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Energy Efficiency – Panacea for Reducing Energy Demand?

Anne Berner

Energy efficiency is one of the keywords of green growth and green deal strategies. In political discussions it is seen as a panacea to reduce energy consumption while also reducing costs of production and thereby ensuring "green" economic growth. Empirically, a decrease in energy intensity is indeed observed due to gains in efficiency and technological advances. Simultaneously, efficiency gains and the associated cost reductions have demonstrably led to an increase in consumption, whereby the energy savings achieved through efficient resource consumption are reduced (rebound effect) or even completely eaten up (backfire effect). The reason is commonly seen in economic and behavioral responses to the use of a more efficient technology (e.g. saved income, reduced costs, increased demand; Sorell & Dimitropolus, 2008).

The quantification of the economy-wide rebound effect is challenging due to the interdependence of energy efficiency improvements, energy prices and economic growth (Gillingham, 2016). It is particularly difficult to clearly disentangle the effect of energy efficiency on energy consumption from other influencing factors, such as economic growth or structural change. To identify the contemporaneous and past linkages among the variables of interest, we utilize a technique widely used in speech separation (Berner et al., 2020): When we sit in a sports bar, our brain is able to differentiate between the commentator of the football match and the conversation at the neighboring table even though the signals are noisy. If we record the sounds of the sports bar we can disentangle the original signals using machine learning (independent component analysis). We apply this technique to identify the signals from noisy time series. Hence, economic output is our football commentator, energy consumption the conversation at the next table and energy prices the question of the waiter.

We employ a system of regression equations (Structural factor-augmented VAR) to model the impact of time lags of the variable itself as well as lags of the other model variables on every variable. This makes the interpretation of movements in the data caused by economically interpretable structural shocks, as for example energy efficiency improvements, possible. Thus, the model allows us to quantify the response of variables to a shock over time. In particular, we can infer the response of energy consumption to an energy efficiency change using impulse response functions and thereby quantify the economy wide rebound (compare Bruns et al., 2019).

We applied the model to five European countries to compare the dynamics in energy use following energy efficiency improvements. Our results indicate high rebound effects for all examined countries after a time period of 6 months. In Figure 1, the impulse response functions of the energy-efficiency shock show the same tendency for all countries: After an initial decrease, the energy use approaches the previous level again. After 12 months the reduction of energy use is offset, implying a rebound effect close to 100 % for all analyzed countries (between 90 and 106 %). The impulse-response curve of the U.S. seems to approach the initial level of energy consumption faster and the curve for Italy slower than that of the other countries. However, the differences between the countries are subtle and should not be over interpreted. In general, estimates for the rebound effects are very consistent across countries and identification methods.
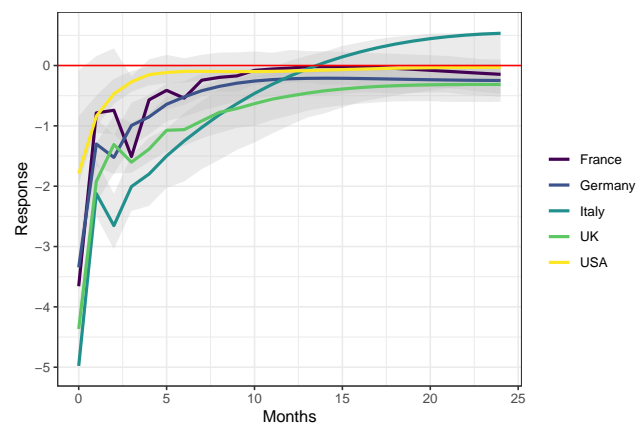

Figure 1 — Impulse response function of an energy efficiency shock, 95% confidence intervals

Even though costless energy efficiency innovations might still enhance welfare, our results imply that they are not a suitable tool to significantly reduce energy use. Hence, the promise to save costs and to maximize profits while saving energy, seems to be too much of a good thing. The picture might change when energy efficiency measures go along with changes in other attributes, as for example increased costs for new technologies or higher energy prices (effects that we control for in our analysis): In this case, energy efficiency improvements are more likely to reduce energy use.

