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POTENTIAL GDP ESTIMATION AND OUTPUT GAPS: INSIGHTS FROM CROSS-COUNTRY STUDIES AND APPLICATIONS TO DEVELOPING ECONOMIES

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Abstract: Despite being essential instruments in macroeconomic research, potential GDP and the production gap are nevertheless difficult to estimate because of methodological decisions, structural variations, and data constraints. Evidence from cross-national studies examining mature, resource-dependent, and transition economies—such as those in the European Union, Japan, Saudi Arabia, Croatia, and Moldova—is reviewed in this study. It analyzes the advantages and disadvantages of the three primary methods—statistical filters, production functions, and multivariate frameworks. The findings indicate that demographic changes are important for advanced economies, sectoral disaggregation is essential for resource economies, and catastrophes like the global financial crisis and the COVID-19 pandemic permanently lower potential production. Notwithstanding variations in methodology, the production gap is still a crucial tool for monetary and fiscal policy and reliably forecasts inflation. In order to provide credible economic management, the article suggests that potential GDP should be seen as a dynamic standard that requires ongoing methodological improvement and context-specific application.

Keywords: Potential GDP, Output gap, Cross-country analysis, Statistical filters, Production function, Multivariate models, Economic crises, Fiscal and monetary policy, Advanced economies, Resource-dependent economies.

Annotatsiya: Makroiqtisodiy tadqiqotlarda muhim vosita bo‘lishiga qaramay, potensial YaIM va ishlab chiqarish bo‘shlig‘ini baholash metodologik qarorlar, tarkibiy farqlar va ma’lumotlar cheklanganligi sababli murakkab hisoblanadi. Ushbu tadqiqotda Yevropa Ittifoqi, Yaponiya, Saudiya Arabistoni, Xorvatiya va Moldova kabi rivojlangan, resurslarga tayanadigan va o‘tish davridagi iqtisodiyotlarni qamrab olgan transmilliy tadqiqotlardan olingan dalillar ko‘rib chiqiladi. Tadqiqot uch asosiy usul — statistik filtrlash, ishlab chiqarish funksiyalari va multivariat yondashuvlarning afzalliklari hamda kamchiliklarini tahlil qiladi. Natijalar shuni ko‘rsatadiki, demografik o‘zgarishlar rivojlangan mamlakatlar uchun muhim ahamiyatga ega, sektorlar bo‘yicha ajratib tahlil qilish resurslarga tayanadigan mamlakatlarda zarur, global moliyaviy inqiroz va COVID-19 pandemiyasi kabi falokatlar esa potensial ishlab chiqarishni doimiy ravishda pasaytiradi. Metodologiyalardagi farqlarga qaramay, ishlab chiqarish bo‘shlig‘i monetar va fiskal siyosat uchun muhim vosita bo‘lib qolmoqda hamda inflyatsiyani ishonchli tarzda bashorat qiladi. Maqola potensial YaIMni dinamik mezon sifatida ko‘rish, uni doimiy metodologik takomillashtirish va kontekstga moslashtirilgan qo‘llash zarurligini ta’kidlaydi.

Kalit so‘zlar: Potensial YaIM, Ishlab chiqarish bo‘shlig‘i, Xalqaro tahlil, Statistik filtrlash, Ishlab chiqarish funksiyasi, Multivariat modellar, Iqtisodiy inqirozlar, Fiskal va monetar siyosat, Rivojlangan mamlakatlar, Resurslarga tayanadigan mamlakatlar.

Аннотация: Несмотря на то, что потенциальный ВВП и разрыв выпуска являются важными инструментами макроэкономических исследований, их оценка затруднена из-за методологических решений, структурных различий и ограниченности данных. В данном исследовании рассматриваются материалы кросс-национальных исследований зрелых, ресурсозависимых и переходных экономик, таких как страны Европейского Союза, Япония, Саудовская Аравия, Хорватия и Молдова. Анализируются преимущества и недостатки трёх основных методов — статистических фильтров, производственных функций и многомерных подходов. Результаты показывают, что демографические изменения имеют ключевое значение для развитых экономик, секторная дезагрегация необходима для ресурсозависимых стран, а такие потрясения, как мировой финансовый кризис и пандемия COVID-19, ведут к постоянному снижению потенциального выпуска. Несмотря на различия в методологиях, разрыв выпуска остаётся важным инструментом для денежно-кредитной и фискальной политики и надёжно прогнозирует инфляцию. В статье делается вывод, что потенциальный ВВП следует рассматривать как динамический стандарт, требующий постоянного методологического совершенствования и контекстуально-специфического применения для обеспечения достоверного экономического управления.

