade partner of Kazakhstan is Russian Federation, as a proxy for world growth rate we use Russian GDP growth. This way we expect it to capture the world demand for tradables better than world GDP. The estimated long-run income elasticity of demand for exports is 3.67. Since a large proportion of exports to third countries goes through Russia, and errors in the data can include the export to other countries as an export (re-export) to Russian Federation, the measure of elasticity is likely to be overestimated.

In addition, it is important to note that the strong form of the BPCG rate closely corresponds to the actual GDP growth before the Great Financial Crisis of 2008-2009. However, after the crisis we see a greater convergence of the strong form rate from the actual one, which signifies about the possible existence of a structural break around this date. Thus, splitting the time frame into two periods might yield the coefficients, which will be closer to the actual dynamics of growth. Furthermore, large price fluctuations may have caused the BPCG relationship to collapse in around 2015–2016, when domestic currency experienced a large nominal devaluation.

Overall, our analysis supports the BPCG hypothesis in the long-run. Within the BPCG rate, in this paper we argue that the "weak" form of the balance-of-payments-constrained growth is more appropriate for testing the Thirlwall's for an emerging economy such as Kazakhstan. Since the large portion of Kazakhstan's trade occurs with Russia, it may not have been considerably impacted by the standard determinants of trade equations, which treats these exports as exogenous and nonstochastic. On the import side, taking into account that developing countries mainly import intermediate and capital goods, which are necessary for growth, and also display greater stability over time, the results on the "weak" form are consistent and more reliable with the related literature. Hence, the "weak" form suggests that the current growth in Kazakhstan is constrained by aggregate demand at least in the medium term.

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Declarations

Conflict of interest The authors declare that they have no competing interests.

References

Alexeev, M., & Conrad, R. (2011). The natural resource curse and economic transition. *Economic Systems, 35*(4), 445–461.

Alonso, J. A., & Garcimartín, C. (1998). A new approach to balance-of-payments constraint: Some empirical evidence. *Journal of Post Keynesian Economics, 21*(2), 259–282.

Anceschi, L. (2011). Review of "Oil is not a curse: ownership structure and institutions in Soviet successor states" by Pauline Jones Luong, Erika Weinthal.

Ansari, M., Hashemzadeh, N., & Xi, Y. (2000). The chronicle of economic growth in southeast Asian countries: Does Thirlwall's law provide an adequate explanation? *Journal of Post Keynesian Economics, 22*(4), 573–588.

Araujo, R. A., & Lima, G. T. (2007). A structural economic dynamics approach to balance-of-payments-constrained growth. *Cambridge Journal of Economics, 31*(5), 755–774.

Atesoglu, H. S. (1997). Balance-of-payments-constrained growth model and its implications for the United States. *Journal of Post Keynesian Economics, 19*(3), 327–335.

Bagnai, A. (2010). Structural changes, cointegration and the empirics of Thirlwall's law. *Applied Economics, 42*(10), 1315–1329.

Bairam, E. I. (1997). Levels of economic development and appropriate specification of the Harrod foreign-trade multiplier. *Journal of Post Keynesian Economics, 19*(3), 337–344.

Bértola, L., Higachi, H., & Porcile, G. (2002). Balance-of-payments-constrained growth in Brazil: a test of Thirlwall's law, 1890–1973. *Journal of Post Keynesian Economics, 25*(1), 123–140.

Brunnschweiler, C.N. (2009). Oil and growth in transition countries. CER-ETH-Center of Economic Research at ETH Zurich, Working paper (09/108).

Christopoulos, D. K., & Tsionas, E. G. (2003). A reassessment of balance of payments constrained growth: Results from panel unit root and panel cointegration tests. *International Economic Journal, 17*(3), 39–54.

Esanov, A., Raiser, M., & Buiter, W. (2001). The political economy of transition in resource-based economies. EBRD working paper no. 65.

Gouvêa, R. R., & Lima, G. T. (2010). Structural change, balance-of-payments constraint, and economic growth: Evidence from the multisectoral Thirlwall's law. *Journal of Post Keynesian Economics, 33*(1), 169–204.