References

Sorrell, S., & Dimitropoulos, J. (2008). The rebound effect: Microeconomic definitions, limitations and extensions. Ecological Economics, 65(3), 636-649.

Berner, A., Bruns, S. B., Moneta, A. & Stern, D. I. (mimeo). No free lunch with energy efficiency in climate politics.

Gillingham, K., Rapson, D., & Wagner, G. (2016). The rebound effect and energy efficiency policy. Review of Environmental Economics and Policy, 10(1), 68-88.

Nowcasting the Output Gap
Prof. Dr. Tino Berger

Central banks often rely on the output gap as a measure of the overall degree of slack in the economy. However, the output gap is unobserved and must be estimated. Recent research suggests that multivariate models designed to span the relevant information for aggregate shocks and capture reduced-form dynamics in the macroeconomic variables can be used to produce reasonable estimates of the output gap. Because these models are based on quarterly data that only become available with some delay, typically at least a month after the end of a quarter, there is concomitant delay in when the output gap for a given quarter can be estimated. This delay is problematic for central banks and other policy organizations wanting to make policy decisions informed by a quantitative measure of current overall slack in the economy, especially in the face of a large and sudden change in economic conditions such as has occurred with the COVID-19 pandemic.

In a recent paper (Berger, Morley, Wong 2020), we propose a way to directly nowcast the output gap using the Beveridge-Nelson decomposition based on a mixed-frequency Bayesian VAR. The mixed-frequency approach produces very similar estimates of the U.S. output gap to those based on a quarterly model, but it is able to provide timely updates to estimates within a quarter as higher-frequency data become available. We find that the output gap nowcasts are much more reliable than those for output growth, with monthly indicators for a credit risk spread, consumer sentiment, and initial claims containing particularly useful information about the output gap.
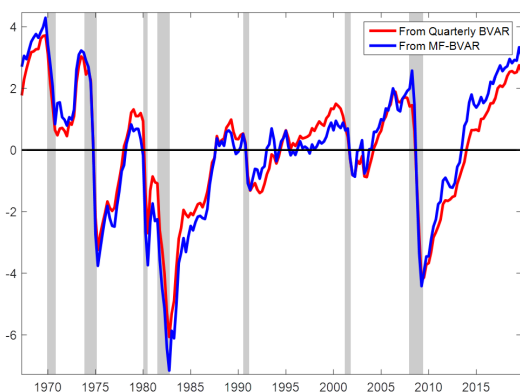

Figure 1 — Comparison of U.S. output gap estimates from quarterly and mixed-frequency BVARs

Analysis of the COVID-19 Crisis

An important question is what the output gap will be in 2020Q2 when the full effects of the recession have been felt throughout the whole quarter. To provide a baseline, we first consider the nowcast at the beginning of the quarter before any monthly data becomes available. Then we consider nowcasts given data for April and May. For these nowcasts, we use the Waggoner and Zha (1999) approach to consider both the conditional expectation and an alternative scenario, given that the conditional expectation appears to be predicated on implausible projected values for certain monthly variables. For the scenario nowcast, we draw guidance from the behavior of the monthly indicators in previous recessions.[1] Even the nowcast at the beginning of the quarter, before any monthly data becomes available, shows a large 7.9 percentage point deterioration from the final estimate of the output gap in 2020Q1. The nowcasts based on April and May data show an extreme deterioration to a value of -29% primarily due to the unprecedented values for the labor-market variables, but also record-breaking reductions in industrial production and housing starts.

Plausibility of Output Gap Estimates for the COVID-19 Crisis?

Are the unprecedented negative output gap estimates reported above plausible? We believe the answer is "yes". First, even -40% in 2020Q2 is plausible if we think about the dramatic decline in labor utilization evident in the monthly data. For example, if the projected decline in employment means that underemployment will be approximately 20% above the natural rate for 2020Q2, then a simple Okun's law relationship with a coefficient of -2 would imply an output gap of -40%.