Ключевые слова: Потенциальный ВВП, Разрыв выпуска, Кросс-страновой анализ, Статистические фильтры, Производственная функция, Многомерные модели, Экономические кризисы, Фискальная и монетарная политика, Развитые экономики, Ресурсозависимые экономики.

INTRODUCTION

In contemporary macroeconomics, the potential gross domestic product (GDP) and the production gap are two of the most important metrics. These measures influence fiscal monitoring, monetary policy, and long-term growth plans. A sustainable level of output and the deviation of actual production from that level are two ideas that cannot be seen and must be approximated via the use of models. Both of these concepts are defined correspondingly as the sustainable level of output. As a result of severe shocks like as the global financial crisis, the COVID-19 pandemic, and the volatility of commodity prices, which have all affected development trajectories throughout the globe, their assessment has received increased attention. Evidence from several countries demonstrates that crises permanently impact potential production, that dependency on resources makes measuring more difficult, and that demographic patterns have an effect on long-term sustainability. While this is going on, various methodological choices—ranging from simple statistical filters to complex multivariate frameworks—are producing different outcomes, which raises problems about the trustworthiness of the findings and the application of the policy. The purpose of this article is to draw lessons for developing nations by analyzing data from both developed economies and economies that are reliant on resources. These economies include the European Union, Japan, Saudi Arabia, and Moldova. In this research, the merits and drawbacks of the methodology are highlighted, findings are compared across different settings, and lessons are extracted about how credible policy frameworks might be tailored to address possible GDP and production gaps.

LITERATURE REVIEW ON THE TOPIC

The examination of potential gross domestic product (GDP) and production gaps has gained significance as policymakers and scholars use these metrics to analyze fiscal sustainability, inform monetary policy, and assess structural changes. Potential GDP is often described as the maximum production level that can be maintained without inducing inflationary pressure, while the output gap quantifies the discrepancies between actual output and this potential (European Commission, 2003; Kawamoto, Nishimura & Tamura, 2017). The estimate of these unobservable variables relies on models that differ in complexity, assumptions, and data needs.

Statistical filters are often used owing to their simplicity. The Hodrick–Prescott (HP) filter separates GDP into a trend component and a cyclical deviation, and has been used in studies concerning Saudi Arabia (Alkhareif & Alsadoun, 2016), Moldova (Ernst, 2005), and EU crisis economies (Măntescu & Lazăr, 2014). Nonetheless, HP estimates are affected by endpoint bias and lack clear connections to structural determinants. The Kalman filter, used in Saudi Arabia and advanced-economy research, offers time-varying adaptability but necessitates more stringent assumptions. Both methodologies risk misidentifying fundamental shifts—such as demographic changes or technological disruptions—as cyclical variations (European Commission, 2003).

Production function methodologies have emerged as the standard in cross-national analyses. The Cobb–Douglas model disaggregates production into capital, labor, and total factor productivity (TFP), facilitating structural analysis. This methodology has been used in Croatia (Kordoš, 2013), Saudi Arabia (Alkhareif & Alsadoun, 2016), Romania (Armeanu et al., 2015), and the European Union (Măntescu & Lazăr, 2014; Altar et al., 2010). Its strength is in openness and the disaggregation of growth sources; yet, outcomes are significantly contingent upon the quality of data about capital and labor.

Multivariate and hybrid methodologies integrate filtering with economic correlations. The European Commission and IMF include Phillips curve and Okun's law dynamics, but Mihai & Bozagiu (2025) use Bayesian extensions for Romania. These models mitigate bias and synchronize production discrepancies with inflation and unemployment, enhancing policy relevance.

