***Boom, Bust, Recovery: Forensics of the Latvia Crisis***

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**Online Appendix I – Growth Predictions from Growth Models**

This annex reports growth predictions for Latvia between 1996 and 2007 from two variants of the Barro growth model. More precisely, we used data for Latvia and regression coefficients from the models in Schadler et al. (2006) and Vamvakidis (2008) to produce growth prediction for Latvia over 1996-2000, 2001-2004 and 2005-2007.

The first model (Schadler et al., 2007, labeled *S Model* below) was estimated using data for 41 to 58 advanced and emerging economies over non-overlapping five-year periods between 1984 and 2004. The list of independent variables includes initial income per capita, population growth, partner country growth, the relative price of investment goods, the level of schooling, the openness ratio, the size of government (proxied by government revenues to GDP) and an indicator of institutional quality. The second model (Vamvakidis, 2008, denoted *V Model* below) was estimated using data for a cross-country sample of 107 developed and developing economies during 1996–2006. Besides initial income per capita, it includes the age dependency ratio, the investment to GDP ratio, the university enrollment ratio, the inflation rate, the FDI-to-GDP ratio, an index of economic freedom and a dummy variable identifying transition economies.

The dependent variable in both models is the average per capita GDP growth rate in PPP terms from Penn World Tables (version 7.1)[[1]](#footnote-2). The models’ coefficients, as well as the details on the specific variables and the data sources used to retrieve values for the independent variables for the case of Latvia, are presented in Table I.1. The convergence coefficients imply that it would take 30 years (*S Model*) and 50 years (*V Model*) for half of the initial income gap to vanish. As a reference, the preferred specification in Barro (2012) implies a half-life of 40 years.

Comparing actual with predicted growth from these models suggests that output growth in Latvia between 2000 and 2007 was increasingly higher than warranted by fundamentals; this was particularly the case after 2004 (see Figure I.1). More precisely, unexplained growth—that is, the difference between actual and predicted average per-capita output growth in PPP terms—was null (-0.2%) in 1996-2000 according to the *S Model*, but increased to 1.2% in 2001-2004 and to 3.9% in 2005-07. The *V Model* suggests a slightly different starting point but the same trend: it suggests that unexplained growth was already positive and large since 1996 (3.1% in 1996-2000 and 3.3% in 2000-2004) but that growth departed substantially from fundamentals in 2005-2007 (when annual unexplained growth reached 6%).

**Table I.1 – Model Variables, Coefficients and Sources**

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| --- | --- | --- |
| **S Model (Schadler et al., 2006)** | |  |
| **Variable** | **Coefficient** | **Details and Source** |
| Constant | 20.31/20.93/20.93 | Constant for each sub-period |
| Initial income | -2.27 | Log of initial real GDP (PPP) per capita (source: Penn World Tables (PWT), chain series, at 2005 constant prices) 1/ |
| Population growth | -1.27 | Initial population growth (average over the 5 preceding years, source: http://data.csb.gov.lv) |
| Partner country growth | 0.61 | Real GDP growth of Latvia's main trading partners, weighted by exports (source: IMF) 3/ |
| Relative price of investment | -0.75 | Ratio of the investment and GDP deflators (from PWT) |
| Schooling | 0.20 | Average years of secondary and higher education (source: Barro-Lee database, http://barrolee.com) |
| Openness ratio | 0.01 | Sum of exports and imports divided by GDP (source: PWT) |
| Government revenue | -0.02 | Ratio of total general government revenue to GDP (source: Eurostat) |
| Institutional quality | 0.03 | Composite risk rating (source: International Country Risk Guide, http://www.prsgroup.com) 2/ |
|  |  |  |
| **V Model (Vamvakidis, 2008)** | | |
| **Variable** | **Coefficient** | **Details** |
| Constant | 11.00 | Constant |
| Initial income | -1.38 | Log of initial real GDP (PPP) per capita (source: PWT, chain series, at 2005 constant prices) 1/ |
| Age dependency rate | -7.05 | World Bank WDI |
| Investment ratio | 0.13 | Ratio of gross fixed capital formation to GDP (source: WEO) |
| University enrollment ratio | 0.02 | Tertiary school enrollment rate (source: World Bank WDI) |
| Inflation | -0.02 | Inflation rate (Source: WEO) |
| FDI/GDP | 0.07 | Ratio of foreign direct investment to GDP (source: WEO) |
| Index of Economic Freedom (IEF) | 0.59 | Initial level of an index measuring different aspects of macroeconomic and structural policies and reforms (Source: http://www.freetheworld.com) |
| Change in IEF | 0.86 | Change in economic freedom index during the period 3/ |
| Transition economy | 0.90 | Dummy variable identifying European transition economies |
|  |  |  |
| Notes: WEO denotes World Economic Outlook; WDI denotes World Development Indicators. | | |
| 1/ Data from Penn World Tables correspond to version 7.1; per capita values were adjusted to take into account the revision of population data as reported by the Latvian Statistical Office. | | |
| 2/ Data for Latvia are available only from 1999. The series was extended to 1995, the initial value for the 1996-2000 sub-period, by using the variation in the index for Russia.  3/ Values for the prediction period. Values for all other variables correspond to initial values (i.e., for the year before the start of the prediction period). | | |
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**References**

Schadler, Susan, Ashoka Mody, Abdul Abiad and Daniel Leigh, 2007, "Growth in the Central and Eastern European Countries of the European Union", IMF Occasional Papers 252, International Monetary Fund.

Barro, Robert J., 2012, "Convergence and Modernization Revisited", NBER Working Papers 18295, National Bureau of Economic Research.

Vamvakidis, Athanasios, 2008, "Convergence in Emerging Europe: Sustainability and Vulnerabilities", IMF Working Papers 08/181, International Monetary Fund.

1. For this exercise we adjusted real GDP per capita data from Penn World Tables to account for the recent revision in population series as reported by the Latvian Statistical Office. [↑](#footnote-ref-2)