Related, the 7.7 percentage point drop in the output gap in 2020Q1 is plausible despite the actual reduction in economic activity only occurring near the end of the quarter. If the flow of production was 3% above potential in January and February, it would need to have been approximately 11% below potential in March for the output gap to end up at -4.6% in 2020Q1 as our estimates suggests. This is an unprecedented reversal, but plausible given labor utilization implied by the dramatic rise in initial claims in the second half of March and certainly by the possibility that the flow of production is as much as 40% below potential in 2020Q2.

References

Berger, Tino and Morley, James and Wong, Benjamin, Nowcasting the Output Gap (May 28, 2020). Available at SSRN: `https://ssrn.com/abstract=3586374` or `http://dx.doi.org/10.2139/ssrn.3586374`.

Waggoner, D. F. and T. Zha (1999). Conditional Forecasts in Dynamic Multivariate Models. *Review of Economics and Statistics* 81 (4), 639–651.

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[1]For the exact values used in the scenario analysis we refer to Berger, Morley and Wong (2020) and the companion website `http://outputgapnow.com/`.

Single Windows for International Trade
Prof. Inmaculada Martínez-Zarzoso Ph.D.

Improving the efficiency of cross-border trade is a pressing need for both developing and developed countries. One way to do so is by implementing single windows for foreign trade (SWs), which function as a single point of entry where all the regulatory documentation needed to export or import goods converges. Thanks to international organizations' support for trade facilitation initiatives, recent years have seen an almost exponential increase in efforts to design and implement SWs.

Although there are earlier examples of SW-like mechanisms based on more rudimentary information technology, SWs began to take off at the end of the 20th century with the spread of the internet. In 2003, the United Nations Economic Commission for Europe (UNECE) recommended establishing SWs to simplify border formalities by unifying trade paperwork into a single electronic record that would comply with regulatory requirements and facilitate the work of border agencies and the business community. SWs are defined as an environment that enables and streamlines flows of information between those involved in cross-border trade and government entities, resulting in significant gains for all parties. SWs also store standardized information and documents, and function as a single entry point, such that the specific information for complying with export, import, and transit requirements only needs to be uploaded into the system once. In general, exporters or importers must fill in the electronic forms in their own country for export or import using SWs.

Single window projects involve IT-based innovation and create a platform for effective collaboration between Customs, Other Government Agencies (OGAs) and businesses. Conceptually, SWs can be viewed as encompassing a set of precepts and building blocks designed to enhance governments' ability to administer and enforce legal requirements across multiple agencies via the use of integrated processes, while at the same time enabling the rapid and efficient flow of legitimate trade across the border. The list of requirements for the implementation of SWs includes political will, strong leadership from the lead government agency, a strategic partnership between the government and key stakeholders in foreign trade, and an appropriate communication and marketing policy. The evolution of SWs in recent years reflects countries' growing interest in combining SWs with the technologies of the Fourth Industrial Revolution, such as IoT (the Internet of Things), artificial intelligence, and, above all, blockchain.

Although there is consensus on the advantages of the system, few studies have analyzed the impact it has on trade facilitation and performance, and the existing analyses are mostly for single countries (Volpe Martincus, 2017). The empirical evidence for single countries shows that operational SWs contribute to reducing the number of documents needed to export or import, and the time required to complete a foreign trade operation, as well as improving trade performance. A recent article published in The World Economy (Martínez-Zarzoso and Chelala, 2020) provides an impact assessment by estimating how SWs foster goods' exports and imports at a global level. The authors estimated a gravity model of trade using a panel data sample of 170 countries over the period from 1995 to 2017.