Cross-national evidence offers significant comparative insights. The economies of the EU in crisis demonstrate that the global financial crisis significantly reduced potential GDP, with some nations seeing negative potential growth (Măntescu & Lazăr, 2014). Japan's amendments to capital and labor statistics elevated potential growth projections to about 0.5–1.0 percent, although its output gap remained a reliable indicator of inflation (Kawamoto et al., 2017). Saudi Arabia exemplifies the significance of sectoral disaggregation: overall GDP estimates fluctuate considerably, however non-oil potential growth remains consistently between 5 and 6 percent (Alkhareif & Alsadoun, 2016). Moldova underscores the vulnerabilities of transition economies, as labor mobility and institutional deficiencies hinder measurement (Ernst, 2005).

A prominent issue in these research is the influence of crises. The EU, Japan, and Saudi Arabia demonstrate that financial crises, demographic disruptions, or fluctuations in commodity prices may permanently alter potential GDP. Crises often diminish potential growth by 1–4 percent (European Commission, 2009), emphasizing the need for methodological prudence and policy adjustment.

Policy insights derived from cross-national studies underscore the need of triangulating methodologies and tailoring them to specific contexts. European Union economies need structural changes and budgetary regulations associated with cyclically adjusted balances; Japan must confront demographic decline; Saudi Arabia must to diversify its economy beyond oil. Notwithstanding methodological discrepancies, all research agree that the production gap is an essential indicator for policymakers.

Conclusion of the Literature Review: International research indicates that estimating techniques must be tailored to structural characteristics, crises inflict enduring damage on potential GDP, and context dictates the most reliable methodology. Insights from mature and resource-dependent economies are essential for emerging nations, providing direction on methodological rigor and structural policy formulation.

RESEARCH METHODOLOGY

Estimating potential GDP and output gaps needs flexible methods that consider different economic structures, data availability, and policy environments. Cross-country studies show a range of methods, from basic statistical filters to intricate multivariate frameworks, often adapted to the unique conditions of each country.

Statistical filters are often a popular starting point. The Hodrick–Prescott (HP) filter is commonly used in EU crisis economies, Saudi Arabia, and transition economies like Moldova, offering a fast breakdown of GDP into its trend and cycle components (Alkhareif & Alsadoun, 2016; Măntescu & Lazăr, 2014; Ernst, 2005). The Kalman filter, while flexible and reliant on many assumptions, has been utilized to track changing parameters in Saudi Arabia and similar resource-rich countries. Advanced analyses often use band-pass filters like Baxter–King or Christiano–Fitzgerald, as noted in IMF studies on Niger for validation purposes.

Production function methods are prevalent in comparative studies. The Cobb–Douglas framework, applied in Romania, Croatia, Saudi Arabia, and EU-wide studies, breaks down growth into contributions from capital, labor, and total factor productivity (Armeanu et al., 2015; Kordoš, 2013; Măntescu & Lazăr, 2014). The method is clear and based on theory, but it needs high-quality input data. Extensions involve changes in labor quality, research and development, and capital across sectors. The Bank of Japan improved its labor input measures by considering the participation of women and the elderly, as well as working hours and utilization rates (Kawamoto et al., 2017).

Multivariate and hybrid models enhance filters and production functions by incorporating the dynamics of inflation and unemployment. The European Commission and IMF use methods that integrate Phillips curve and Okun's law relationships, with Bayesian extensions (Mihai & Bozagiu, 2025) enhancing their robustness. These methods minimize end-point bias and create gaps that are relevant for policy.

Adjusting for country-specific factors is essential in comparative studies. Saudi Arabia and other oil exporters differentiate between total and non-oil GDP to prevent distortions caused by OPEC production influences. In transition economies like Moldova, weak data systems lead to the use of filters alongside inventory methods. Countries like Japan consider demographic factors, whereas EU crisis nations emphasize cyclically adjusted balances for fiscal oversight.

Comparative lessons show that there is no one-size-fits-all method. Filters are straightforward yet lack theory; production functions offer a framework but need data; multivariate methods combine macro dynamics but depend on extensive datasets. Evidence from various countries indicates that methodology should align with context: oil exporters need detailed sector analysis, advanced economies require precise input metrics, and transition economies encounter institutional limitations.

