# Price convergence and market integration in Russia

Konstantin Gluschenko *

Institute of Economics and Industrial Engineering, Siberian Branch of the Russian Academy of Sciences, and Department of Economics, Novosibirsk State University pr. Lavrentieva 17, 630090 Novosibirsk, Russia

## ARTICLE INFO

## ABSTRACT

Following the price-liberalization reforms implemented by Russia in 1992, an initial period of disconnect between regional markets began to transform around 1994. This paper analyzes the spatial pattern of goods market integration that evolved within Russia in 1994–2000, classifying country's regions into three categories: integrated with a benchmark region, not integrated but tending towards integration, and not integrated and not tending towards integration. To quantify tendencies towards integration, an AR(1) model of regional price differentials is augmented with a trend term that is capable of displaying asymptotic decay (indicating price convergence). The results obtained suggest that only about one-fifth of Russia's regions appear as not integrated and showing no tendency towards integration over the sample period.

© 2011 Elsevier B.V. All rights reserved.

## 1. Introduction

Political changes and Russia's rapid shift in the early 1990s from a centrally planned economy to one governed by market principles gave rise to a dramatic regional fragmentation of its national market. In 1994, this process of fragmentation began to subside due to the emergence of market institutions. From that time on, a progressive improvement in market integration was observed, as Berkowitz and DeJong (2001, 2003) and Gluschenko (2003) have documented. Obviously, integration of the Russian market is spatially heterogeneous: each region can be integrated with some set of other regions and not integrated with another set. Moreover, a feature of the transition process is that some non-integrated regions are nonetheless moving towards integration. The above papers consider the temporal pattern of market integration in Russia rather than the spatial pattern because they use cross-sectional analysis, thus obtaining results averaged over country's regions.

The aim of this paper is to characterize the spatial pattern of goods market integration in Russia in 1994–2000, applying time series analysis. The spatial pattern is produced by classifying each region as belonging to one of three groups: integrated with a benchmark region, not integrated but tending towards integration, or not

integrated and not tending towards integration. The law of one price serves as the criterion of market integration. The data for the empirical analysis are monthly time series of the cost of a staples basket across 75 (of the 89) regions of Russia.

The variable to be analyzed is the price differential between a given region and the benchmark region. Given stationarity of the price ratio, the law of one price holds, hence these regions are deemed to be integrated. The conventional AR(1) model with no unit root describes this behavior. In turn, a transition towards integration appears as a non-stationary ratio that tends towards stationarity over time. Such a process is modeled by an autoregression with a nonlinear, asymptotically decaying trend: a region is deemed as tending towards integration when its price ratio exhibits trend decay. If region's price differential satisfies neither model, the region is deemed not integrated and not tending towards integration. The models are also augmented to account for a structural break caused by the 1998 financial crisis in Russia. The results obtained suggest that 54% of the covered Russian regions are integrated with the benchmark region, 24% tend towards integration, and 22% are non-integrated and show no trend towards integration.

Examining market integration in Russia through time series analysis has been the subject of studies by Berkowitz et al. (1998), Gardner and Brooks (1994), and Goodwin et al. (1999). Considering the early transition years (i.e. the first half of the 1990s), these studies characterize the Russian market as poorly integrated but showing signs of potential improvement. The spatial patterns obtained suggest that only a few regions or cities can be deemed integrated in a certain

* Tel.: +7 383 3302548; fax: +7 383 3302580.
E-mail address: glu@nsu.ru.

sense. Berkowitz and DeJong (1999), albeit applying a cross-sectional approach, find an interesting feature of the spatial pattern of Russia's market integration. They identify a Red Belt group of pro-Communist and anti-market-reform regions as a culprit behind segmentation of the Russian market.

This paper contributes to the above literature in two aspects. From a methodological standpoint, it proposes a new methodology of analyzing price convergence in the time series context. From an empirical standpoint, the paper is complementary those cited above in that it provides broader spatial and temporal coverage: the analysis covers almost all Russian regions and a time span ending in 2000 (albeit missing the very early years of transition, 1992–1994). Together with Berkowitz and DeJong (2001, 2003) and Gluschenko (2003), the results of this paper provide a two-dimensional, time-space pattern of Russia's market integration from the early years of transition to the beginning of the 2000s.

The remainder of the paper is organized as follows. Section 2 describes methodology of the analysis and the data used. Section 3 presents empirical results obtained. Section 4 concludes.

## 2. Methodology and data

### 2.1. Strategy of the analysis

Perfect integration of a spatially dispersed goods market implies the absence of impediments to the movement of goods between all spatial segments (e.g., national regions). In other words, a perfectly integrated market would operate like a single competitive market despite spatial dispersion of its segments. The price of a (tradable) good across regions would be uniform so that the law of one price, maintained by inter-regional arbitrage, holds. Thus, the law of one price may be used as a theoretical benchmark for empirically analyzing goods market integration.

Market integration in Russia can be seen as a two-stage process, involving an initial stage of progressive segmentation beginning in January 1992 and a second stage of progressive integration beginning around 1994. The second stage is the subject of this study. Taking a pair of regions, the goal is to identify three types of classifications in the second stage of the evolution: (a) integrated regions, where price equality already prevails; (b) non-integrated regions tending towards integration, i.e. prices are converging towards a common level; and (c) non-integrated regions that show no indication of a trend towards integration. For brevity, hereafter regions from the second group are

referred to as "regions tending towards integration," and regions from the third group are referred to as simply "non-integrated regions."