According to the results reported by Martínez-Zarzoso and Chelala (2020), implementing SWs can increase trade between countries by around 37 percent when both the importer and the exporter have operational SWs, and can bring about increases of 23 percent in exports and 14 percent in imports when only one of the two partners has an SW. Other specifications of the model that include zero trade flows show a lower estimated effect, albeit always positive and statistically significant; moreover, they are always higher if both the importer and exporter countries have operational SWs in comparison to only one of the trading partners having one. This impact is a consequence of lower costs, greater competitiveness, the appearance of new agents, and the resulting increase in the volumes of trade and shorter associated processing times, which enables more operations to be completed in the same period.

Further research could provide a more exhaustive impact analysis of interoperability, in which new technologies such as blockchain are beginning to play a fundamental role. International bodies also have a significant part to play in this process: for example, by helping to establish guidelines for data harmonization; by analyzing business processes, a prerequisite for effective harmonization; or by creating common regulatory frameworks for SWs that are part of the network. Without this harmonization and standardization, interoperability will remain out of reach for countries that have yet to implement SWs, and the substantial trade gains from this facilitation tool will remain in the hands of economies that pioneered the implementation of SWs.

References

Martínez-Zarzoso, I. and Chelala, S. (2020) "The Impact of Single Windows on Trade", *The World Economy*, forthcoming.

Volpe Martincus, C. (2017). *Out of the Border Labyrinth: An Assessment of Trade Facilitation Initiatives in Latin America and the Caribbean.* Washington, DC: IADB.

Eigennutz und Gemeinwohlorientierung in Referenden: Semestertickets in Göttingen

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Referenden sind umstritten. Während manche die Legitimation direkt-demokratischer Entscheidungen betonen, befürchten andere, dass Volksabstimmungen von irrationalen oder eigennützigen Überlegungen dominiert werden. Welche Motive das Abstimmungsverhalten in Referenden bestimmen, untersuchen wir [2] an Hand zweier 2010 und 2013 durchgeführter Umfragen zu Urabstimmungen über vier Semestertickets an der Universität Göttingen. Diese Tickets werden durch Pflichtbeiträge finanziert und erlauben allen Studierenden, je nach Art des Tickets, kostenlosen oder stark verbilligten Zugang zu Nahverkehrszügen, Stadtbussen oder kulturellen Einrichtungen. Wir unterscheiden monetären Eigennutz („Abstimmen nach Geldbeutel") und gemeinwohlorientierte Motive wie Altruismus, Umweltbewusstsein oder die Unterstützung der örtlichen Kulturszene.

Gegenüber früheren Beiträgen bietet unsere Untersuchung zwei Vorteile. Zum einen verfügen wir über objektive Maße für den monetären Gewinn, der aus der Nutzung des jeweiligen Tickets erwächst. So messen wir diesen in der Umfrage von 2010 durch den Betrag, den der Student bzw. die Studentin durch das Bahn-Semesterticket gegenüber dem Nahverkehrstarif für die Heimfahrten zu den Eltern spart.

Zum anderen erlaubt die gemeinsame Analyse monetärer und gemeinwohlorientierter Motive, die Natur der letzteren genauer zu verstehen. Wir befragten die Studierenden, ob solche Motive, etwa der monetäre Vorteil der anderen Studierenden, ihre Abstimmungsentscheidung beeinflusst haben. Wenn dies bejaht wird, stellt sich die Frage, ob der bzw. die Antwortende tatsächlich die Situation anderer Studierender verbessern will und erwartet, dass seine oder ihre Stimme dazu beiträgt („soziale Präferenzen"), oder ob die als keinesfalls wahlentscheidend angesehene Stimmabgabe letztlich dazu dient, die eigene soziale Gesinnung zum Ausdruck zu bringen („expressives Wählen").