Hieke, H. (1997). Balance-of-payments-constrained growth: A reconsideration of the evidence for the us economy. *Journal of Post Keynesian Economics, 19*(3), 313–325.

Horvath, R., & Zeynalov, A. (2016). Natural resources, manufacturing and institutions in post-soviet countries. *Resources Policy, 50*, 141–148.

IMF. (2022). *Balance of payments and international investment position statistics*. International Monetary Fund: Technical report.

Jeon, Y. (2009). Balance-of-payment constrained growth: the case of China, 1979–2002. *International Review of Applied Economics, 23*(2), 135–146.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control, 12*(2–3), 231–254.

Kronenberg, T. (2004). The curse of natural resources in the transition economies. *Economics of transition, 12*(3), 399–426.

Leon-Ledesma, M. A. (1999). An application of Thirlwall's law to the Spanish economy. *Journal of Post Keynesian Economics, 21*(3), 431–439.

Marquez, J. (1985). Foreign exchange constraints and growth possibilities in the ldcs. *Journal of Development Economics, 19*(1–2), 39–57.

McCombie, J. S. (1997). On the empirics of balance-of-payments-constrained growth. *Journal of Post Keynesian Economics, 19*(3), 345–375.

McCombie, J. S., & Roberts, M. (2002). The role of the balance of payments in economic growth. In M. Setterfield (Ed.), *The economics of demand-led growth: Challenging the supply-side vision of the long run* (pp. 87–114). Cheltenham: Edward Elgar.
Moreno-Brid, J. C. (1999). Mexico's economic growth and the balance of payments constraint: A cointegration analysis. *International Review of Applied Economics, 13*(2), 149–159.
NBK. (2020). *Kazakhstan: Balance of payments and external debt for the first quarter of 2019*. National Bank of Kazakhstan: Technical report.
Oskenbayev, Y., Yilmaz, M., & Abdulla, K. (2013). Resource concentration, institutional quality and the natural resource curse. *Economic Systems, 37*(2), 254–270.
Perraton, J. (2010). Balance of payments constrained growth and developing countries: An examination of Thirlwall's hypothesis. *International Review of Applied Economics, 17*(1), 1–22.
Pomfret, R. (2012). Resource management and transition in central Asia, Azerbaijan and Mongolia. *Journal of Asian Economics, 23*(2), 146–156.
Razmi, A. (2005). Balance-of-payments-constrained growth model: The case of India. *Journal of Post Keynesian Economics, 27*(4), 655–687.
Razmi, A. (2015). Correctly analysing the balance-of-payments constraint on growth. *Cambridge Journal of Economics, 40*(6), 1581–1608.
Senhadji, A., & Montenegro, C. (1998). Time series analysis of export demand function: A cross-country analysis. Working paper, International Monetary Fund.
Setterfield, M. (2003). Supply and demand in the theory of long-run growth: Introduction to a symposium on demand-led growth. *Review of Political Economy*.
Thirlwall, A. P. (1979). The balance of payments constraint as an explanation of the international growth rate differences. *PSL Quarterly Review, 32*(128), 45–53.
Thirlwall, A. P. (1997). Reflections on the concept of balance-of-payments-constrained growth. *Journal of Post Keynesian Economics, 19*(3), 377–385.
Thirlwall, A.P. (2012). Balance of payments constrained growth models: History and overview. In *Models of balance of payments constrained growth* (pp. 11–49). Springer.
Thirlwall, A. P., & Hussain, M. N. (1982). The balance of payments constraint, capital flows and growth rate differences between developing countries. *Oxford Economic Papers, 34*(3), 498–510.
Young, A. (1995). The tyranny of numbers: Confronting the statistical realities of the east Asian growth experience. *The Quarterly Journal of Economics, 110*(3), 641–680.
Ziesemer, T. (1995). Growth with imported capital goods, limited export demand and foreign debt. *Journal of Macroeconomics, 17*(1), 31–53.