In the above context, the term *convergence of prices* becomes ambiguous. Indeed, when considering types (a) and (b), two fundamentally distinct concepts of convergence are possible. Fig. 1 illustrates the difference between the concepts: the thin lines depict actual dynamics of prices, while the thick lines represent their theoretical long-run paths. (Hereafter, $p_{rt}$ and $p_{st}$ denote the price of a good in regions $r$ and $s$, respectively, at time $t$; $p'$ stands for a relative price.)

These two concepts can be described as follows:

Fig. 1(a) implies regions $r$ and $s$ are type (a). They are *in* spatial equilibrium, such that price disparities between regions are merely random shocks dying out over time. Prices fluctuate around parity and permanently tend to return to it. This is the case dealt with in the literature on the law of one price and purchasing power parity (PPP); it is sometimes referred to as "convergence to the law of one price/PPP" in this literature. The term "convergence" here relates to the shocks, implying their convergence to zero. It characterizes the short-run behavior of prices, while the long-run behavior of prices is described by the path

$$p_{rt} / p_{st} = 1, t = 0, ..., T. \tag{1}$$

Thus, this concept can be designated as "short-run convergence."

Fig. 1(b) implies that regions $r$ and $s$ are type (b). The regions are *tending towards* spatial equilibrium:

$$\lim_{t \to \infty} p_{rt} / p_{st} = 1. \tag{2}$$

(In the figure, the price in $s$ catches up with the price in $r$.) Price disparity permanently diminishes over time, fluctuating around this general trend due to random shocks. This is the case characterized in the literature on economic growth (regarding incomes, outputs, etc.) as "convergence." In the short run, the price disparity converges to the long-run path (i.e. random deviations die out over time), and the path itself converges to the parity line $p_{rt}/p_{st} = 1$ over the long run. In this case, "convergence" implies that the differences in prices over a long period of time deterministically converge to zero. Thus, this concept can be designated as "long-run convergence."[1]

In Eqs. (1) and (2), absolute price parity is taken as the steady state. This implies perfect integration—a rare condition in the real world. We would reasonably expect persistent (equilibrium) differences in prices between $r$ and $s$ induced by natural market frictions such as physical distance and difficulty accessing a number of regions. Thus, it may be more realistic to relax the criterion for market integration, allowing for such market frictions. In this case, relative price parity would have to be dealt with, and unity in the right-hand side of Formulae (1) and (2) would be substituted for an arbitrary constant ratio of prices, $\alpha_{rs}$.

The trouble is that this $\alpha$ reflects both the effect of "natural," irremovable market frictions (which are compatible with the notion of integration) and the effect of artificial, transient ones that impede market integration. This can be formalized as, e.g., $\alpha = \alpha_n(L_{rs}) \cdot \alpha_a$, where $\alpha_n$ is the effect of transportations costs proxied by distance between $r$ and $s$, $L_{rs}$, and $\alpha_a$ is the effect of "anti-integration forces." As Gluschenko (2010a) finds, the latter effect is considerable in Russia. In the context of a pairwise time series analysis, however, there is no way to identify $\alpha_n$ and $\alpha_a$ separately. This is why the strict version of the law of one price is adopted in this study as a criterion of integration, any deterministic difference in prices being interpreted as an indication of non-integration. Certainly, this may result in some understatement of the degree of market integration in Russia.



(a)

(b)

**Fig. 1.** Two concepts of price convergence: (a) short-run convergence (ordinary cointegration); (b) long-run convergence (catching-up) combined with short-run one.

---

[1] Econometrically, prices $p_{rt}$ and $p_{st}$ in Fig.1(a) are nonstationary (unit root) processes. However, both have the same trend so that their ratio is stationary around 1. In Fig. 2(b), individual prices are also unit root processes, but they have different trends that converge to each other over time. Thus, the price ratio here is a nonsta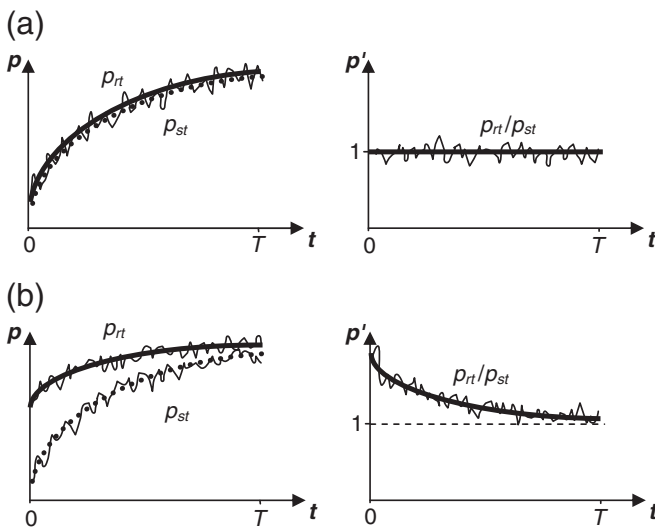tionary process tending to stationarity over time.