Die Ergebnisse belegen, dass sowohl monetäre Vorteile als auch soziale oder expressive Motive das Abstimmungsverhalten beeinflussen. Ein Student, der keine anderen Motive angibt, stimmt mit Wahrscheinlichkeit 32% für die Einführung des Bahn-Semestertickets, wenn seine Ersparnis gerade den Ticketpreis deckt. Übertrifft die Ersparnis den Ticketpreis um den durchschnittlichen Wert von 255 Euro, so steigt die Wahrscheinlichkeit für eine Ja-Stimme auf 72 %. Ein Student, der angibt, bei der Abstimmung den Nutzen anderer Studierender zu berücksichtigen, und vermutet, dass die Studierenden im Durchschnitt durch das Ticket gewinnen, stimmt mit einer um 28 %-Punkte höheren Wahrscheinlichkeit für das Bahn-Semesterticket als ein Student, der sich nicht am Nutzen anderer orientiert.
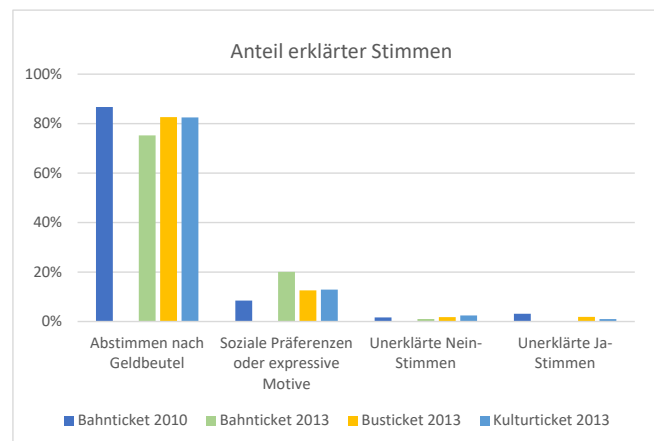

Abbildung 1 — Anteil der Abstimmungsentscheidungen, die durch monetäre Vorteile oder durch soziale Präferenzen und expressive Motive erklärt werden können.

Wie die Abbildung illustriert, erklären diese Motive fast alle abgegebenen Stimmen. In der ersten Gruppe von Säulen wird für die vier Abstimmungen (Bahnticket 2010; Bahn-, Bus-, Kulturticket 2013) dargestellt, für welchen Anteil der Probanden das Abstimmungsverhalten mit unseren Informationen über den monetären Vorteil im Einklang steht. Die zweite Gruppe von Säulen zeigt den Anteil derjenigen Studierenden, deren Abstimmungsverhalten ihrem monetären Nutzen widerspricht, die aber altruistische oder gemeinwohlorientierte Motive angeben. Die letzten beiden Gruppen von Säulen zeigen die Anteile der Nein- bzw. Ja-Stimmen, die durch keines dieser Motive erklärt werden können. Diese Anteile liegen durchweg unter 3%.

Für die Unterscheidung von sozialen Präferenzen und expressiven Motiven ist es wichtig, ob der Wähler die Wahrscheinlichkeit wahlentscheidend zu sein nicht nur als gering, sondern als praktisch null einschätzt. Trifft letzteres zu und liegen gleichzeitig expressive Motive vor, dürfte der monetäre Vorteil keinen Erklärungsbeitrag für das Abstimmungsverhalten liefern, da er auf Grund des vernachlässigbaren Einflusses auf das Wahlergebnis irrelevant ist und von expressiven Überlegungen dominiert wird. Da wir dies jedoch nicht beobachten, sind entweder die beobachteten gemeinwohlorientierten Motive ausschließlich nicht-expressiv und die Wähler stimmen ab um die Situation anderer zu verbessern, oder die Wahrscheinlichkeit das Abstimmungsergebnis zu beeinflussen wird als nicht-vernachlässigbar eingeschätzt. Dies ist konsistent mit dem Vorliegen expressiver Motive, die Daten erlauben jedoch nicht, diese von sozialen Präferenzen zu trennen: Expressives Wählen und soziale Präferenzen sind beobachtungsäquivalent.

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[2]Meya, J., P. Poutvaara und R. Schwager (2020). Pocketbook voting, social preferences, and expressive motives in referenda, *Journal of Economic Behavior and Organization* 175, 185-205.