The development of methods in different countries shows a shift from basic filters to production functions, and finally to hybrid and multivariate models. This shows improved data access and an increasing need for estimates that are relevant to policy and consistent with theory in both advanced and developing settings.

ANALYSIS AND RESULTS

Cross-country studies show that potential GDP is not static; it changes due to crises, demographic changes, and improvements in methodology. Research from the European Union indicates that the 2008–2009 financial crisis significantly slowed potential growth, with countries like Cyprus, Greece, Portugal, Italy, and Spain experiencing negative growth rates (Măntescu & Lazăr, 2014). This illustrates "economic scarring," where negative shocks diminish long-term productivity instead of just causing short-term changes. The policy implications are crucial: reforms should extend beyond immediate demand stabilization to tackle fundamental rigidities in labor and product markets, while focusing on investment in sectors that boost productivity (European Commission, 2009).

Saudi Arabia shows how the makeup of different sectors influences estimates. From 1980 to 2015, the average potential growth based on total GDP was about 2.4 percent, increasing to 3.9 percent during

2011–2015, largely driven by significant infrastructure investments (Alkhareif & Alsadoun, 2016). Productivity estimates vary significantly based on the method used, as oil output is influenced more by OPEC decisions than by domestic resource accumulation. Focusing on the non-oil sector provides more reliable results, typically around 5–6 percent, highlighting the importance of disaggregation in resource-dependent economies.

Japan highlights that improving methods can change potential GDP estimates while still being relevant for policy. The Bank of Japan has updated its estimate of potential growth to 0.5–1.0 percent, aligning it with pre-crisis levels. This revision incorporates new GDP accounts, capital stock data, and adjustments in the labor market, including the participation of women and the elderly, as well as trends in working hours (Kawamoto, Nishimura & Tamura, 2017). The output gap continues to effectively predict inflation, highlighting its importance as a cyclical indicator, even amid challenges like secular stagnation and demographic decline.

These findings indicate that crises lower potential GDP in various economies, highlight the importance of sectoral analysis in resource-rich nations, and suggest that advanced economies gain from improved measurement of labor and capital inputs. Even with different methods, the output gap remains an important tool for fiscal and monetary authorities. These insights highlight the need for potential GDP estimation to adapt to structural changes, ensuring that policy frameworks stay credible in both advanced and developing settings.

CONCLUSION AND SUGGESTIONS

Research shows that estimating potential GDP and output gaps presents both methodological challenges and essential policy needs. In various economies, one clear lesson stands out: crises have lasting impacts on productivity. The global financial crisis, COVID-19 pandemic, and commodity price shocks have diminished potential GDP in both advanced and developing economies, revealing the issue of long-term economic "scarring" (Măntescu & Lazăr, 2014). Japan shows how a shrinking population limits growth, while the EU's struggling economies highlight how financial instability reduces potential. Conversely, Saudi Arabia's non-oil sector shows that focused reforms and investments can maintain resilience even in challenging times (Alkhareif & Alsadoun, 2016).

Another conclusion is that no single method works for everyone. Statistical filters are popular for their ease of use, yet their biases can restrict their applicability in policy-making. Production function methods enable a detailed analysis of growth, but they require accurate data on capital and labor. Multivariate and Bayesian methods help minimize estimation bias and enhance connections to inflation and unemployment, increasing their credibility in fiscal and monetary contexts (Mihai & Bozagiu, 2025). Countries like Japan demonstrate that refining methods, like remeasuring labor inputs and capital stock, can enhance potential estimates while keeping the output gap reliable as a cyclical indicator (Kawamoto, Nishimura & Tamura, 2017).

Ultimately, context is important. Oil exporters should distinguish between oil and non-oil activities to ensure accurate results. Advanced economies need detailed demographic and labor metrics, while EU member states must synchronize fiscal oversight with reliable potential GDP estimates (European Commission, 2009).

Potential GDP should be seen as a dynamic target, influenced by reforms, demographic shifts, technological advancements, and crises. The implications of this policy are evident: Cross-country experience indicates that effective macroeconomic management relies on regularly updated, methodologically sound potential GDP estimates that reflect structural realities.

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